Towards an Asian Space Agency?

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The whence and whither of Asian interstate relations in the space sector in the 21st century

by

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Declaration

I, Christoph Beischl, hereby confirm that all parts of this thesis presented for examination are my own work.

Date: - -.- -.- - - -

Abstract

Despite the known benefits offered by intergovernmental organisations (IGOs) to governments, the inception of the intergovernmental Asia-Pacific Space Cooperation Organization in 2006, as well as various academic proposals for the creation of other space-specific IGOs in Asia in the 21st century, recent years have still not seen a real engagement amongst Asian governments with dedicated space programmes towards establishing a broad regional space-specific IGO.

Within this context, this study has decided to ask whether there is a reasonable potential amongst Asian governments to commence negotiations towards establishing an Asian Space Agency (ASA) – perceived within certain stipulations as a broad IGO-based regional space cooperation mechanism – based on the general political and legal status quo of their space programmes as of 2017.

In particular, this study focusses on whether the governments with the most ambitious space programmes and domestic access to leading space technology (development) capabilities in Asia, identified as China, India, Iran, Japan, North Korea and South Korea, currently display such a potential. After all, they might be likely at the centre of an ASA.

For that, this study develops and employs a methodological approach based on Moravcsik's well-established International Relations theory 'Liberalism' and a plausible determination of basic political and legal ASA characteristics.

At the analytical core is a government-by-government assessment and subsequent specialised comparison of the state preferences (somewhat constituting national interests) underlying the current space programmes of the six selected governments, their major domestic and cooperative space-related measures promoted in the pursuit of these state preferences, as well as their respective basic political and legal framework concerning IGO-based regional space cooperation.

In contrast to its confident hypothesis, this study concludes in the end that the present space-related state preference situation amongst the six selected governments is such that there is currently no reasonable potential amongst them to commence negotiations towards establishing an ASA. The most problematic factor for the establishment of an ASA is each government's respective current second space-related autonomy-oriented state preference.

Notably, to finish on a more positive and practical note, this study's final sections further discuss generally the closest IGO-based regional space agency variant to a fully-fledged ASA about which the six selected governments might reasonably negotiate in the context of their current space-related state preferences. Also, the final sections put forward some general policy and regulatory recommendations that might help to broaden these governments' (IGO-based) intergovernmental space cooperation in the future.

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Abbreviations

10 Principles	Ten Principles for the Establishment of the One-Ideology System
13th Five-Year Plan	13th Five-Year National Economic and Social Development Plan of the People's Republic of China
2013 Aerospace Document	Comprehensive Document Regarding Iranian Aerospace
2014 Presidential Letter	Letter of the [Iranian] President to his Deputy on Scientific and Technology Matters
ADD	Agency for Defence Development
AIDPA	Aerospace Industry Development and Promotion Act
ALOS	Advanced Land Observing Satellite
Antrix	Antrix Corporation Limited
AP-MCSTA	Asia Pacific Multilateral Cooperation in Space Technology and Applications
APOSOS	Asia-Pacific Ground-Based Optical Space Objects Observation System
APRSAF	Asia-Pacific Regional Space Agency Forum
APSCO	Asia-Pacific Space Cooperation Organization
APSCO Convention	Convention of the Asia-Pacific Space Cooperation Organization
ASA	Asian Space Agency
ASAT	Anti-satellite weapon
ASEAN	Association of Southeast Asian Nations
ASNARO	Advanced Satellite with New system ARchitecture for Observation
ASTRO-H	X-ray Astronomy Satellite
BDS	BeiDou Navigation Satellite System
BRI	Belt and Road Initiative
BRICS	[Ref. to an intergovernmental association formed by Brazil, Russia, India, China, South Africa]
BRISIC	Belt and Road Initiative Space Information Corridor
BSDP	Basic Space Development Plan
BSDP2013	[Ref. to the ROK government's mid- to long-term space development plan covering 2013-2040]
BSL	Basic Space Law
BSP	Basic Space Plan
CAS	Chinese Academy of Sciences
CAS500	Compact Advanced Satellite 500
CBDS	China's BeiDou Navigation Satellite System [White Paper]
CBERS	China-Brazil Earth Resource Satellite
CGWIC	China Great Wall Industry Corporation
CLEP	China Lunar Exploration Programme
Climate R³	Regional Readiness Review For Key Climate Missions
CMSA	China Manned Space Agency [apparently sometimes used to refer to CMSEO]
CMSE	China Manned Space Engineering [apparently sometimes used to refer to CMSEO and/or CMSP]
CMSEO	China Manned Space Engineering Office [apparently sometimes referred to as CMSA or CMSE]
CMSP	China Manned Space Programme [apparently sometimes referred to as CMSE]
CNP	Comprehensive national power
CNSA	China National Space Administration
CNSP	Committee on National Space Policy
CPC	Communist Party of China
CSA2000	中国的航天 / China's Space Activities [White Paper from 2000]
[{ch}- or {eng}-suffix refers to the original Chinese or translated English document version, respectively]	
CSA2006	2006 年中国的航天 / China's Space Activities in 2006 [White Paper]
[{ch}- or {eng}-suffix refers to the original Chinese or translated English document version, respectively]	
CSA2011	2011 年中国的航天 / China's Space Activities in 2011 [White Paper]
[{ch}- or {eng}-suffix refers to the original Chinese or translated English document version, respectively]	
CSA2016	2016 中国的航天 / China's Space Activities in 2016 [White Paper]
[{ch}- or {eng}-suffix refers to the original Chinese or translated English document version, respectively]	
CSAs	[Ref. to CSA2000, CSA2006, CSA2011 and CSA2016 altogether]
CSIDP	National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)
CSSTEAP	Centre for Space Science and Technology Education in Asia and the Pacific
CZ	Changzheng [launcher family; sometimes referred to as LM]
DAMPE	Dark Matter Particle Explorer
DOS	Department of Space, Government of India

DPRK	Democratic People's Republic of Korea
DPRK Constitution	Socialist Constitution of the DPRK
DSSP	Data Sharing Service Platform
EO	Earth observation
EQUULEUS	EQUilibriUm Lunar-Earth point 6U Spacecraft
ERG	Exploration of energization and Radiation in Geospace
ESA	European Space Agency
ESA Convention	Convention for the establishment of a European Space Agency
ETS	Engineering Test Satellite
EU	European Union
GAGAN	GPS Aided Geo Augmented Navigation
GEO	Group on Earth Observations
GEO-KOMPSAT	Geostationary Korea Multi-Purpose Satellite
GPS	Global Positioning System
GSLV	Geosynchronous Satellite Launch Vehicle
HXMT	Hard X-ray Modulation Telescope
IADC	Inter-Agency Space Debris Coordination Committee
ICBM	Intercontinental ballistic missile
IGO	Intergovernmental organisation
IGS	Intelligence Gathering Satellite
Indian-Japanese MoU 2016	Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) concerning cooperation in the field of outer space
Indian-South Korean MoU 2010	Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space
INSA	Iran National Space Administration
INSAT	India National Satellite
International Disaster Charter	International Charter "Space and Major Disasters"
IO	International organisation
IR	International Relations
IRIB	Islamic Republic of Iran Broadcasting
IRNSS	Indian Regional Navigation Satellite System
ISA	Iranian Space Agency
ISA Statute	Statute of the Iranian Space Agency
ISNET	Inter-Islamic Network on Space Sciences and Technology
ISRO	Indian Space Research Organisation
ISS	International Space Station
ITU	International Telecommunication Union
JAXA	Japan Aerospace Exploration Agency
JAXA Law	Law Concerning Japan Aerospace Exploration Agency
KAIST	Korea Advanced Institute of Science and Technology
KARI	Korea Aerospace Research Institute
KASS	Korea Augmentation Satellite System
KCNA	Korean Central News Agency
KCST	Korean Committee of Space Technology
Kibo-ABC	Asian Beneficial Collaboration through "Kibo" Utilisation
KIS	Kim Il-sung
KJI	Kim Jong-il
KJU	Kim Jong-un
KLEP	Korean Lunar Exploration Programme
KMS	Kwangmyongsong
KNSC	Korea National Space Committee
KOMPSAT	Korea Multi-Purpose Satellite
KPS	Korean Positioning System
KSLV	Korea Space Launch Vehicle
KZ	Kuaizhou
LEO	Low Earth Orbit
LM	Long March [launcher family; also referred to as CZ]
MCIT	Ministry of Communications and Information Technology of the Islamic Republic of Iran

MCIT Law	Law for Tasks and Authorisation of the Ministry of Communications and Information Technology of the Islamic Republic of Iran
MGA	Multi-GNSS Asia
MEXT	Ministry of Education, Culture, Sports, Science and Technology of Japan
MMX	Martian Moons eXploration
MODAFL	Ministry of Defence and Armed Forces Logistics of the Islamic Republic of Iran
MoU	Memorandum of Understanding
MTCR	Missile Technology Control Regime
NADA	National Aerospace Development Administration
NADA Bylaw	Bylaw of the National Aerospace Development Administration of the DPRK
NavIC	Navigation with Indian Constellation
NDRC	National Development and Reform Commission of the People's Republic of China
NITI Aayog	National Institution for Transforming India
NPC	National People's Congress of the People's Republic of China
NSPS	National Space Policy Secretariat
NSS	National Security Strategy
OMOTENASHI	Outstanding MOon exploration Technologies demonstrated by NAno Semi-Hard Impactor
ONSP	Office of National Space Policy
PFI	Private Finance Initiative
Planet-C	Venus Climate Orbiter
PSLV	Polar Satellite Launch Vehicle
QSS	Quasi-Zenith Satellite System Services Inc.
QUESS	Quantum Experiments at Space Scale
QZSS	Quasi-Zenith Satellite System
RCSSTEAP	Regional Centre for Space Science and Technology Education in Asia and the Pacific (China)
Remote Sensing Data Act	Act concerning Ensuring Adequate Handling of Satellite Remote Sensing Data
ROK	Republic of Korea
RSDP	Remote Sensing Data Policy
SAARC	South Asian Association for Regional Cooperation
SAFE	Space Applications for Environment
SASTIND	State Administration on Science, Technology and Industry for National Defence
Satcom Policy	Frame-work for Satellite Communication Policy
SaTReC	Satellite Technology Research Centre
SBAS	Satellite Based Augmentation System
SC	State Council of the People's Republic of China
SCIO	State Council Information Office of the People's Republic of China
SDPA	Space Development Promotion Act
SGAC	Space Generation Advisory Council
SHSD	Strategic Headquarters for Space Development
Sino-Indian Space Cooperation Outline 2015	2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China
SLATS	Super Low Altitude Test Satellite
SLIM	Smart Lander for Investigating Moon
SMMS	APSCO Joint Small Multi-Mission Satellite Constellation
SNIDP	National Medium- and Long-Term Satellite Navigation Industry Development Plan
SOLAR-B	Solar Physics Satellite
SPA	Supreme People's Assembly of the DPRK
Space Activities Act	Act concerning launch and control of satellites
SPRINT-A	Spectroscopic Planet Observatory for Recognition of Interaction of Atmosphere
SSC	Space Supreme Council
SSS	Student Small Satellite
STDP	National Medium- and Long-Term Science and Technology Development Plan (2006-2020)
THAAD system	Terminal High Altitude Area Defence system
Vision Decree	Iran's Twenty-year Vision Decree
WPK	Workers' Party of Korea
WPK Charter	Charter of the Workers' Party of Korea
UAE	United Arab Emirates
UN	United Nations
UN-SPIDER	UN Platform for Space-based Information for Disaster Management and Emergency Response

UNCOPUOS	United Nations Committee on the Peaceful Uses of Outer Space
UNGA	United Nations General Assembly
UNOOSA	United Nations Office for Outer Space Affairs
UNSC	United Nations Security Council
WMO	World Meteorological Organization

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1 Research context, interest, hypothesis and literature

1.1 Research context

According to the Institutionalist school in the field of International Relations (IR) studies, collaboration through an intergovernmental organisation (IGO)[1] can bring many benefits to governments. For example, IGOs can provide a framework for exchanging information reliably, reducing uncertainty about interstate behaviour, stabilising expectations, and decreasing transaction costs like for contract negotiation and implementation or monitoring of compliance with contractual obligations.[2] As such, it is not surprising that 21st century Asia has seen some engagement towards setting up IGO-based regional cooperation in the space sector.

Most prominently, the 'Convention of the Asia-Pacific Space Cooperation Organization' (APSCO Convention) entered into force in 2006 and established the intergovernmental Asia-Pacific Space Cooperation Organization (APSCO).[3] After the intergovernmental[4] European Space Agency (ESA), created by the 'Convention for the establishment of a European Space Agency' (ESA Convention) that entered into force in 1980,[5] APSCO presently constitutes the world's second most comprehensive regional IGO mainly attending to space-related matters.[6]

Besides that, various academics have, underpinned by political and legal reasoning, proposed the establishment of other space-specific IGOs in Asia (and the Pacific region) in the past two decades. To date, the most salient amongst these proposals call for an

1 Sometimes also known as international governmental organisation: Graham Evans and Jeffrey Newnham, *The Penguin Dictionary of International Relations* (Penguin Books 1998) 238.

2 Volker Rittberger, Bernhard Zangl and Andreas Kruck, *International Organization* (2nd edn, Palgrave Macmillan 2012) 18–25.

3 Convention of the Asia-Pacific Space Cooperation Organization (APSCO) (signed 28 October 2005, entered into force 12 October 2006) 2423 UNTS 128 (APSCO Convention); for a copy, see also: 'Convention of the Asia-Pacific Space Cooperation Organization (APSCO)' <http://www.apsco.int/UploadFile/2009924/F1TKF8A2009924.pdf> accessed 14 September 2018. For more information on APSCO, see this study's Section 4.6.1.2.

4 For a reference to ESA constituting an IGO, see: 'ESA and the EU' (*ESA*, 1 June 2011) <http://www.esa.int/About_Us/Welcome_to_ESA/ESA_and_the_EU> accessed 25 January 2016.

5 Convention for the establishment of a European Space Agency (signed 30 May 1975, entered into force 30 October 1980) 1297 UNTS 161 (ESA Convention); for a copy including the latest amendment as of 10.06.2009, see: 'Convention for the Establishment of a European Space Agency' <http://download.esa.int/docs/LEX-L/ESA-Convention/20101200-SP-1317-EN_Extract_ESA-Convention.pdf> accessed 15 September 2017.

6 Based on information in: Haifeng Zhao, 'Current Legal Status and Recent Developments of APSCO and Its Relevance to Pacific Rim Space Law and Activities' (2009) 35(2) Journal of Space Law 559, 562,572-573,597; Marco Aliberti, 'Regionalisation of Space Activities in Asia?' (2013) 66 ESPI Perspectives 1, 2.

Asian Space Development Agency, as promoted by Kim Doo Hwan from South Korea,[7] an Asia and the Pacific Space Agency, as promoted by Minoru Suzuki from Japan,[8] or an ASEAN[9] Space Organization, as promoted by Chuckeat Noichim from Thailand.[10] Kim draws heavily on the ESA Convention in developing a convention for his proposed agency.[11] Suzuki endorses a merger of APSCO and the Asia-Pacific Regional Space Agency Forum (APRSAF)[12].[13] Noichim models, from a legal point of view, an IGO that shall serve the sustainable space-related development among ASEAN member states.[14]

Lastly, it is notable that delegates to the 1st Asia-Pacific Regional Space Generation Workshop, organised by the Space Generation Advisory Council (SGAC) in Japan in 2014, discussed, among others, the topic of an Asia-Pacific Space Agency. Against the backdrop that ESA is a good example of a regional space agency, their deliberations ended in the recommendation for the treaty-based formation of such an agency. In particular, it shall engage in peaceful space exploration and utilisation, conduct ambitious space projects, allow for membership of any Asia-Pacific state, receive equal contributions of leading Asian space powers and provide region-wide benefits.[15]

1.2 Research interest

Interestingly, the combination of the known benefits offered by IGOs to governments, APSCO's inception, the various academic proposals for other space-specific IGOs in Asia (and the Pacific region) and the related recommendation of some SGAC members[16]

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7 Doo Hwan Kim, *Essays for the Study of the International Air and Space Law* 國際航空法 宇宙法 研究論叢 *(*국제항공법 우주법 연구논총*)* (Korean Studies Information Co, Ltd 2008) 443–466; for an earlier version of Kim's article, in which he referred to the organisation as 'Asian Space Agency' instead, see: Doo Hwan Kim, 'The Possibility of Establishing an Asian Space Agency' (2001) 5 Singapore Journal of International & Comparative Law 214.

8 Minoru 實 Suzuki 鈴木, 'アジア太平洋宇宙機関構想 Toward the Establishment of Asia and the Pacific Space Agency' (2010) 34 総合政策研究 Journal of Policy Studies 57.

9 ASEAN stands for Association of Southeast Asian Nations. Its members as of 2017 are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

10 Chukeat Noichim, 'The Asean Space Organization. Legal Aspects and Feasibility' (PhD thesis, Leiden University 2008) <https://openaccess.leidenuniv.nl/bitstream/handle/1887/13358/Full%20text.pdf> accessed 6 October 2016.

11 Kim, *Essays for the Study of the International Air and Space Law* (n 7) 459–464.

12 For more information on APRSAF, see this study's Section 7.6.1.

13 Suzuki 鈴木 (n 8) 59–60.

14 Noichim (n 10) 150–167.

15 SGAC, 'Final Report 1st Asia-Pacific Regional Space Generation Workshop (AP-SGW)' (Final Report, SGAC 2014) 10–12 <http://spacegeneration.org/images/stories/AP-SGW/2014/AP-SGW-Final%20Report23FEB15.pdf> accessed 9 February 2016.

16 As all introduced in this study's Section 1.1.

has still not triggered a stable process towards establishing broad IGO-based Asian space cooperation.

For example, in 2011, Turkey became only the eight and so far the last country to ratify the APSCO Convention, joining the ranks of Bangladesh, China, Iran, Mongolia, Pakistan, Peru and Thailand. Indonesia has remained a signatory state since 2005 but has yet to ratify the convention.[17] Several prominent Asian space-faring nations like India and Japan have abstained from substantial interaction with the organisation altogether. Also, a significant portion of the APSCO members' major space-related measures fitting, in theory, with the organisation's general purpose of 'effectively improv[ing] the capability of the Member States in space science, space technology and their peaceful applications, and bring[ing] more socio-economic benefits to each of the Member States',[18] continues to be implemented outside of APSCO.[19]

Withal, the many Asian governments with dedicated space programmes by 2017[20] have made no discernable attempt to realise or at least earnestly deliberate about setting up any other regional space-specific IGO.

Considering all that, this study has decided to ask the following **primary research question**:

> *Is there a reasonable potential amongst Asian governments to commence negotiations towards establishing an Asian Space Agency (ASA) based on the general political and legal status quo of their space programmes as of 2017?*[21]

17 Wei Zhang and others (eds), *Major Events of Asia-Pacific Space Cooperation Organization 2009-2011* (APSCO n.d.) 29.
18 APSCO Convention preamble.
19 This study's Chapters 4 and 6 on China and Iran provide ample evidence and indicators in this regard.
20 This study's Chapter 3 identifies 15 such governments.
21 Henceforward, the terms 'current', 'present', 'currently' and 'presently' refer to 'as of 2017' if not indicated otherwise.

In essence, an ASA is stipulated[22] here (see Table 1) as an IGO that, with a view on representing a somewhat broad Asian space cooperation mechanism, has a membership comprising at least a majority of the Asian governments with dedicated space programmes and takes on a significant role in the realisation of its government members' space programmes. Also, this group of government members has to contain at least a majority of the governments with the most ambitious space programmes and domestic access to leading space technology (development) capabilities in Asia (henceforward: **the preeminent Asian governments in the space sector**).[23]

Table 1: Essential stipulations about an ASA

<table>
<tr><th colspan="2">ASA</th></tr>
<tr><td colspan="2"><u>Cooperation mechanism:</u>
IGO</td></tr>
<tr><td><u>Membership:</u>
• Comprising at least a majority of the Asian governments with dedicated space programmes
○ that also contains at least a majority of the preeminent Asian governments in the space sector</td><td><u>General agenda:</u>
• Taking on a significant role in the realisation of its government members' space programmes</td></tr>
</table>

In addressing its research question, this study has further decided to analytically focus on the current space programmes of the preeminent Asian governments in the space sector[24]. One rationale behind that is that the specific research outcome determines whether there is a reason to even immerse in an additional related study concerning the remaining Asian governments with currently dedicated space programmes. Moreover, it is likely the initial engagement of these preeminent Asian governments in negotiations towards establishing a somewhat broad regional space-specific IGO like an ASA that functions as a strong incentive for other Asian governments with currently less ambitious space programmes and less advanced domestic space technology (development) capabilities to consider joining in. To the latter, the opportunity to gain stable access to these preeminent Asian

22 This study derives these stipulations by inductive reasoning from ESA as the prime example of a fairly comprehensive regional space-specific IGO and as a positively perceived institution by various Asian scholars. ESA is known to encompass the majority of European governments with dedicated space programmes, including all those with the most ambitious space programmes and domestic access to leading space technology (development) capabilities in Europe (ie France, Germany, Italy, Spain, the UK). Also, it plays a significant role in the realisation of its members' space programmes. For some indicators in this regard, see the information presented in: UNCOPUOS (Legal Subcommittee) 'The European Space Agency as mechanism and actor of international cooperation' (28 March 2014) A/AC.105/C.2/2014/CRP.28; concerning the positive remarks about ESA by Asian scholars, see the aforementioned references to ESA by Kim and some SGAC members, as well as the references in: Mingyan Nie, *Legal Framework and Basis for the Establishment of Space Cooperation in Asia* (Lit Verlag 2016) 7; Noichim (n 10) 121,125; Zhao, 'Current Legal Status and Recent Developments of APSCO and Its Relevance to Pacific Rim Space Law and Activities' (n 6) 563.

23 For a determination of the basic political and legal ASA characteristics taking into account these stipulations, see this study's Section 2.2.

24 This study's Chapter 3 identifies them as the governments of China, India, Iran, Japan, North Korea and South Korea.

governments' more sophisticated space technology (development) capabilities is presumably highly attractive. Finally, this study's particular research findings already enable the formulation of policy and regulatory recommendations to advance the evolution of an ASA at the core stage, as well as broader intergovernmental cooperation amongst the selected governments in general.

1.3 Hypothesis

This study hypothesises regarding its primary research interest is that there is a reasonable potential amongst the preeminent Asian governments in the space sector to commence negotiations towards establishing an ASA based on the general political and legal status quo of their space programmes as of 2017.[25]

After all, at first glance current governmental space programmes of prominent Asian space-faring states like China, India and Japan appear to involve several similar major space-related measures. Moreover, the engagement of various prominent Asian space-faring states in APSCO,[26] APRSAF, the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP),[27] the Regional Centre for Space Science and Technology Education in Asia and the Pacific (China) (RCSSTEAP)[28] and the Inter-Islamic Network on Space Sciences and Technology (ISNET)[29] displays a certain readiness for intergovernmental space collaboration in the Asian region.

1.4 Existing literature

This study's substantial consultation of English publications, as well as its look into some Chinese and German writing,[30] has unearthed a variety of previous political and legal research discussing aspects of intergovernmental space cooperation in Asia, either in

25 This is coherent with Nie's recent interpretation that the scale and achievements of space-related cooperation in Asia, including within APSCO, 'are not satisfactory': Nie (n 22) 5,177.

26 Notably, this study does not consider APSCO to constitute an ASA yet. For example, APSCO currently does not include a majority of the preeminent Asian governments in the space sector.

27 'Centre for Space Science and Technology Education in Asia and the Pacific' (*CSSTEAP*) <http://www.cssteap.org/> accessed 18 August 2015. For more information on CSSTEAP, see this study's Section 5.6.11.2.

28 'Regional Centre for Space Science and Technology Education in Asia and the Pacific(China)' (*RCSSTEAP*) <http://www.rcssteap.org/Index/index.html> accessed 14 May 2018. For more information, see this study's Section 4.6.11.2.

29 'About ISNET' (*ISNET*) <http://www.isnet.org.pk/index.asp> accessed 15 April 2018.

30 The author has working proficiency in these three languages. English publications receive the most attention in this study because English is the *lingua franca* of the international space sector and prominent Asian researchers usually publish their essential findings also in this language.

specialised studies[31] or as part of wider assessments of Asian space programmes.[32] However, even though such research has yielded many exciting findings, no combination constitutes the particular political and legal analysis of the current space programmes of all preeminent Asian governments in the space sector necessary to address this study's IGO-specific research interest outlined above to the fullest extent.

If anyone, Nie conducted the most recent legal inquiry in this direction. His work at least 'discuss[es] the legal opportunities for establishing an institutionalized framework of space cooperation in Asia[, taking into account such existing regional institutions like APSCO and APRSAF].'[33] After that, the work of the regional Space Policy and Law Network in Asia Pacific, set up by the University of Tokyo, Japan and India's National Institute of Advanced Studies, appears the most likely candidate to be able to provide some expedient answers to this study's research question in the near future. Researchers involved in this network have already looked at Indian, Japanese, Malaysian, Philippine and Singaporean space programmes and policy perspectives in recent years to identify common interests and regional cooperation opportunities.[34]

Ultimately, this study has decided to refrain from crafting a detailed overview of such existing literature at this point. It holds that the latter offers no significant merit to the execution of its relevant analysis and would unnecessarily increase the thesis' girth. Instead, it diligently refers to and incorporates information and findings in others' previous work on the Asian space sector as pertinent throughout its chapters.

31 For example: Kim, *Essays for the Study of the International Air and Space Law* (n 7) 443–466; Noichim (n 10); Suzuki 鈴木 (n 8); Aliberti (n 6); Rong Du, 'Space Cooperation in Asia: A Mystery', *IAC-14.E3.1.4* (65th IAC, Toronto 2014) <https://swfound.org/media/187608/rong_du_paper_iac_2014.pdf> accessed 20 February 2018; Zachary P Jones, 'Southeast Asian Space Programs: Motives, Cooperation, and Competition' (Master's Thesis, Naval Postgraduate School 2014) <https://calhoun.nps.edu/bitstream/handle/10945/43935/14Sep_Jones_Zachary.pdf> accessed 20 February 2018; Nie (n 22); Yuichiro Nagai and others, 'Assessment of Space Programs and Policies for Regional Cooperation in the Asia Pacific Region', *IAC-17-E3.1.8* (68th IAC, Adelaide 2017) <http://nias.res.in/sites/default/files/2017-MKRao-IAC-17-E3.1.8ApSpacePolicyFullPaper.pdf> accessed 20 February 2018; Yun Zhao, 'Space Cooperation and Space Security in the Asia-Pacific Region' (2017) 4(1) Fletcher Security Review 77.

32 For example: James Clay Moltz, *Asia's Space Race. National Motivations, Regional Rivalries, and International Risks* (Columbia University Press 2012); Ajey Lele, *Asian Space Race: Rhetoric or Reality?* (Springer 2013).

33 Nie (n 22) 1–9. Citation on 1.

34 Nagai and others (n 31) 1.

2 Methodology

This study draws on a Liberal IR theory (Section 2.1) and a determination of basic political and legal ASA characteristics (Section 2.2) in developing a suitable methodological approach to address its research interest (Section 2.3).

2.1 Theoretical pillar: Liberalism

Consistent with Sheehan's argument that many political developments in the international space sector since the end of the Cold War align well with the Liberal IR school's[35] interpretation of international politics,[36] this study has selected Moravcsik's well-established IR theory 'Liberalism' as the theoretical foundation on which to build its methodological approach. Liberalism provides sufficient tools to conclude which amongst the preeminent Asian governments in the space sector have a reasonable potential to enter into negotiations towards establishing an intergovernmental space cooperation mechanism based on the general political and legal status quo of their space programmes as of 2017.

At its core, Liberalism holds that international politics, including in the form of intergovernmental cooperation, takes place in an anarchic international environment, meaning there is neither a world government nor another authority with a monopoly on the legitimate right to the use of force.[37] Undoubtedly, this is true for the international space sector.

The theory further contends that the main explanatory variable influencing the interaction among governments, which represent states in the international arena, regarding a specific issue-area or even a whole policy field consists of their 'state preferences' concerning the issue-area or policy field in question. In practice, state preferences usually correspond to what governments call their national interests or main objectives.

A government's state preferences develop from the preferences – here meaning the central interests – of the respective state's dominant domestic societal actors, e.g. a strong

35 For more information on IR schools and their related theories, see for example: Tim Dunne, Milja Kurki and Steve Smith (eds), *International Relations Theories. Discipline and Diversity* (3rd edn, Oxford University Press 2013).

36 Michael Sheehan, *The International Politics of Space* (Routledge 2007) 12–16.

37 Andrew Moravcsik, 'Liberal Theories of International Relations: A Primer' (Memo, Princeton University 2010) 2 <www.princeton.edu/~amoravcs/library/primer.doc> accessed 14 September 2017.

national leader, the government as a social group, political parties, ministerial staff, companies, non-governmental action groups or a combination of them. The transmission of such societal actors' preferences into government-pursued state preferences takes place through the respective state's formal and informal domestic political decision-making system. The domestic dominance of societal actors, and thus their preferences' relevance in the formulation of state preferences, stems from their position of influence within this system. Overall, Moravcsik puts forward three theoretical strands of Liberalism in support of the analysis of state preference formation, but, of course, they are not final. Through the lenses of 'Ideational Liberalism', a researcher looks at domestic actors' social identities like 'national identity, political ideology, and socioeconomic order' as a source of state preferences. 'Commercial Liberalism' focuses on 'the pattern of transnational market incentives', meaning the economic opportunities and risks offered by this market to societal actors. Lastly, 'Republican Liberalism' concentrates on the impact of a state's 'institutional structure of domestic political representation' on the formulation of state preferences.

Liberalism explains the particular effect of state preferences on intergovernmental behaviour through 'the concept of policy interdependence. Policy interdependence refers to the distribution and interaction of preferences—that is, the extent to which the pursuit of state preferences necessarily imposes costs and benefits (known as policy externalities) upon other states, independent of the "transaction costs"[38] imposed by the specific strategic means chosen to obtain them.'[39] Overall, Moravcsik outlines three general patterns of policy interdependence, whereby only one offers a sound basis for cooperation among governments.

First, naturally compatible or harmonious state preferences among governments, which means policy externalities resulting from the respective unilateral pursuit of their state

38 Following from Gilligan's deliberations, this study assumes that, when it comes to institutionalised strategic means like IGOs, Moravcsik alludes here primarily to the following: independent of the 'transaction costs in the formation of institutions' chosen to obtain them. See: Michael J Gilligan, 'The Transaction Costs Approach to International Institutions' in Helen V Milner and Andrew Moravcsik (eds), *Power, Interdependence, and Nonstate Actors in World Politics* (Princeton University Press 2009) 63.

39 Based on information in: Andrew Moravcsik, 'The New Liberalism' in Christian Reus-Smit and Duncan Snidal (eds), *The Oxford Handbook of International Relations* (Oxford University Press 2008) 234–246. Citations on Ideational, Commercial and Republican Liberalism on 241,242,244; Moravcsik, 'Liberal Theories of International Relations: A Primer' (n 37) 1–10. Citation on policy interdependence on 4; Andrew Moravcsik, 'Taking Preferences Seriously: A Liberal Theory of International Politics' (1997) 51(4) International Organization 513, 516-520,524-533.

preferences are either optimal or insignificant among them, usually lead to coexistence with no or only little conflict. If any, collaboration might take place in the form of simple interstate coordination. Intense cooperation is expected to yield no notable additional benefits. Obviously, such a state preference constellation among Asian governments based on their space programmes is unlikely to trigger negotiations towards setting up an intergovernmental space cooperation mechanism (like a space-specific IGO).

Second, conflictual behaviour amongst governments occurs typically if the pursuit of one side's state preferences necessarily creates a negative policy externality for the other side, e.g. in zero-sum games. The greater the benefits for one side and the higher the costs for the other side, the more likely and severe is their conflictual behaviour towards another. Therefore, Asian governments in such a state preference setting based on their space programmes also have no solid foundation to commence negotiations towards creating an intergovernmental space cooperation mechanism (like a space-specific IGO).

Third, Moravcsik argues within his Liberal theory that '[w]here, finally, motives[, which are based here on state preferences,] are mixed such that an exchange of policy concessions through coordination or precommitment can improve the welfare of both parties relative to unilateral policy adjustment (i.e., a collective action problem), states have an incentive to negotiate policy coordination. Games like coordination, assurance, prisoner's dilemma, and suasion have distinctive dynamics, as well as impose precise costs, benefits, and risks on the parties.' Based on this argument and further related information presented in Moravcsik's writings, this study ultimately considers, on a general level, state preference-based situations amongst governments that are mixed such that cooperation in the pursuit of their state preferences can notably improve benefits or reduce or prevent losses for each side relative to the unilateral pursuit of their state preferences (henceforward: **mixed-motive games**) as the most suitable springboard for governments to reasonably engage in negotiations towards establishing an intergovernmental cooperation mechanism.[40] In terms of its research interest, this study thus has to primarily search for **current space-related mixed-motive games amongst the preeminent Asian governments in the space sector**. The main explanatory variable

40 Based on information in: Moravcsik, 'Taking Preferences Seriously: A Liberal Theory of International Politics' (n 39) 520–521. Citation on 521; Moravcsik, 'The New Liberalism' (n 39) 239; Moravcsik, 'Liberal Theories of International Relations: A Primer' (n 37) 3–5; for more information on game variants, see for example: Andrew M Colman, *Game Theory and Its Applications in the Social and Biological Sciences* (2nd edn, Routledge 1999).

in this regard consists of the **state preferences underlying the current space programme** (henceforward also: **current space-related state preferences) of each preeminent Asian government in the space sector, with an analytical focus on each such programme's general political and legal status quo.**

At this point, it needs to be taken into account that Liberalism does not assume that negotiations towards setting up an intergovernmental space cooperation mechanism in the context of a (set of) space-related mixed-motive game(s) automatically result in talks to establish a space-specific IGO (like an ASA). Instead, governments are known to strategically choose the mechanism they deem suitable for the cooperative pursuit of their state preferences in question.[41] On average, they engage internationally in a rational[42] and risk-averse[43] manner.[44] As such, this study's methodology needs to further incorporate a way to discern when preeminent Asian governments in the space sector with an identified reasonable potential to commence negotiations towards establishing an intergovernmental space cooperation mechanism can, also based on the general political and legal status quo of their space programmes, plausibly consider negotiating about such a mechanism to take the form of an ASA.

2.2 Theoretical pillar: basic political and legal ASA characteristics

The basic political and legal ASA characteristics are the methodological approach's second theoretical pillar. They are a useful kit to conclude which potential negotiations amongst the preeminent Asian governments in the space sector towards establishing an

41 Moravcsik, 'Liberal Theories of International Relations: A Primer' (n 37) 2–3; Moravcsik, 'The New Liberalism' (n 39) 237–239; Moravcsik, 'Taking Preferences Seriously: A Liberal Theory of International Politics' (n 39) 519.

42 'The rationality assumption means that state leaders and their domestic supporters engage in foreign policy for the instrumental purpose of securing benefits provided by (or avoiding costs imposed by) actors outside of their borders, and in making such calculations, states seek to deploy the most cost-effective means to achieve whatever their ends (preferences) may be.' Moravcsik, 'Liberal Theories of International Relations: A Primer' (n 37) 2.

43 '[Dominant domestic societal actors...] strongly defend existing investments but remain more cautious about assuming costs and risks in pursuit of new gains.' Moravcsik, 'Taking Preferences Seriously: A Liberal Theory of International Politics' (n 39) 517; see also: Moravcsik, 'The New Liberalism' (n 39) 236.

44 Concerning the negotiation process itself, which is not part of this study's analysis, Moravcsik adds that the 'relative preference intensity' determines states' respective bargaining power over one another. For more information on this issue, see: Andrew Moravcsik, 'Sequencing and Path Dependence in European Integration' (Conference on The Sequencing of Regional Economic Integration: Issues in the Breadth and Depth of Economic Integration in the Americas, Mendoza College of Business, University of Notre Dame, September 2005) 15–16 <http://www3.nd.edu/~jbergstr/MoravcsikSept2005.pdf> accessed 19 December 2016; Moravcsik, 'Liberal Theories of International Relations: A Primer' (n 37) 5; Moravcsik, 'The New Liberalism' (n 39) 239–240; Moravcsik, 'Taking Preferences Seriously: A Liberal Theory of International Politics' (n 39) 523–524.

intergovernmental space cooperation mechanism[45] can, also based on the general political and legal status quo of their space programmes, reasonably consider consultations about the formation of an ASA.

Concerning the determination of such characteristics, it needs to be understood that the specialised political and legal literature presents neither a definition of an ASA as stipulated under Section 1.2 nor any other authoritative 'regional space agency' definition that can be adapted in this regard.

Based on this background, this study has decided to resort to a synthesis of Rittberger and others' introduction to the field of International Organisation (IO) studies,[46] Archer's research on IOs[47] and the IO and IGO definition attempts by Evans and Newnham in their IR dictionary[48] to achieve a tenable description of basic political and legal IGO characteristics. It then combines these IGO characteristics with its aforementioned essential stipulations[49] about an ASA to establish a plausible and applicable array of basic political and legal ASA characteristics. Ultimately, five such ASA characteristics emerge:

(1) Rittberger and others explain that an IGO constitutes one of two[50] general IO formats. Compared to an international regime, most prominently defined by Krasner as 'implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations',[51] an IO has an actor quality regarding its ascribed purpose.[52]

As a space-specific IGO, an ASA thus can be considered to have an actor quality concerning a space-related purpose.

45 As identified on the basis of Liberalism introduced in this study's Section 2.1.
46 Rittberger, Zangl and Kruck (n 2). IO studies belong into the realm of IR studies.
47 Clive Archer, *International Organizations* (4th edn, Routledge 2015).
48 Evans and Newnham (n 1) 238-240,270-271.
49 See especially Table 1 in this study's Section 1.2.
50 The other but here irrelevant IO format is that of an international non-governmental organisation.
51 'Principles are beliefs of fact, causation, and rectitude. Norms are standards of behavior defined in terms of rights and obligations. Rules are specific prescriptions or proscriptions for action. Decision-making procedures are prevailing practices for making and implementing collective choice.' Stephen D Krasner, 'Structural Causes and Regime Consequences: Regimes as Intervening Variables' in Stephen D Krasner (ed), *International Regimes* (Cornell University Press 1983) 2.
52 Rittberger, Zangl and Kruck (n 2) 5–7. Point (3) is the reason why this study speaks of purpose instead of issue-area here.

(2) An IGO is established by an intergovernmental agreement between two or more states. The agreement is usually formalised by a treaty or convention that acts as a constitution and gives the organisation a legal personality within international law. Typically, membership is voluntary. Regardless of how numerous its membership grows, and even though an IGO might allow for non-governmental parties as formal members with participatory rights or a consultant status, the majority of an IGO's membership has to consist of governments, or, at the minimum, its decision-making has to be dominated by them. Otherwise, it loses its genuine intergovernmental trait.[53]

Hence, an ASA can be considered to be established by a formal, usually voluntarily entered intergovernmental agreement amongst at least a majority of the Asian governments with dedicated space programmes, while this group of government members also encompasses at least a majority of the preeminent Asian governments in the space sector. Asian government members must continuously make up the majority of the ASA membership or, at a minimum, dominate its internal decision-making to uphold the agency's status as an Asian IGO.

(3) An IGO serves a purpose. According to Evan and others, an IGO 'engages in problem-solving in the interests of, and possibly on behalf of, their member states.'[54] Similarly, Archer holds that IOs have 'the aim of pursuing the common interest of the membership.'[55] Considering the introduction of Liberalism in the previous section, such interests can be understood in this study to refer to state preferences.

In order to take on the stipulated significant role in the realisation of its government members' space programmes, it is reasonable to argue that an ASA's purpose has to be the pursuit of a significant portion of their overall current space-related state preferences.

(4) In terms of its actor quality, an IGO assumes an actor role executing certain functions to fulfil its ascribed purpose.

53 Based on information in: ibid 7,9,73; Evans and Newnham (n 1) 238,270; Archer (n 47) 29–31. Rittberger and others' argument that existing IGOs may also establish other IGOs is, at its core, still a decision among states since they are the principal actors within IGOs. Archer's argument that two member states can set up or uphold an IO, and thus an IGO, is given preference over Rittberger and others' explanation that IGOs are usually established among at least three states. Nothing stops two governments from entering into an agreement to establish an IGO, and there is always a chance that membership in an existing IGO is, due to a loss of members, reduced to two states.

54 Evans and Newnham (n 1) 238.

55 Archer (n 47) 29-31,45-49. Citation on 31.

Rittberger and others outline three ideal-typical IGO actor roles, namely that of an instrument, an arena, and a corporate actor. As an instrument, an IGO is a mere tool for implementing decisions by its members concerning its ascribed purpose. As an arena, it is a 'permanent institution[...] of conference diplomacy', e.g. it acts as a platform for policy coordination amongst its members concerning its ascribed purpose. Finally, an IGO holding some sway over decision-making vis-à-vis its full members concerning its ascribed purpose is a corporate actor. The degree of its clout depends on how strongly its members pooled their sovereignty within it (unanimity not required for decision-making) or delegated their sovereignty to it (IGO's potential for autonomous decision-making, without its members wielding the power to veto or of an intervening vote).[56]

According to Archer, functions executed by an IGO within its actor roles can range from interest articulation and aggregation, norm establishment, recruitment of participants, socialisation, rule-making, rule application, rule adjudication, informational exchange and provision, to operations.[57] Rittberger and others present a more concise classification, seemingly covering Archer's list. They differentiate between 'programme function', which encompasses 'the setting of behavioural and distributive norms and rules', and 'operational function', which refers to 'implementation, especially the monitoring of compliance with norms and rules and capacity-building for implementation.'[58] In practice, an IGO can be a hybrid assuming a combination of actor roles and functions for the fulfilment of its ascribed purpose.[59]

Due to its attributed significance concerning the realisation of its government members' space programmes, an ASA's actor role(s) and function(s) thus arguably need be such that it is responsible for a significant portion of the major measures promoted within their current space programmes (henceforward also: **current major government-promoted space-related measures**) regarding its ascribed purpose.

(5) Until its dissolution, an IGO, and therefore also an ASA, maintains a permanent existence. It has an agreed executive body, official seat of its headquarters and internal

56 Rittberger, Zangl and Kruck (n 2) 4-6,8. Citation on 4; see also the input of Archer and Evans and others in: Archer (n 47) 114–135; Evans and Newnham (n 1) 239–240.
57 Archer (n 47) 135–149.
58 Rittberger, Zangl and Kruck (n 2) 7–8. For a detailed description of the output dimension related to these two functions, see: ibid 119-137.
59 As indicated in: Archer (n 47) 134–135.

structure and decision-making system.[60] Naturally, the ASA headquarters might be best situated in a territory under the jurisdiction of an Asian government member.

Eventually, this study holds that not all of these basic political and legal ASA characteristics need to be analytically considered to address its particular research interest adequately. It contends that a (set of) current space-related mixed-motive game(s) amongst preeminent Asian governments in the space sector[61] needs to fit only the following **three principal prerequisites**[62] based on the general political and legal status quo of their space programmes to allow for their game(s)-related potential negotiations towards establishing an intergovernmental space cooperation mechanism reasonably consider consultations about the formation of an ASA:

i. the (set of) game(s) - and consequently the potential negotiation process – needs to involve at least a majority of the preeminent Asian governments in the space sector;
ii. the (set of) game(s) - and consequently the potential negotiation process – needs to concern the pursuit of a significant portion of the involved preeminent Asian governments in the space sector's overall current space-related state preferences;
iii. the preeminent Asian governments in the space sector involved in the (set of) game(s) must at least not be opposed to
    - entering into an agreement for regional IGO-based cooperation, as well as
    - a transfer of a significant portion of their current major government-promoted space-related measures regarding the pursuit of their game(s)-defining current space-related state preferences under the responsibility of a regional IGO.

    This study holds that the main explanatory variable for this point's first element is **each involved preeminent Asian government in the space sector's current basic political and legal framework concerning IGO-based regional space cooperation**. The main explanatory variable for this point's second element covers **each involved preeminent Asian government in the space sector's current major government-promoted space-related measures regarding the pursuit of its game(s)-defining current space-related state preferences**.

60 Evans and Newnham (n 1) 270; Archer (n 47) 30–31; for a detailed discussion on internal structures and decision-making procedures of IGOs, see: Rittberger, Zangl and Kruck (n 2) 13–137.
61 As identified on the basis of Liberalism introduced in this study's Section 2.1.
62 Primarily derived from aforementioned basic political and legal ASA characteristics (2), (3) and (4).

It is plausible to suggest that all the other components of the basic political and legal ASA characteristics determined above, e.g. the agreement's exact format, the organisation's internal decision-making system and the seat of it headquarters, are no principal prerequisites to commence such negotiations but will be decided upon throughout the actual negotiation process.

2.3 Methodological approach

Pursuant to these two theoretical pillars, this study puts forward and applies the following methodological approach to address its research interest. Table 2 in Section 2.3.3 provides a condensed overview.

2.3.1 First step: assessment of the three main explanatory variables

To achieve a proper application of this study's three main explanatory variables as determined under Sections 2.1-2, the methodological approach's first step is, while focussing on the general political and legal status quo of their space programmes and while adding some analytically tenable constrictions, the assessment of each preeminent Asian government in the space sector's

- current space-related state preferences;
- current basic political and legal framework concerning IGO-based regional space cooperation; and
- current major government-promoted space-related measures regarding the pursuit of its current space-related state preferences

in a separate chapter for each such government.

Coherent with Liberalism as introduced above, this study looks especially for national interests and main objectives driving each selected government's present space programme in its attempt to determine their respective current space-related state preferences. Overall, it finds that the latter can be split along five categories:

- space-related socioeconomic state preferences;
- space-related political state preferences;
- space-related national security state preferences;
- space-related science and technology state preferences;
- space-related autonomy-oriented state preferences.

Within each category, this study also condenses the state preference specifics into a more general terminology. Altogether, this categorisation and generalisation allow for a more structured comparison of current space-related state preferences and subsequent identification of current space-related mixed-motive games amongst the selected governments. Notably, in most instances, this study sees no analytical need to detail these space-related state preferences' respective domestic evolution.

In terms of the current basic political and legal framework concerning IGO-based regional space cooperation, this study looks especially for information about the general political and legal considerations and imperatives put forth in the context of each selected government's current space programme concerning its engagement in IGO-based regional space cooperation.

On the topic of the current major government-promoted space-related measures regarding the pursuit of current space-related state preferences, this study has decided to concentrate analytically on each selected government's

- major government-promoted domestic space-related measures; and
- major government-promoted cooperative space-related measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector.[63]

It categorises such measures along activity fields common to the space sector, e.g. remote sensing, human spaceflight and launchers, to facilitate a more structured comparison of such measures amongst the selected governments and subsequent identification of their reasonable potential to commence negotiations towards establishing an ASA. One reason for putting the analytical spotlight on these two particular sets of major government-promoted space-related measures is, for one, the fact that this study has a limited scope of writing space available and thus cannot address each and every space-related measure of the selected governments. Also, this study holds that its specific findings regarding these two sets of measures already suffice to draw plausible conclusions regarding its primary research interest, including the assessment of the selected governments' current space-related state preferences.

63 This study does its best to find and present such measures. However, it acknowledges that it cannot claim completeness. It is up to the individual researcher to classify a specific government-promoted space-related domestic or cooperative measure as 'major'. Ultimately, this study is confident that it has not overlooked any measure that would render its conclusions void.

In support of the assessments above, each government-specific chapter starts with

- a description of the main analytical considerations concerning this study's particular evaluation of the respective government's current space programme, e.g. limited access to English translations of government policy documents;
- an overview of the (known/assumed) main domestic political and legal documents guiding the respective government's current space programme; and
- an introduction of the (known/assumed) basic domestic decision-making system behind the formulation and implementation of the respective government's present space programme.

Altogether, these three points reduce the risk that this study overlooks or misinterprets any fundamental piece of information in its particular evaluation of the selected governments' current space programmes. Also, they indicate analytical limitations.

The relevant data for this methodological approach's first step is extracted from a smorgasbord of primary and secondary material in English and, to a limited degree, in Chinese and German.[64] This includes, for example, domestic government policy and strategy documents, domestic legislation, international agreements, press releases, conference presentations, news reports and previous studies in the field. The search for and interpretation of this material has greatly benefited from the input by renowned academics and professionals in the Asian space sector and at ESA.[65] Naturally, this study addresses the interpretation of data in other researchers' previous work as necessary.

2.3.2 Second step: identification of current space-related mixed-motive games

The methodological approach's second step materialises from the combination of Liberalism's mixed-motive game aspect introduced under Section 2.1 and the first two (i/ii) of the three principal prerequisites developed under Section 2.2.

More specifically, this step comprises a comparison of the just identified current space-related state preferences amongst the preeminent Asian governments in the space sector

64 As already mentioned before, this study's author has working proficiency in these three languages. If any, (unofficial) translations of primary sources regarding the selected governments are usually available in English because it functions as the *lingua franca* of the international space sector. Moreover, this status of the English language makes it so that government representatives and Asian researchers communicate essential information on their respective government's space programme commonly also in this language.

65 For more information on these experts, see this study's 'Acknowledgement' chapter. Any mistakes in this study are its author's alone.

to detect current space-related mixed-motive games amongst them. Analytically, these governments are considered to be situated in a space-related mixed-motive game if a plausible argument can be made that their space-related state preference-based situation is mixed such that cooperation in the pursuit of their space-related state preferences can notably improve benefits or reduce or prevent losses for each side relative to the unilateral pursuit of their space-related state preferences.

Following from the two principal prerequisites, the primary focus in this comparison is on identifying the (set of) current space-related mixed-motive game(s) amongst preeminent Asian governments in the space sector that arguably involves at least a majority of these governments and concerns the pursuit of a significant portion of the latter's overall current space-related state preferences.

2.3.3 Third step: evaluation of ASA potential

The methodological approach's third analytical step evaluates which of the just identified research-relevant (set of) current space-related mixed-motive game(s) also fits the third (iii) principal prerequisite developed under Section 2.2, and thus currently offers the involved governments with a reasonable potential to commence negotiations towards establishing an intergovernmental cooperation mechanism in the form of an ASA.[66] This answers this study's primary research question.

Again, this prerequisite is that the governments involved in the research-relevant (set of) current space-related mixed-motive game(s) must at least not be opposed to entering an agreement for regional IGO-based cooperation, as well as to a transfer of a significant portion of their current major government-promoted space-related measures regarding the pursuit of their game(s)-defining current space-related state preferences under the responsibility of a regional IGO. The main explanatory variable for the first element is each involved preeminent Asian government in the space sector's current basic political and legal framework concerning IGO-based regional space cooperation. The main explanatory variable for the second element, incorporating certain constrictions lined out in Section 2.3.1, covers each involved preeminent Asian government in the space sector's current major government-promoted (domestic and cooperative) space-related measures

66 Whereby this does not mean that they will definitely choose to establish such an organisation.

regarding the pursuit of its game(s)-defining current space-related state preferences. The methodological approach's first step provides all the relevant information in this regard.

At this point, this study wants to note that, analytically-speaking, there is no perfect way to standardise the criteria of significance under any of the methodological approach's steps. It is ultimately up to the individual study to offer compelling arguments for its ruling why a (set of) space-related mixed-motive game(s) conforms with or lacks the criteria of significance.

Table 2: Overview of methodological approach

Methodological approach
First step (addressed in Chapters 4-9): Evaluation of each preeminent Asian government in the space sector's • current space-related state preferences; • current basic political and legal framework concerning IGO-based regional space cooperation; and • current major government-promoted (domestic and cooperative) space-related measures regarding the pursuit of its current space-related state preferences
Second step (addressed in Chapter 10): Comparison of the just identified current space-related state preferences amongst the preeminent Asian governments in the space sector → aimed at determining the particular (set of) current space-related mixed-motive game(s) amongst them that arguably • involves at least a majority of these governments; and • concerns the pursuit of a significant portion of the latter's overall current space-related state preferences
Third step (addressed in Chapter 10): Evaluation of which of the just identified research-relevant (set of) current space-related mixed-motive game(s) also fits the following: → the involved governments must at least not be opposed to • entering into an agreement for regional IGO-based cooperation based on their already identified respective current basic political and legal framework concerning IGO-based regional space cooperation; and • a transfer of a significant portion of their already identified respective current major government-promoted (domestic and cooperative) space-related measures regarding the pursuit of their game(s)-defining current space-related state preferences under the responsibility of a regional IGO

3 Determination of preeminent Asian governments in the space sector

As put forth in Section 1.2, this study has decided to focus analytically on the current space programmes of the preeminent Asian governments in the space sector, which are understood to encompass the governments with the most ambitious space programmes and domestic access to leading space technology (development) capabilities in Asia.

Unfortunately, there is no authoritative list of such governments in the specialised literature, as well as no generally accepted index of Asian governments with dedicated space programmes upon which to draw. Even APSCO and APRSAF have never published a compilation of all their potential Asian member states.[67] If any, Moltz and Lele have attempted the most prominent determination of a space-related Asian region by states in their respective writings discussing whether there is an Asian space race. Yet, their delineations differ considerably from each other.[68]

Under these circumstances, this study resorts to the following reasoning to arrive at a plausible list of preeminent Asian governments in the space sector as of 2017.

First of all, it acknowledges that there is no universally accepted delineation of the Asian region in general.[69] Withal, it recognises that the term 'region' has not seen an authoritative definition. For instance, Evans and others argue that a region is made up by geographical contiguity and a degree of – e.g., social, economic and political – homogeneity among states.[70] MacFarlane holds that '[r]egions are geographically limited spaces linked by notions of shared history, culture, custom, or threat.'[71] Herz calls regions 'areas of the world formed by a number of countries that are economically and politically interdependent and are defined politically by the actors involved in building regional

67 In their cases, it might be a precaution to remain flexible in expanding their future membership. They might want to avoid missing out on benefits that come with certain states joining them.

68 Moltz has taken 14 states into account in his deliberation of an Asian space race, namely Australia, China, India, Indonesia, Japan, Malaysia, North Korea, Pakistan, the Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam: Moltz (n 32) 8,158-159; Lele has considered a group of 21 UN member states in discussing the topic of an Asian space race: Bangladesh, China, India, Indonesia, Israel, Iran, Japan, Jordan, Malaysia, Myanmar, North Korea, Pakistan, the Philippines, Saudi Arabia, Singapore, South Korea, Sri Lanka, Syria, Thailand, Turkey, and Vietnam. Moreover, he refers to the UAE in his work: Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 9,38-39.

69 Philip Bowring, 'What Is "Asia"?' (1987) 135(7) Far Eastern Economic Review 30.

70 Evans and Newnham (n 1) 472–473.

71 S Neil MacFarlane, 'Regional Organizations and Global Security Governance' in Thomas G Weiss and Rorden Wilkinson (eds), *International Organization and Global Governance* (Routledge 2014) 431.

institutions.'[72] However, what can be gleaned from these definition attempts is that a researcher who wants to determine a list of states making up a particular region has to search for combined geographical as well as topic-relevant linkages amongst them.

With this in mind, this study finds it practical to mimic Lele's approach[73] of looking at the Statistics Division of the United Nations (UN) Secretariat's 'M49 Standard' to achieve an initial broad geographical delineation of an Asian region by states. In short, this Standard splits the world into 'geographic regions [...] based on continental regions; which are further subdivided into sub-regions and intermediary regions drawn as to obtain greater homogeneity in sizes of population, demographic circumstances and accuracy of demographic statistics.' By mid-2017, it describes Asia as a nexus of 48 geographically connected states. Asia's five ascribed subregions are Central[74], Eastern[75], Southern[76], South-Eastern[77], and Western[78] Asia.[79] Notably, Russia is not part of this Standard's Asian region despite having most of its landmass situated on the Asian continent.

After that, this study explores, on a general level, these 48 states for (somewhat verifiable) dedicated governmental space programmes and related linkages amongst each other to identify a plausible current list of Asian governments with dedicated space programmes.

In this regard, this study agrees again with Lele who sees Russia together with all the other former Soviet Union member states to be situated outside of Asia in terms of outer space. He explains that the latter states have not presented notable space-specific investments in recent years. In the limited scope that they have shown engagement in the space sector, they have usually interacted with Russia, which experts consider being more

72 Monica Herz, 'Regional Governance' in Thomas G Weiss and Rorden Wilkinson (eds), *International Organization and Global Governance* (Routledge 2014) 237.

73 Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 8. Lele uses a by now outdated version of the Statistic Division's geoscheme.

74 Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

75 China (incl. Hong Kong and Macao), Japan, Mongolia, North Korea, South Korea.

76 Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka.

77 Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste, Vietnam.

78 Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, the State of Palestine, Syria, Turkey, UAE, Yemen.

79 'Methodology Standard Country or Area Codes for Statistical Use (M49)' (*United Nations Statistics Division*) <https://unstats.un.org/unsd/methodology/m49/> accessed 14 September 2017. It is added on the webpage: 'The assignment of countries or areas to specific groupings is for statistical convenience and does not imply any assumption regarding political or other affiliation of countries or territories by the United Nations.'

of an independent European space power that has some special interests in Asia. Most prominently, Kazakhstan, which hosts the former Soviet Union spaceport known as *Baikonur Cosmodrome*, mainly fosters Russia's space-related interests.[80] It has leased the spaceport to Russia until 2050, and they have jointly invested in its extension.[81]

Adding to that, this study finds that Moltz makes, for the most part, further a reasonable point in omitting all so-called Middle Eastern states from the delineation of a space-related Asian region because they usually display an overall localised political, economic and military orientation.[82]

Altogether, this means that the M49 Standard's 48 states can be reduced by 23 states, namely Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan (former Soviet Union), as well as Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, the State of Palestine, Syria, Turkey, the United Arab Emirates (UAE) and Yemen (Middle East).[83] Yet, in practice, this study argues that an exception has to be made for Iran and Turkey. Their territory (Iran) or at least a major part of it (Turkey) is not only geographically located on the Asian continent, but their full APSCO membership also indicates the existence of dedicated governmental space programmes with a deliberate and sustainable orientation towards all of Asia.

Regarding the other states subsumed under the M49 Standard's Asia delineation, Cyprus can be excluded here on the grounds that it is a member state of the European Union (EU) and a European Cooperating State of ESA.[84]

Besides that, Afghanistan, Bhutan, Brunei, Cambodia, Laos, the Maldives, Myanmar, Nepal, Sri Lanka and Timor-Leste can be subtracted from a current list of Asian governments with dedicated space programmes because their governments presently

80 Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 8–9.

81 'Kazakhstan Finally Ratifies Baikonur Rental Deal With Russia' (*SpaceDaily*, 12 April 2010) <http://www.spacedaily.com/reports/Kazakhstan_Finally_Ratifies_Baikonur_Rental_Deal_With_Russia_999.html> accessed 6 January 2017.

82 Moltz (n 32) 8. Notably, he also excludes all former Soviet Union member states from such a region but gives less reasons for it than Lele.

83 No authoritative political or legal definition of the 'Middle East' exists but these states fit into the common interpretation of this subregion.

84 'Cyprus Becomes 11th ESA European Cooperating State' (*ESA*, 8 July 2016) <http://www.esa.int/About_Us/Welcome_to_ESA/Cyprus_becomes_11th_ESA_European_Cooperating_State> accessed 26 October 2016.

either have no identifiable or at most seem to maintain very limited space programmes. Regarding the latter, Bhutanese engineers mostly engage with a Japanese university in the *Bhutan-1* cubesat project to foster Bhutan's space science and technology capacity building.[85] Royal Group of Cambodia, a Cambodian investment firm, has entered into a framework agreement with the Chinese government-related China Great Wall Industry Corporation[86] (CGWIC) in January 2018 to build and launch the *Techo-1* communications satellite.[87] Laos only owns 45% of the *LaoSat-1* communications satellite as a partner in the Sino-Laotian LaoSat-1 Joint Venture Co. Moreover, Laos has relied on the Chinese side for a loan to finance this project, and in building the satellite and training Laotian personnel for satellite operation.[88] The government in Myanmar has just set up a steering committee in 2017 to commence discussions on developing a Myanmar-owned satellite system.[89] Finally, the private Sri Lankan operator SupremeSAT that is reportedly backed by its government owns the *SupremeSAT-1* communications satellite together with China Satcom. A Chinese launcher put the satellite into orbit in 2012. In the same year, SupremeSAT further signed a commercial contract over $215 million with CGWIC for the construction and launch of *SupremeSAT-2* around 2018, whereby a Chinese bank apparently helps to finance this project.[90]

Singapore is a special case. Singaporean entities seem quite active in the space sector, but it is hard to assess how much of a role the government has in that. Reportedly, most Singaporean space undertakings are led by universities and commercial companies.[91] As

85 Younten Tshedup, 'BHUTAN-1 Expected to Be in Space by May' (*Kuensel*, 1 February 2018) <http://www.kuenselonline.com/bhutan-1-expected-to-be-in-space-by-may/> accessed 30 April 2018.

86 'Shareholder Profile' (*CGWIC*) <http://www.cgwic.com/About/Shareholder.html> accessed 21 November 2017.

87 Caleb Henry, 'Cambodia to Buy Chinese Satellite as Relations Tighten on Belt and Road Initiative' (*SpaceNews*, 12 January 2018) <http://spacenews.com/cambodia-to-buy-chinese-satellite-as-relations-tighten-on-belt-and-road-initiative/> accessed 30 April 2018.

88 Peter B de Selding, 'Laos, with China's Aid, Enters Crowded Satellite Telecom Field' (*SpaceNews*, 30 November 2015) <http://spacenews.com/laos-with-chinese-aid-is-latest-arrival-to-crowded-satellite-telecom-field/> accessed 18 November 2016.

89 'First Coordination Meeting of Steering Committee to Set up Myanmar Owned Satellite System Held' (*Global New Light Of Myanmar*, 29 April 2017) <http://www.globalnewlightofmyanmar.com/first-coordination-meeting-of-steering-committee-to-set-up-myanmar-owned-satellite-system-held/> accessed 30 October 2017; 'Second Coordination Meeting on Setting up Owned Satellite System Held' (*Global New Light Of Myanmar*, 4 July 2017) <http://www.globalnewlightofmyanmar.com/second-coordination-meeting-on-setting-up-owned-satellite-system-held/> accessed 30 October 2017.

90 Peter B de Selding, 'Sri Lanka Paying China Great Wall $215M To Build, Launch SupremeSAT-2' (*SpaceNews*, 30 May 2013) <http://spacenews.com/35545sri-lanka-paying-china-great-wall-215m-to-build-launch-supremesat-2/> accessed 30 October 2017; 'SupremeSAT-I' (*SupremeSAT*) <http://www.supremesat.com/satellites/supremesat-i/> accessed 30 October 2017; 'SupremeSAT- 2' (*SupremeSAT*) <http://www.supremesat.com/satellites/supremesat-ii/> accessed 30 October 2017.

91 Leong Keong Kwoh, 'Singapore Country Report 2017' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <http://www.aprsaf.org/annual_meetings/aprsaf24/data/day16/3_1_171115-APRSAF24.pdf> accessed 13 March 2018.

such, this study exempts the Singaporean government from its current list of Asian governments with dedicated space programmes.

Considering all that and based on some accessible material providing evidence for or somewhat indicating the existence of dedicated governmental space programmes in the remaining group of states, a current list of 15 Asian governments[92] with dedicated space programmes manifests at this point. These are the governments of Bangladesh,[93] China, India, Indonesia[94], Iran, Japan, Malaysia[95], Mongolia[96], North Korea, Pakistan[97], the Philippines[98], South Korea, Thailand[99], Turkey[100] and Vietnam[101] (see also Table 3).

Among those, this study holds that the governments of China, India, Iran, Japan, North Korea and South Korea are the most plausible candidates for the list of preeminent Asian

92 Moltz's own determination that Australia's space-related international ties are primarily with Western states counters his inclusion of Australia into a space-related Asian region: Moltz (n 32) 160–165; Lele also incorporates the Republic of China, usually referred to as Taiwan, when talking about Asian governments' space programmes: Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 76–77. This study does not address Taiwan because it is no UN member state.

93 Eg: Shaurov Dhar, 'Bangladesh Space Research & Remote Sensing Organization (SPARRSO)' (Presentation, ETE 451 Case, North South University, Bangladesh) <http://shaurov.weebly.com/uploads/2/3/8/7/2387470/presentation_on_sparrso.pdf> accessed 8 October 2015; 'APSCO Member States' (*APSCO*) <http://apsco.int/AboutApsco.asp?LinkNameW1=APSCO_Member_States&LinkCodeN=11> accessed 19 January 2015.

94 Eg: Thomas Djamaluddin, 'Indonesia Country Report' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <http://www.aprsaf.org/annual_meetings/aprsaf24/data/day16/2_3_LAPAN.pdf> accessed 13 March 2018.

95 Eg: Noordin Ahmad, 'Country Report - Malaysia "Space Technology for Enhanced Governance and Development"' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <http://www.aprsaf.org/annual_meetings/aprsaf24/data/day16/2_8_MALAYSIA.pdf> accessed 13 March 2018; 'National Space Policy 2030: Driving the Space Sector in Malaysia' (*Coordinates*, April 2017) <http://mycoordinates.org/national-space-policy-2030-driving-the-space-sector-in-malaysia/> accessed 14 May 2017.

96 Eg: Vandansambuu Batbayar, 'Space Technology in Mongolia' (Presentation, APRSAF-21, Tokyo, 4 December 2014) <https://www.aprsaf.org/annual_meetings/aprsaf21/pdf/program/plenary/d3_1340_07_mongolia.pdf> accessed 25 November 2015; 'APSCO Member States' (n 93).

97 Eg: Ahmed Syed Bilal, 'Space Activities in Pakistan' (Presentation, APRSAF-21, Tokyo, 4 December 2014) <https://www.aprsaf.org/annual_meetings/aprsaf21/pdf/program/plenary/d3_1340_08_pakistan.pdf> accessed 14 December 2015; 'APSCO Member States' (n 93).

98 Eg: Raul Sabularse, 'Philippine Space Development' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <http://www.aprsaf.org/annual_meetings/aprsaf24/data/day16/2_9_PhilippineCountryReport.pdf> accessed 13 March 2018.

99 Eg: Ammarin Pimnoo, 'Thailand's National Space Strategy 2017-2036' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <http://www.aprsaf.org/annual_meetings/aprsaf24/data/day16/3_2_GISTDA.pdf> accessed 13 March 2018; 'APSCO Member States' (n 93).

100 Eg: Ali Baygeldi, 'Satellite and Space Activities in Turkey' (Presentation, APRSAF-23, Manila, 17 November 2016) <http://www.aprsaf.org/annual_meetings/aprsaf23/pdf/program/plenary/AP23_D3_1330_CR-10_Turkey.pdf> accessed 13 March 2018; 'APSCO Member States' (n 93).

101 Eg: Dao Ngoc Chien, 'Results of Implementation of National Strategy for Research and Application of Space Technology up to 2020 (2016-2017)' (Presentation, APRSAF-24, Bangaluru, 16 November 2017) <http://www.aprsaf.org/annual_meetings/aprsaf24/data/day16/3_5_AP24_CountryReport.pdf> accessed 13 March 2018.

governments in the space sector as of 2017. These six governments presently appear to have, compared to the information on the governmental space programmes of Bangladesh, Indonesia, Malaysia, Mongolia, Pakistan, the Philippines, Thailand, Turkey and Vietnam presented in their respective footnotes above, the most ambitious space programmes and domestic access to leading space technology (development) capabilities in Asia. Information on (the breadth of) the current space programmes of the Chinese, Indian, Iranian, Japanese, North Korean and South Korean governments is offered in much detail throughout this study, especially in its Chapters 4-9.

Table 3: List of Asian governments with dedicated space programmes as of 2017

As of 2017		
Preeminent Asian governments in the space sector		
China	India	Iran
Japan	North Korea	South Korea
Other Asian governments with (somewhat verifiable) dedicated space programmes		
Bangladesh	Indonesia	Malaysia
Mongolia	Pakistan	the Philippines
Thailand	Turkey	Vietnam

4 People’s Republic of China (China)

4.1 Analytical considerations

Overall, this study can draw on a smorgasbord of publicly accessible Chinese and English material, including (translated) domestic political and legal documents, concerning its particular evaluation of the Chinese government’s current space programme. Notably, this study’s search for and interpretation of such material has profited considerably from the input of various renowned experts in the Chinese space sector during the author’s semester-long research stay in China in 2015.[102]

However, there are also several challenges to the use of this material. One of this study’s three main challenges is the fact that available English translations of domestic political and legal documents are sometimes inaccurate. For example, the English versions of the government’s space-specific white papers between 2000 and 2016[103] continuously read ‘space industry’ in place of the original Chinese versions’ ‘航天事业’. Yet, the actual purport of ‘事业’ is more that of a national level ‘undertaking’.[104] The English word ‘industry’ does not necessarily cover that meaning. At the same time, the translation of ‘产业’ and ‘工业’ into ‘industry’ is appropriate.[105] As such, this study refers to translated primary material only whenever it sees no substantial difference to the Chinese original. It points towards the latter whenever the available translation appears problematic.

The second main challenge is that Chinese politics, and thus many a domestic political and legal document and statement, teems with phrases that stand in for more complex political concepts. Section 4.4.1 outlines the most relevant of such phrases in the context of this study to ensure reliable research results.

The third main challenge is the limited breadth of official information about the undoubtedly existent military side of the government’s current space programme. It necessitates a particularly careful interpretation of the available information in this regard

102 See also this study’s ‘Acknowledgements’ chapter. Any mistakes in this study are its author’s alone.

103 For more information on those white papers, see this study’s Section 4.2.

104 Based on information provided by Chinese experts in 2015. See also: ‘事业’ (*Oxford Dictionaries*) <https://premium.oxforddictionaries.com/translate/chinese-english/%E4%BA%8B%E4%B8%9A> accessed 21 September 2018.

105 ‘产业’ (*Oxford Dictionaries*) <https://premium.oxforddictionaries.com/translate/chinese-english/%E4%BA%A7%E4%B8%9A> accessed 21 September 2018; ‘工业’ (*Oxford Dictionaries*) <https://premium.oxforddictionaries.com/translate/chinese-english/%E5%B7%A5%E4%B8%9A> accessed 21 September 2018.

to avoid distorting findings on the government's current space-related state preferences and corresponding major measures.

4.2 Main domestic political and legal documents

There is no overarching Chinese national space law and no single all-encompassing government space policy and strategy document. Based on the accessed information, and without claiming completeness, this study considers at least the following domestic political and legal documents as to mainly guide the Chinese government's space programme as of 2017. Naturally, their known content deserves special attention throughout this chapter.

At the centre is the '13th Five-Year National Economic and Social Development Plan of the People's Republic of China'[106] (13th Five-Year Plan). Adopted in March 2016 by the National People's Congress (NPC), which constitutes China's unicameral national legislature, this plan sets out the government's main national development objectives and related essential strategy elements for the next five years.[107] It includes references to national (aero)space-related industrial, scientific and technological development.[108]

More specialised political documents in place are, regardless of their potentially earlier publication date, commonly implemented in line with the current five-year plan. While writing, the most prominent and presumably most influential space-specific political documents appear to be the 'National Medium- and Long-Term Satellite Navigation Industry Development Plan'[109] (SNIDP) from 2013 and the 'National Medium- and Long-

106 '中华人民共和国国民经济和社会发展第十三个五年规划纲要 [13th Five-Year National Economic and Social Development Plan of the People's Republic of China Outline]' (*NDRC*, March 2016) <http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjh/201603/P020160318564052484043.pdf> accessed 21 September 2017; for an unofficial English translation, see: Compilation and Translation Bureau, Central Committee of the CPC (tr), 'The 13th Five-Year Plan for Economic and Social Development of the People's Republic of China (2016-2020)' (*NDRC*) <http://en.ndrc.gov.cn/newsrelease/201612/P020161207645765233498.pdf> accessed 21 September 2017.

107 For a general analysis of this plan, see: Katherine Koleski, 'The 13th Five-Year Plan' <https://www.uscc.gov/Research/13th-five-year-plan> accessed 4 December 2017.

108 For example: Compilation and Translation Bureau, Central Committee of the CPC (n 106) chs 22,23,49,52.

109 General Office of the SC, '国务院办公厅关于印发国家卫星导航 产业中长期发展规划的通知 [Notice of the General Office of the State Council on the Printing and Distribution of the National Medium- and Long-Term Satellite Navigation Industry Development Plan]' (*SC*, 9 October 2013) <http://www.gov.cn/zwgk/2013-10/09/content_2502356.htm> accessed 4 December 2017.

Term Civil Space Infrastructure Development Plan (2015-2025)'[110] (CSIDP) from 2015. Additionally, the government's still active 'National Medium- and Long-Term Science and Technology Development Plan (2006-2020)'[111] (STDP) from 2006, 'Made in China 2025' action plan[112] from 2015 and '13th Five-Year National Strategic Emerging Industries Development Plan'[113] from 2016 include a strong push for, among others, domestic space-related industrial and technological development.

Legislation-wise, Zhao states that 'most of the rules governing space activities in China are put down in form of departmental rules; thus, the regulatory regime in the space field is at a relatively low level.'[114] As such, they might be easily overturned, and their guiding role within the government's current space programme can be considered to be somewhat limited. One of the two presently most prominent domestic space-related legal documents was initially adopted in 2001 under the title 'Administrative Measures for the Registration of Objects Launched into Outer Space'[115]. As its name suggests, it deals with the registration of space objects. The other was initially adopted in 2002 under the title 'Interim Administrative Measures on Permits for Civil Space Launch Projects'[116]. It prescribes a licensing process for the launch of civil space objects.[117]

110 '国家民用空间基础设施中长期发展规划（2015-2025 年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (*NDRC*) <http://www.ndrc.gov.cn/gzdt/201510/W020151029394768113250.pdf> accessed 21 September 2017.

111 '国家中长期科学和技术发展规划纲要（2006—2020 年）[National Medium- and Long-Term Science and Technology Development Plan Outline (2006-2020)]' (*Ministry of Science and Technology of the People's Republic of China*, 9 February 2006) <http://www.most.gov.cn/mostinfo/xinxifenlei/gjkjgh/200811/t20081129_65774.htm> accessed 25 May 2015; for an unofficial English translation, see: 'The National Medium- and Long-Term Program for Science and Technology Development (2006-2020) An Outline' (*China International Science and Technology Corporation*) <http://www.cistc.gov.cn/oa/file/download.asp?id=6298> accessed 10 June 2015.

112 SC, '国务院关于印发《中国制造 2025》的通知 [Notice of the State Council on Printing and Distributing "Made in China 2025"]' (*SC*, 8 May 2015) <http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm> accessed 4 December 2017.

113 SC, '国务院关于印发"十三五"国家战略性新兴产业发展规划的通知 [Notice of the State Council on Printing and Distributing the "13th Five-Year" National Strategic Emerging Industries Development Plan]' (*SC*, 29 November 2016) <http://www.gov.cn/zhengce/content/2016-12/19/content_5150090.htm> accessed 4 December 2017.

114 Yun Zhao, *National Space Law in China. An Overview of the Current Situation and Outlook for the Future* (Brill Nijhoff 2015) 24.

115 For an unofficial English translation, see: Faculty of International Law of China University of Political Science and Law and National Center for Remote Sensing, Air, and Space Law at the University of Mississippi, 'Chinese Law: Registration, Launching and Licensing Space Objects' (2007) 33(2) Journal of Space Law 437, 437–441.

116 For an unofficial English translation, see: ibid 442–457.

117 Zhao, *National Space Law in China* (n 114) 38–42. These documents' English titles follow here the translations offered by Zhao.

The government through the State Council Information Office (SCIO) published its first space-specific white paper titled ‘中国的航天’[118], or ‘China’s Space Activities’[119] in its English version, (CSA2000) in 2000. It was followed by ‘2006 年中国的航天’[120]/ ‘China’s Space Activities in 2006’[121] (CSA2006), which was later replaced by ‘2011 年中国的航天’[122]/‘China’s Space Activities in 2011’[123] (CSA2011). Since 2016, ‘2016 中国的航天’[124]/‘China’s Space Activities in 2016’[125] (CSA2016), and ‘中国北斗卫星导航系统’/‘China’s BeiDou Navigation Satellite System’[126] (CBDS) have taken the place of the government’s primary space-specific white papers. In contrast to how other researchers sometimes portray them, this study has found no conclusive evidence that these documents, or any other of the government’s white papers for that matter, have ever constituted binding domestic political or legal documents per se. Nonetheless, it holds that they can be treated as valuable sources for its specific evaluation of the government’s current space programme. After all, CSA2016 explains: ‘To enable the world community to better understand China’s space industry [sic!], we are publishing this white paper to offer a brief introduction to the major achievements China has made in this field since 2011, its main tasks in the next five years, and its international exchanges and cooperation efforts.’ In particular, all the white papers mentioned above seem, for the most part, to aim at presenting the essential civil aspects determined in the various domestic space-related plans and regulations at the time of their respective publication.[127]

118 SCIO, ‘《中国的航天》 ["China’s Spaceflight"]’ (*SCIO*, 22 November 2000) <http://www.scio.gov.cn/zfbps/ndhf/2000/Document/307950/307950.htm> accessed 22 August 2015.

119 SCIO, ‘China’s Space Activities’ (*China.org.cn*, November 2000) <http://www.china.org.cn/e-white/8/index.htm> accessed 14 May 2015.

120 SCIO, ‘《2006 年中国的航天》 ["China’s Spaceflight in 2006"]’ (*SCIO*, 13 October 2006) <http://www.scio.gov.cn/zfbps/ndhf/2006/Document/307876/307876.htm> accessed 22 August 2015.

121 SCIO, ‘China’s Space Activities in 2006’ (*China.org.cn*, October 2006) <http://www.china.org.cn/english/features/book/183672.htm> accessed 18 May 2015.

122 SCIO, ‘《2011 年中国的航天》（全文） ["China’s Spaceflight in 2011" (Full Text)]’ (*SCIO*, 29 December 2011) <http://www.scio.gov.cn/zxbd/nd/2011/Document/1073255/1073255.htm> accessed 1 June 2015.

123 SCIO, ‘China’s Space Activities in 2011’ (*China.org.cn*, 29 December 2011) <http://www.china.org.cn/government/whitepaper/node_7145648.htm> accessed 3 May 2015.

124 SCIO, ‘《2016 中国的航天》白皮书（全文）["China’s Spaceflight in 2016" White Paper (Full Text)]’ (*SCIO*, 27 December 2016) <http://www.scio.gov.cn/zfbps/32832/Document/1537007/1537007.htm> accessed 16 September 2017.

125 SCIO, ‘Full Text: China’s Space Activities in 2016’ (*SCIO*, 27 December 2016) <http://www.scio.gov.cn/zxbd/wz/Document/1537091/1537091.htm> accessed 18 September 2017.

126 SCIO, ‘中国北斗卫星导航系统 China’s BeiDou Navigation Satellite System’ (*SCIO*, 16 June 2016) <http://english.scio.gov.cn/2016-06/16/content_40535894.htm> accessed 16 September 2017. This link provides both the Chinese and English document version.

127 For the citation, see: SCIO, ‘CSA2016{eng}’ (n 125) preamble; based on the Chinese CSA2016 version, it should read ‘space undertakings’ instead of ‘space industry’ here: SCIO, ‘CSA2016{ch}’ (n 124) 前言 [preamble]; this study’s argument that the aforementioned white papers focus on the civil side of the government’s space programme is supported by Pollpeter and others’ conclusion that military aspects of the government’s space programme are usually not detailed in its space-specific white papers: Kevin Pollpeter and others, ‘China Dream, Space Dream. China’s Progress in Space

4.3 Basic domestic decision-making system

The domestic decision-making system behind the formulation and implementation of the Chinese government's present space programme is not known in all detail. As Aliberti explains, there is a high-level of secrecy combined with complicating factors like '(a) the existence of a "Byzantine maze" of bureaucratic structures that involve a myriad of organisations, as well as countless organisations within organisations; (b) the general complexity of the inner workings of China's power structures and hierarchies; (c) the multiple restructurings, renaming, and relocation of bureaucratic offices and institutes that have occurred through the past 50 years in the Chinese space organisation; and (d) the continuous expansion of space governance in terms of the creation of new administrative entities designed to respond to the needs of new programmes and missions.' Even members within the system are not always aware of their exact position within it.[128] Ultimately, this study holds that knowledge of the following context sufficiently aids its particular assessment of said programme.

At its core, China is an authoritarian one-party state in which the Communist Party of China (CPC), the state, including the government, and the military form a symbiotic relationship. More precisely, the CPC and its members permeate and exercise control over the state and military.[129]

In particular, the General Secretary of the CPC's Central Committee has a substantial influence on any major government programme. The office holder usually also fills the highest position in the CPC's most senior political decision-making body, namely first ranked member of the party's Politburo Standing Committee, as well as the positions of Chairman of the CPC's Central Military Commission and State President. Xi Jinping (习近平) occupies all these offices after the conclusion of a transitional period between 2012 and 2013.[130]

Technologies and Implications for the United States' (Report, US-China Economic and Security Review Commission 02 March 2015) 2 <https://www.uscc.gov/sites/default/files/Research/China%20Dream%20Space%20Dream_Report.pdf> accessed 12 May 2015.

128 Marco Aliberti, *When China Goes to the Moon...* (Springer 2015) 8; this assessment is supported by some conclusions drawn in other papers, eg: Juqian Li, 'Progressing Towards New National Space Law: Current Legal Status and Recent Developments in Chinese Space Law and Its Relevance to Pacific Rim Space Law and Activities' (2009) 35(2) Journal of Space Law 439, 445–446; Shouping Li, 'The Role of International Law in Chinese Space Law and Its Relevance to Pacific Rim Space Law and Activities' (2009) 35(2) Journal of Space Law 539, 548–549.

129 Aliberti (n 128) 8–9.

130 Susan V Lawrence, 'China's Political Institutions and Leaders in Charts' (CRS Report for Congress R43303, 12 November 2013) <https://www.fas.org/sgp/crs/row/R43303.pdf> accessed 18 June 2015.

Besides the State President, other CPC-controlled state-related entities with a well-known or assumed distinct influence on the formulation and implementation of the government's current space programme at least include the State Council (SC), which represents the Chinese government; the National Development and Reform Commission (NDRC); the NPC; the Ministry of Industry and Information Technology, especially through the subordinate State Administration for Science, Technology and Industry for National Defence (SASTIND); the Ministry of Science and Technology; the Ministry of Finance; two state-owned conglomerates called China Aerospace Science and Technology Corporation (commonly referred to as CASC) and China Aerospace Science and Industry Corporation (commonly referred to as CASIC); the Chinese Academy of Sciences (CAS); the China Meteorological Administration; and the China National Space Administration (CNSA). Contrary to public perception, CNSA, founded in 2013 and hierarchically put under SASTIND, is not a fully-fledged national space agency.[131] It primarily fulfils two functions. First, it is the government's representative in the international space sector. For example, it signs many of the government's international space cooperation agreements and administers international scientific and technical exchanges. Second, it is, presumably through direct exchange with SASTIND, responsible for fostering China's space industry and technology development. It takes part in setting up and managing Chinese space technology and industry policies, strategies and regulations.[132]

Finally, official information on the management of the *China Manned Space Programme* (CMSP)[133], which follows a special joint command system and involves the so-called China Manned Space Engineering Office (CMSEO) that apparently is sometimes also referred to as China Manned Space Agency (CMSA), and various findings in previous studies suggest that, even though their particular influence is often hard to pinpoint, a range of – ultimately CPC-connected – domestic military entities and personnel partake

131 Based on information provided by Chinese space experts in 2015 and in: Aliberti (n 128) 10-12,15-22; Zhao, *National Space Law in China* (n 114) 26–35.

132 Based on information in: '机构职能 [Organisation and Function]' (*CNSA*) <http://www.cnsa.gov.cn/n1081/n7469/n308501/index.html> accessed 19 February 2015; Aliberti (n 128) 11–12; Zhao, *National Space Law in China* (n 114) 28–30.

133 'China Space Station and Its Resources for International Cooperation' (Handbook Ver 1.0, UNOOSA/CMSA 28 May 2018) 1 <http://www.unoosa.org/documents/doc/psa/hsti/CSS_1stAO/CSS_1stAO_Handbook_2018.pdf> accessed 23 July 2018; in Chinese called '中国载人航天工程': '中国载人航天工程简介 [Brief Overview of China Manned Space Engineering]' (*CAS*, 14 June 2013) <http://www.cas.cn/zt/kjzt/zkyyzrht/gcjj/201306/t20130614_3865775.shtml> accessed 22 July 2018.

considerably in the formulation and implementation of the government's current space programme.[134]

4.4 Space-related state preferences

4.4.1 Special political terminology

As already mentioned in Section 4.1, Chinese politics teems with phrases that stand in for more complex political concepts. An understanding of the following phrases markedly contributes to the assessment of the government's current space-related state preferences.

4.4.1.1 National rights and interests

According to CSA2016, the protection of – no further defined – 'national rights and interests' ('国家权益') is one purpose behind China's space undertakings.[135] It is reasonable to assume that such interests especially encompass the government's core national interests put forward in a white paper from 2011. These core national interests are 'state sovereignty, national security, territorial integrity and national reunification, China's political system established by the Constitution and overall social stability, and the basic safeguards for ensuring sustainable economic and social development.'[136] Based on another white paper, national reunification usually means the return of Taiwan under the full control of the People's Republic of China.[137] The reference to China's political system established by the Constitution presumably aims at securing the CPC's sole rule over China considering that the 'Constitution of the People's Republic of China' points out the CPC's leadership role over the Chinese people.[138]

134 Based on information presented in: Aliberti (n 128) 13–15; Zhao, *National Space Law in China* (n 114) 30–31; '中国载人航天工程组织管理 [China Manned Space Engineering Organisation Management]' (*China Manned Space*, September 2016) <http://www.cmse.gov.cn/art/2015/8/2/art_24_11273.html> accessed 21 September 2018; 'Management' (*China Manned Space*) <http://en.cmse.gov.cn/col/col71/index.html> accessed 21 September 2018; Kevin L Pollpeter, Michael S Chase and Eric Heginbotham, 'The Creation of the PLA Strategic Support Force and Its Implications for Chinese Military Space Operations' (Research Report RR-2058-AF, RAND Corporation 2017) <https://www.rand.org/content/dam/rand/pubs/research_reports/RR2000/RR2058/RAND_RR2058.pdf> accessed 27 November 2017.

135 SCIO, 'CSA2016{eng}' (n 125) ch I; SCIO, 'CSA2016{ch}' (n 124) ch I.

136 SCIO, 'China's Peaceful Development' (*China.org.cn*, 6 September 2011) ch III <http://www.china.org.cn/government/whitepaper/node_7126562.htm> accessed 31 May 2015.

137 Taiwan Affairs Office of the SC and SCIO, 'The One-China Principle and the Taiwan Issue(2000)' (*SCIO*, February 2000) <http://www.gov.cn/english/official/2005-07/27/content_17613.htm> accessed 28 January 2018.

138 'Constitution of the People's Republic of China (Full Text after Amendment on March 14, 2004)' (*NPC*) preamble <http://www.npc.gov.cn/englishnpc/Constitution/node_2825.htm> accessed 4 February 2015.

4.4.1.2 Chinese Dream and Space Dream

CSA2016 further names the 'Chinese Dream'[139] ('中国梦') as part of the vision guiding the government's current space undertakings.[140] In a nutshell, this phrase, first introduced at the highest political level in a speech of President Xi in November 2012,[141] stands, depending on the translation of '中华民族伟大复兴'[142], for 'the great renewal of the Chinese nation'[143] or 'the great rejuvenation of the Chinese nation'[144]. Ultimately, this renewal or rejuvenation involves to completely overcome China's historical aberrations in large parts of the 19th and 20th century and to lift it back into its previous rank of a prosperous and one of the strongest and most influential powers in the world.[145] Towards that end, the government especially pursues the so-called 'Two [consecutive] Centenary Goals' ('"两个一百年"奋斗目标')[146]: '[1] To finish building a moderately prosperous society in all respects by the time the CPC celebrates its centenary in 2021 and [2] to turn the People's Republic of China into a modern socialist country that is prosperous, strong, democratic[147], culturally advanced, and harmonious by the time it celebrates its centenary in 2049.'[148] These Two Centenary Goals interlink well with the government's aforementioned core national interests. Most prominently, the striving for increased national prosperity and strength fits the core national interests concerning national security and economic and social development.

The relevance that the government ascribes to its space programme in achieving the Chinese Dream as outlined above becomes clear through President Xi's determination

139 Sometimes also 'China Dream'.

140 SCIO, 'CSA2016{eng}' (n 125) ch I; SCIO, 'CSA2016{ch}' (n 124) ch I.

141 'Background: Connotations of Chinese Dream' (*China Daily*, 5 March 2014) <http://www.chinadaily.com.cn/china/2014npcandcppcc/2014-03/05/content_17324203.htm> accessed 27 May 2015.

142 斌 [Bin] 李 [Li], '习近平：承前启后 继往开来 继续朝着中华民族伟大复兴目标奋勇前进 [Xi Jinping: Inherit the Past and Usher in the Future, Carry Forward the Revolutionary Cause and Forge Ahead into the Future, Continue Forging Valiantly Ahead Toward the Chinese People's Mighty Goal of Rejuvenation]' (*Xinhuanet*, 29 November 2012) <http://news.xinhuanet.com/politics/2012-11/29/c_113852724.htm> accessed 27 May 2015.

143 'Xi Pledges "Great Renewal of Chinese Nation"' (*Xinhuanet*, 29 November 2012) <http://news.xinhuanet.com/english/china/2012-11/29/c_132008231.htm> accessed 27 May 2015.

144 'President Xi's Worldwide Diplomacy Benefits China, the World' (*SCIO*, 6 January 2016) <http://www.scio.gov.cn/32618/Document/1461004/1461004.htm> accessed 20 September 2017.

145 Based on information in: 李 [Li] (n 142); Pollpeter and others (n 127) 3–5; Benjamin Carlson, 'The World According to Xi Jinping' (*The Atlantic*, 21 September 2015) <http://www.theatlantic.com/international/archive/2015/09/xi-jinping-china-book-chinese-dream/406387/> accessed 24 October 2015.

146 While writing, this was the commonly used Chinese phrase for these goals. See, for example: 波 [Bo] 梁 [Liang], '"两个一百年"奋斗目标是中华民族伟大复兴的重要里程碑 [The Two Centenary Goals Are an Important Milestone for the Great Rejuvenation of the Chinese Nation]' (*SCIO*, 21 June 2017) <http://www.scio.gov.cn/zhzc/10/Document/1555727/1555727.htm> accessed 12 December 2017.

147 As indicated by the reference to 'socialist country', it does not mean democracy in the Western image.

148 Compilation and Translation Bureau, Central Committee of the CPC (n 106) ch 2 (numbering added).

that the pursuit of the 'Space Dream' ('航天梦') is an important component of turning China into a strong country,[149] and towards 'realizing the Chinese people's mighty dream of national rejuvenation.'[150] According to CSA2016's Chinese version, the government understands the Space Dream as to involve space exploration, the development of space undertakings, and China's transformation into a space power.[151]

4.4.1.3 Comprehensive national power

All four Chinese CSA versions refer to the build-up of – as commonly translated in Western academic publications – 'comprehensive national power'[152] (CNP; '综合国力') as a purpose of Chinese space undertakings.[153] Combining various researchers' findings, a state's CNP consists of the entirety of a state's hard and soft power capabilities, e.g. in form of scientific and technological capabilities, that it can apply to achieve its domestic and international objectives.[154]

4.4.2 Socioeconomic state preferences

This study concludes that the government's current space-related socioeconomic state preference is the advancement of China's socioeconomic development.

For one, the national economic and social development-oriented 13th Five-Year Plan addresses national (aero)space-related industrial, scientific and technological development.[155] Moreover, the government declares in CSA2016 to facilitate Chinese space undertakings 'to meet the demands of economic[...] development, [...] and social

149 京荆 [Jingjing] 邓 [Deng], '习近平同神舟十号航天员亲切通话 [Xi Jinping Cordially Communicates with Shenzhou X Astronauts]' (中国日报 *[China Daily]*, 24 June 2013) <http://www.chinadaily.com.cn/dfpd/2013shenshi/2013-06/24/content_16653305.htm> accessed 31 May 2015.

150 As cited in: Pollpeter and others (n 127) 7.

151 SCIO, 'CSA2016{ch}' (n 124) preamble. There it reads: '探索浩瀚宇宙，发展航天事业，建设航天强国，是我们不懈追求的航天梦。'.

152 Dean Cheng, 'China's Space Program and Comprehensive National Power' (*The University of Nottingham*, 28 October 2014) <https://blogs.nottingham.ac.uk/chinapolicyinstitute/2014/10/28/chinas-space-program-promotes-comprehensive-national-power/> accessed 20 October 2015; Pollpeter and others (n 127) 5–6.

153 SCIO, 'CSA2000{ch}' (n 118) ch I; SCIO, 'CSA2006{ch}' (n 120) ch I; SCIO, 'CSA2011{ch}' (n 122) ch I; SCIO, 'CSA2016{ch}' (n 124) ch I.

154 Based on information in: Pollpeter and others (n 127) 5–7; Dean Cheng, 'Chinese Concepts of Space Security', *Handbook of Space Security. Policies, Applications and Programs* (Springer 2015) 432; Wuttikorn Chuwattananurak, 'China's Political Stability and Comprehensive National Power: A Case Study of the Conflict in Xinjiang' (2014) 11(9) Journal of US-China Public Administration 721, 721–726.

155 As already identified in this study's Section 4.2.

progress', 'improve the […] cultural levels of the Chinese people', and 'build China into a space power in all respects, with the capabilities [...] to promote strong and sustained economic and social development'. Also, the same white paper explains that China's space undertakings shall 'provide strong support for the realization of the Chinese Dream'.[156] As indicated in Section 4.4.1.2, the Chinese Dream has a strong socioeconomic connotation by incorporating the goal of building a moderately prosperous Chinese society in all respects by 2021.

References throughout the government's CSIDP[157] combined with this chapter's assessment of major government-promoted space-related measures[158] suggest that one target area under this state preference is the development and application of space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for China. For example, this appears to include issues in such areas like agriculture, climate change, disaster management, the environment, fishery, forestry, geology, health, hydrology, infrastructure, land use, mapping and surveying, meteorology, natural resources, telecommunications and broadcasting services, transportation and urban planning. The development and application of space-related capabilities and capacities to support disaster management and tackle environmental topics is particularly reasonable considering that China is prone to natural disasters,[159] and has encountered several environmental matters negatively affecting its socioeconomic status.[160]

Finally, the narrative presented throughout CSA2016 and CSIDP regarding the Chinese space industry and the domestic and international space market allows arguing that three more – and somewhat interlinked – target areas related to the space-related advancement of China's socioeconomic development are, in sum, the expansion of the domestic (private) space industry, the extension of the domestic space market, and the enhancement of Chinese entities' role in the international space market.[161]

156 SCIO, 'CSA2016{eng}' (n 125) ch I.
157 '国家民用空间基础设施中长期发展规划（2015-2025年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (n 110).
158 See especially this study's Sections 4.6.1-4.
159 'Disaster Management' (*United Nations Development Programme*) <http://www.cn.undp.org/content/china/en/home/ourwork/crisispreventionandrecovery/overview.html> accessed 22 April 2018.
160 Eleanor Albert and Beina Xu, 'China's Environmental Crisis' (*Council on Foreign Relations*, 18 January 2016) <https://www.cfr.org/backgrounder/chinas-environmental-crisis> accessed 22 April 2018.
161 SCIO, 'CSA2016{eng}' (n 125) chs IV-V; '国家民用空间基础设施中长期发展规划（2015-2025年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (n 110).

4.4.3 Political state preferences

The government does not highlight the pursuit of space-related political state preferences in an immediately recognisable manner. Nonetheless, this study finds that they currently exist in the form of securing the legitimacy of the CPC's rule over all of China, as well as advancing China's international prestige and influence.

This conclusion emerges from the government's statements in CSA2016 that China's space undertakings shall 'provide strong support for the realization of the Chinese Dream of the renewal of the Chinese nation' and 'protect China's national rights and interests'.[162] As explained in Sections 4.4.1.1-2, the Chinese Dream ultimately involves putting China back into its previous rank as one of the strongest and most influential powers in the world, while the core national interests encompass, among others, a striving for upholding the CPC's control over China and achieving national reunification with Taiwan.

Additionally, Pollpeter and others have reasonably argued in their extensive analysis of the government's space programme around 2015, which already falls in the era of President Xi, that 'the Chinese leadership believes that major powers have large space programs, and to be considered a major power one must have the trappings of a big power. [...] By developing a robust space program and participating in high-profile activities such as human space flight and lunar exploration, the CCP[163] can demonstrate that it is the best provider of material benefits to the Chinese people and the best organization to propel China to its rightful place in world affairs. [… Also,] China pursues cooperative activities for a number of reasons. These include improving its international position, increasing its influence among less developed countries, and technology transfer.'[164]

Lastly, Sections 4.6.6-8 identify various current major government-promoted space-related measures that can be (partially) explained on the basis of such state preferences.

4.4.4 National security state preferences

There are various indicators that safeguarding China's national security constitutes the government's current space-related national security state preference.

162 SCIO, 'CSA2016{eng}' (n 125) ch I.
163 Abbreviation variation of CPC.
164 Pollpeter and others (n 127) 24.

CSA2016 prominently expounds that China's space undertakings shall 'meet the demands of […] national security' and establish 'capabilities […] to effectively and reliably guarantee national security'. Also, they shall help to 'protect China's national rights and interests', whereby, as determined in Section 4.4.1.1, China's core national interests comprise, *inter alia*, national security and such related elements like state sovereignty and territorial integrity.[165] Finally, such a state preference is likely because, as introduced in Section 4.3, domestic military-related actors apparently play a role in the formulation and implementation of the government's current space programme.

Target areas under this state preference seem to be the enhancement of the Chinese military's strategic support system, the prevention of the weaponisation of and an arms race in outer space, as well as the hedging against potential enemies' use of their space capabilities during armed conflict with China.

The target area of enhancing the Chinese military's strategic support system is palpable by this study's finding that several current major government-promoted space-related measures apparently have a military support-orientation.[166]

Concerning the two other target areas, CSA2016 explicitly states that China 'opposes the weaponization of or an arms race in outer space.'[167] At the same time, Chinese decision-makers are not naïve. The government's military-related white paper from 2015 refers to outer space as 'a commanding height in international strategic competition' and explains that 'China will keep abreast of the dynamics of outer space, deal with security threats and challenges in that domain, and secure its space assets to serve its national economic and social development, and maintain outer space security.'[168] In this regard, China shows especially a hedging behaviour against potential enemies' use of their space capabilities during armed conflict with China. For one, the government's space programme 'does not prohibit "use of force" or the "threat of force" against objects in space during armed conflict.' Moreover, some observers suggest that the country already engages in the development and ground storage of terrestrially-based counterspace systems, and displays

165 SCIO, 'CSA2016{eng}' (n 125) ch I.
166 See especially this study's Sections 4.6.2-4.
167 SCIO, 'CSA2016{eng}' (n 125) ch I.
168 SCIO, 'China's Military Strategy' (*Ministry of National Defense of the People's Republic of China*, May 2015) ch IV <http://eng.mod.gov.cn/Database/WhitePapers/2014.htm> accessed 23 October 2015.

an openness for the development and ground storage of space-based weapon systems.[169] China famously tested a domestic, terrestrially-based anti-satellite weapon (ASAT) system against an old Chinese satellite in 2007.[170] Lastly, China and Russia may prominently solicit the adoption of the 'Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects'[171] (commonly known as PPWT) in the Conference on Disarmament. Yet, their last draft of this treaty includes that a state's right to self-defence in accordance with UN Charter art 51 is not affected by the treaty, which ultimately leaves the door open for the development and use of ground-based counterspace systems and space-based weapon systems in times of conflict.[172]

4.4.5 Science and technology state preferences

The government's current space-related science and technology state preference seems to be the advancement of China's scientific and technological level per se; whereby the reference to 'per se' indicates here more of a basic research and knowledge gathering orientation.

The main reference point is CSA2016's explanation that the government conducts space undertakings 'to meet the demands of […] scientific and technological development', 'improve the scientific […] levels of the Chinese people', establish 'the capabilities […] to make scientific discovery and research at the cutting edge' and 'explore outer space

169 Based on information in: Pollpeter and others (n 127) 19; Sandra Erwin, 'U.S. Intelligence: Russia and China Will Have "Operational" Anti-Satellite Weapons in a Few Years' (*SpaceNews*, 14 February 2018) <http://spacenews.com/u-s-intelligence-russia-and-china-will-have-operational-anti-satellite-weapons-in-a-few-years/> accessed 26 June 2018; Harsh Vasani, 'How China Is Weaponizing Outer Space' (*The Diplomat*, 19 January 2017) <https://thediplomat.com/2017/01/how-china-is-weaponizing-outer-space/> accessed 3 June 2018. Citation in first source. Due to the lack of official material on Chinese counterspace and space-based weapon systems, these system are not discussed any further under this chapter's sections on major government-promoted space-related measures.

170 The government holds that the test was not aimed against any country and that it provided information about the test to several foreign governments, including Japan: 'Foreign Ministry Spokesperson Liu Jianchao's Regular Press Conference on 23 January, 2007' (*Embassy of the People's Republic of China in the United States of America*, 24 January 2007) <http://www.china-embassy.org/eng/fyrth/t291388.htm> accessed 23 October 2015.

171 A copy of the draft treaty as of 2014 is attached to: Conference on Disarmament 'Letter dated 10 June 2014 from the Permanent Representative of the Russian Federation and the Permanent Representative of China to the Conference on Disarmament addressed to the Acting Secretary General of the Conference transmitting the updated Russian and Chinese texts of the draft treaty on prevention of the placement of weapons in outer space and of the threat or use of force against outer space objects (PPWT) introduced by the Russian Federation and China' (12.06.2014) CD/1985.

172 Based on information in: Michael Listner and Rajeswari Pillai Rajagopalan, 'The 2014 PPWT: A New Draft but with the Same and Different Problems' (*The Space Review*, 11 August 2014) <http://www.thespacereview.com/article/2575/1> accessed 23 October 2015; Pollpeter and others (n 127) 19.

and enhance understanding of the earth and the cosmos'.[173] Furthermore, this study has identified some current major government-promoted space-related measures that (partially) fit the pursuit of such a state preference.[174]

4.4.6 Autonomy-oriented state preferences

Two autonomy-oriented state preferences are arguably part of the government's current space programme.

The first one appears to be to ensure the stable use of outer space for China. This materialises from CSA2016 stating that the government aims at ensuring a clean and peaceful space environment and works on constructing and applying a stable and reliable space infrastructure.[175] Also, the government's military-related white paper from 2015 informs the reader that the country will 'deal with security threats and challenges in [… the space] domain, and secure its space assets to serve its national economic and social development, and maintain outer space security.'[176] Additionally, this study has found some current major government-promoted space-related measures that are seemingly directed towards serving the pursuit of such a state preference.[177]

The second space-related autonomy-oriented state preference encompasses the development and maintenance of the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

This surfaces from the government's declaration in CSA2016 that it seeks to 'build China into a space power in all respects', to continuously enhance China's capability to enter and use outer space, and to 'have an advanced and open [Chinese] space science and technology industry'. The document further explains that the government's present space programme follows the principle of innovative and open development, which promotes domestic innovation and self-reliance in the space sector. Besides that, CSA2016 calls for China's space undertakings to build up the country's CNP. Considering the determination of CNP in Section 4.4.1.3, this latter aspect presumably includes a striving for an

173 SCIO, 'CSA2016{eng}' (n 125) ch I.
174 See especially this study's Sections 4.6.5-8.
175 SCIO, 'CSA2016{ch}' (n 124) ch I.
176 SCIO, 'China's Military Strategy' (n 168) ch IV.
177 See especially this study's Sections 4.6.1.2 and 4.6.9.

improvement of the different domestic space-related hard and soft power capabilities available to the government in the pursuit of its various other (space-related) objectives.[178] Lastly, this state preference is somewhat discernable by this study unearthing that the government currently puts more emphasis on promoting major domestic than major cooperative space-related measures, including with regard to human resource development.[179]

4.5 Basic pol. & leg. framework concerning IGO-based regional space cooperation

There are various indicators that the Chinese government is, in general, open to engaging in IGO-based regional space cooperation, including with the other preeminent Asian governments in the space sector.

Most prominently, CSA2016 puts forward that the Chinese government supports, among others, bi- and multilateral space cooperation within common goals, as well as IGO-based activities promoting the development of Chinese space undertakings. The document further highlights the government's (continued) interest in space-related collaboration through already entered IGOs like APSCO.[180] No particular other government appears to be excluded from that per se.

With a view on principles guiding the Chinese government's current intergovernmental space cooperation, it is reasonable to assume that the 'Five Principles of Peaceful Coexistence' play a role. They officially steer the government's international politics. Promoted since 1954, these principles encompass '[1] mutual respect for sovereignty and territorial integrity, [2] mutual non-aggression, [3] non-interference in each other's internal affairs, [4] equality and mutual benefit, and [5] peaceful coexistence'.[181] The government's 'win-win strategy' and its political concept of *zhèngquè de yì lì guān* ('正确的义利观'), which does not translate well into English, elucidate the principle of equality and mutual benefit. Following the win-win strategy means 'to abandon the zero-sum mentality, accommodate the other's interests while seeking one's own, promote

178 SCIO, 'CSA2016{eng}' (n 125) ch I.
179 See the findings throughout this study's Section 4.6.
180 SCIO, 'CSA2016{ch}' (n 124) ch V.
181 'Xi's Speech at "Five Principles of Peaceful Coexistence" Anniversary' (*China.org.cn*, 7 July 2014) <http://www.china.org.cn/world/2014-07/07/content_32876905.htm> accessed 25 May 2015; for the principles' history, see: 'China's Initiation of the Five Principles of Peaceful Co-Existence' (*Ministry of Foreign Affairs of the People's Republic of China*) <http://www.fmprc.gov.cn/mfa_eng/ziliao_665539/3602_665543/3604_665547/t18053.shtml> accessed 25 May 2015.

common development while developing oneself, and continue to deepen the pattern of shared interests.'[182] By applying the *zhèngquè de yì lì guān* concept, the Chinese government aims at upholding equality among partners, taking long-term perspectives, and fostering common development and the rapid progress of developing countries.[183]

CSA2016 also adds that Chinese space undertakings shall take place 'on the basis of [...] peaceful use, inclusive development, and actively carrying out international exchanges and cooperation in space, committed to promoting the common progress of mankind's space undertakings and long-term sustainable development.'[184] Moreover, the document declares with a view to the main international space agreements that the Outer Space Treaty[185], acceded to in 1983,[186] and the Benefits Declaration[187] guide China's international space cooperation.[188] Somewhat overlapping with the *zhèngquè de yì lì guān* concept, this declaration calls on states to pay special regards to the needs of developing countries and countries with incipient space programmes.[189] Besides that, China further adheres to the Rescue Agreement[190], the Liability Convention[191] and the Registration Convention[192], all acceded to in 1988.[193] It has not joined the Moon Agreement[194].

182 Hui Lu, 'Signed Article: Innovations in China's Diplomatic Theory and Practice under New Conditions' (*Xinhuanet*, 16 August 2013) <http://news.xinhuanet.com/english/bilingual/2013-08/16/c_132636034.htm> accessed 4 June 2015.

183 '正确的义利观 A More Balanced Approach to Upholding Principles and Pursuing Interests' (*China.org.cn*, 18 November 2014) <http://www.china.org.cn/china/china_key_words/2014-11/18/content_34085512.htm> accessed 4 June 2015.

184 SCIO, 'CSA2016{ch}' (n 124) ch I. There, it reads: '在。。。和平利用、包容发展基础上，积极开展航天国际交流与合作，致力于推进人类航天事业的共同进步和长期可持续发展。' The same document's ch V supports this argument.

185 Referring to the 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies': 'Space Law Treaties and Principles' (*UNOOSA*) <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html> accessed 13 October 2018.

186 'Treaty Signatures' (*UNOOSA*) <http://www.unoosa.org/oosatdb/showTreatySignatures.do> accessed 23 March 2015.

187 Referring to the 'The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries': 'Space Law Treaties and Principles' (n 185).

188 SCIO, 'CSA2016{ch}' (n 124) ch V.

189 Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, UNGA Res 51/122 (13 December 1996).

190 Referring to the 'Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space': 'Space Law Treaties and Principles' (n 185).

191 Referring to the 'Convention on International Liability for Damage Caused by Space Objects': ibid.

192 Referring to the 'Convention on Registration of Objects Launched into Outer Space': ibid.

193 Li, 'Progressing Towards New National Space Law: Current Legal Status and Recent Developments in Chinese Space Law and Its Relevance to Pacific Rim Space Law and Activities' (n 128) 460–461; for the dates, see: 'Treaty Signatures' (n 186).

194 Referring to the 'Agreement Governing the Activities of States on the Moon and Other Celestial Bodies': 'Space Law Treaties and Principles' (n 185).

Finally, it is notable here that Chinese decision-makers have set up an export control regime that might interfere with the government's present potential for intergovernmental collaboration in the development and use of space-related products with a possible dual-use quality like space launch systems.[195] Prominent documents in this regard are the 'Regulations of the People's Republic of China on Administration of Arms Export'[196], its related 'Military Products Export Control List'[197], and the 'Regulations of the People's Republic of China on Export Control of Missiles and Missile-related Items and Technologies'[198], which has a 'Missiles and Missile-related Items and Technologies Export Control List' annexed to it. However, this study ultimately abstains from a more detailed description of this regime. After all, the government in an authoritarian one-party state like China has almost certainly considerable room to manoeuvre on whether to enforce this regime regarding a (potential) intergovernmental cooperation mechanism.

4.6 Major domestic and cooperative space-related measures

4.6.1 APRSAF and APSCO

4.6.1.1 APRSAF

The participation of Chinese government-related (and non-governmental) entities in Japanese-led APRSAF, somewhat constituting a regional space cooperation regime, can to a certain degree be considered a current major Chinese government-promoted institutionalised regional cooperative space-related measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

While not representing all of the Chinese involvement in APRSAF, the primary specific current Chinese government-promoted cooperative space-related measure within this regime appears to be the contribution to *Sentinel Asia*. The latter's participants aim at advancing disaster management in the Asia-Pacific region through the joint application of

195 Zhao, *National Space Law in China* (n 114) 155–179.

196 For an unofficial English translation, see: 'Regulations of the People's Republic of China on Administration of Arms Export' (*NPC*) <http://www.npc.gov.cn/englishnpc/Law/2007-12/14/content_1384262.htm> accessed 26 January 2015.

197 The list is mentioned here: Zhao, *National Space Law in China* (n 114) 164.

198 For an unofficial English translation, see: 'Regulations of the People's Republic of China on Export Control of Missiles and Missile-Related Items and Technologies' (*NPC*) <http://www.npc.gov.cn/englishnpc/Law/2007-12/14/content_1384258.htm> accessed 26 January 2015.

space technology. Among the presently over 100 project team members are, *inter alia*, government-related entities from China, India, Japan and South Korea.[199]

As such, as well as considering the more detailed introduction of APRSAF in Section 7.6.1, the Chinese government's engagement in this regime falls likely mainly into the pursuit of its current space-related socioeconomic state preference, in particular the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for China.

Also, the Chinese government might see a Chinese involvement in APRSAF, and more specifically *Sentinel Asia*, as adding to the pursuit of its current space-related political state preference of advancing China's international prestige and influence. After all, other – especially technology-wise less developed – participants in *Sentinel Asia* might be grateful to the Chinese contribution to their disaster management, which might translate into a better standing of China among them in general.

4.6.1.2 APSCO

The Chinese government's current main institutionalised regional cooperative space-related measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector is APSCO, a regional space-specific IGO.

Briefly speaking, the Chinese government was one of the initial eight signatories[200] of the APSCO Convention on 28.10.2005. It ratified the convention on 30.06.2006. By that, China became one of the first five full member states[201] when the convention went into force on 12.10.2006. Nowadays, the organisation's eight full members[202] encompass two of the preeminent Asian governments in the space sector, namely China and Iran, as well as Bangladesh, Mongolia, Pakistan, Peru, Thailand and Turkey.[203]

Purpose-wise, the APSCO Convention suggests that its members have officially agreed to cooperate for, 'based on the principles of peaceful uses of outer space, mutual benefits and complementariness, equal consultations and development, […] effectively

199 For this and more information on APRSAF and *Sentinel Asia*, see this study's Section 7.6.1.
200 Bangladesh, China, Indonesia, Iran, Mongolia, Pakistan, Peru and Thailand.
201 Bangladesh, China, Mongolia, Pakistan and Peru.
202 Indonesia remains only a signatory state. Instead, Turkey became the eight full member in 2011.
203 Zhang and others (n 17) 29.

improv[ing] the capability of the Member States in space science, space technology and their peaceful applications, and bring[ing] more socio-economic benefits to each of the Member States'. The socioeconomic part seems to include especially the areas of disaster management, environmental protection and the development of competitive national space-related industries.[204] Towards that end, the APSCO members have evidently agreed to engage at least in collaboration concerning space technology and its applications, space science research, education and training, exchange of scientists and technologists, Earth observation (EO), satellite communications, satellite navigation and positioning, as well as the creation of a central data bank for programme development and dissemination of relevant information regarding APSCO programmes and activities. Also, the members apparently aspire to involve their respective domestic industries in their APSCO-related undertakings to the greatest possible extent.[205]

Within this context, the following have arguably been the specific major Chinese government-promoted cooperative space-related measures under APSCO since 2006:[206]

China provides data from – reportedly nine – domestically controlled EO satellites to APSCO's *Data Sharing Service Platform* (DSSP) project. In short, DSSP supports the sharing and application of remote sensing data among APSCO member states within the organisation's official purpose, e.g. to advance the members' disaster management.[207]

Somewhat related to DSSP, and considered a key area of cooperation under the Chinese government's current space programme,[208] China also engages considerably in the *APSCO Joint Small Multi-Mission Satellite Constellation* (SMMS) project, which shall be completed around 2022. The project's core elements are to 'construct a system of small multi-mission satellite constellation including space and ground segments for remote sensing and integrated data collection; and realize multi-source data acquisition to meet user requirements; enhance the capability for utilizing remote sensing and integrated data

204 APSCO Convention preamble,arts 5-6. Citation based on the preamble.
205 APSCO Convention arts 5-6.
206 They do not account for all specific measures so far proposed and implemented under APSCO.
207 Xunjin Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (Presentation, UN/UAE-High Level Forum, Dubai, 8 November 2017) 12–13 <http://www.unoosa.org/documents/pdf/hlf/HLF2017/presentations/Day3/High_Level_Panel/1st/Presentation4.pdf> accessed 15 April 2018; Manop Aorpimai, 'APSCO and Its GEO-Related Activities' (Presentation, 10th GEOSS Asia-Pacific Symposium, Hanoi, 18 September 2017) 6–10 <https://vnsc.org.vn/geoss-ap10/data/4%20Country%20Reports%2018.9/15.%20APSCO%20Presentation.pdf> accessed 15 April 2018.
208 SCIO, 'CSA2016{eng}' (n 125) ch V.

collection to develop applications to meet user requirements, as well as conduct technical exchanges, appropriate training and cooperation.' This shall involve the application of some existing domestic satellites of APSCO members, as well as the project-specific development of additional small-, micro- and nano-satellites. While writing, China already provides remote sensing data collected by the *Gaofen-1, -2* and CBERS-4 satellites, and allows for some use of its ground station network. Further highlighting China's strong role in this project, APSCO and the China Earth Observation System and Data Center of CNSA signed a contract on 'Implementation of the system design and definition phase (Phase B) of APSCO Joint Small Multi-Mission Satellite (SMMS) Constellation Program' on 27.11.2017.[209]

Besides that, the Chinese side takes on a significant role in the implementation of the *Asia-Pacific Ground-Based Optical Space Objects Observation System* (APOSOS) project. Notably, the National Astronomical Observatory of CAS hosts the APOSOS data centre, and the Changchun Institute of Optics, Fine Mechanics and Physics develops three telescopes for the project to be installed in Iran, Pakistan and Peru. Overall, the project shall support the APSCO members' space situational awareness capability regarding the detection, tracking and identification of space objects, e.g. satellites and debris.[210]

APSCO's activity field of education and training relies substantially on the Chinese side as well. For example, the latter sponsors students from APSCO member states in participating in the APSCO-promoted Master's and PhD programmes.[211] The APSCO Education and Training Center was established at China's Beihang University.[212] Also, the Chinese side has taken the lead of APSCO's *Student Small Satellite* (SSS) project for hands-on training of students and facilities in small satellite development. The project,

209 Based on information in: Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) 33–35; 'The Signing Ceremony of Contract on SMMS Program between APSCO and CNSA' (*APSCO*, 30 November 2017) <http://www.apsco.int/sitesearchOne.asp?ID=577> accessed 15 April 2018. Citation based on the last link.

210 Based on information in: Lan Chen, 'Chinese Space Quarterly Report January - March 2014' (2014) May 2014(12 Revised Version) *Go Taikonauts!* 3, 6; Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) 21–24.

211 Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) 39.

212 'APSCO Delegation's Visit to Beihang University and the Opening Ceremony of APSCO Education and Training Center in China' (*APSCO*, 24 March 2014) <http://apsco.int/NewsOne.asp?ID=322> accessed 9 September 2015.

which is introduced as a key area of cooperation under the Chinese government's current space programme,[213] kicked-off in 2016.[214]

Combining and interpreting all that information, the Chinese government's engagement within APSCO can be considered to be especially directed towards serving the pursuit of the following current space-related state preferences:

First, the government's APSCO membership appears aimed at fostering the pursuit of its current space-related socioeconomic state preference, in particular the target areas of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for China, as well as of expanding the domestic (private) space industry.

Second, by taking into account its aforementioned strong involvement in certain APSCO-specific undertakings and its significant contributions to the establishment and maintenance of the APSCO's headquarters,[215] the Chinese government has likely recognised APSCO as a useful tool to bind the other APSCO members closer to China in the space sector, hoping that this might ultimately also strengthen China's international prestige among and influence over them in general. This is coherent with one of the government's current space-related political state preferences.

Third, the APOSOS project suits the pursuit of the government's current space-related autonomy-oriented state preference of ensuring the stable use of outer space for China.

Finally, since APSCO shall foster the joint improvement of capabilities in space science, technology and their peaceful applications and has already seen joint educational and training activities, the Chinese government presumably sees APSCO further as an instrument that can temporarily assist in the pursuit of its current space-related autonomy-

213 SCIO, 'CSA2016{eng}' (n 125) ch V.

214 Based on information in: 'APSCO Small Student Satellite Project' (*APSCO*, 21 November 2011) <http://www.apsco.int/NewsOne.asp?ID=12> accessed 16 September 2015; 'APSCO-SSS Project' (*APSCO-SSS Project*) <http://www.apsco-sss.com/index_en.cshtml> accessed 19 April 2018; 'Introduction' (*APSCO-SSS Project*) <http://www.apsco-sss.com/introduction_en.cshtml> accessed 19 April 2018.

215 The Chinese government donated and continues to host the APSCO headquarters in Beijing: 'The Headquarters of APSCO' (*APSCO*) <http://www.apsco.int/AboutApscosS.asp?LinkNameW1=The_Structure_of_APSCO&LinkNameW2=The_Headquarters_of_APSCO&LinkCodeN3=1713&LinkCodeN=12> accessed 19 April 2017.

oriented state preference of developing and maintaining China’s domestic human, industrial, scientific and technological capacities and capabilities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

4.6.2 Remote Sensing

4.6.2.1 Major domestic measures

In line with the government’s prioritisation of creating an independent Chinese civil space infrastructure, the overarching major government-promoted domestic space-related remote sensing measure is the development and application of a comprehensive Chinese-controlled remote sensing satellite system offering (in the future global) low-, medium- and high-spatial-resolution data of Earth based on a broad range of technologies, e.g. optical observation and synthetic-aperture radar. Without explicitly limiting it to them, the main satellite series in this system apparently are China’s land, ocean and atmospheric observation satellites series.[216]

On a more specific level, the major government-promoted domestic – or at least domestically controlled – remote sensing satellite series throughout the 21st century seemingly have, while partially fitting the development of the aforementioned remote sensing satellite system, been so far the following series (alphabetically, and without claiming completeness): *Fengyun* (风云),[217] *Gaofen* (高分; primary series of the *China High-resolution Earth Observation System*[218], commonly known as CHEOS),[219] *Haiyang* (海洋),[220] *Huanjing* (环境; primary series of China’s *Small Satellites Constellation for*

216 SCIO, ‘CSA2016{eng}’ (n 125) chs III-IV; ‘国家民用空间基础设施中长期发展规划（2015-2025年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]’ (n 110) 7–11.

217 Pollpeter and others (n 127) 69–70; ‘Satellites’ (*China Meteorological Administration*) <http://www.cma.gov.cn/en2014/satellites/> accessed 31 August 2015.

218 The system is a major special project promoted under STDP: ‘The National Medium- and Long-Term Program for Science and Technology Development (2006-2020) An Outline’ (n 111) 32.

219 ‘Gaofen (High Resolution)’ (*China Space Report*) <https://chinaspacereport.com/spacecraft/gaofen/> accessed 21 November 2017.

220 Xingwei Jiang and Mingsen Lin, ‘Ocean Observation from Haiyang Satellites: 2012-2014’ in Hejun Yin and others (eds), *Space Science Activities in China. National Report 2012-2014* (CNCOSPAR 2014) 191,193,196-200 <http://english.nssc.cas.cn/ns/NU/201410/W020141016603625696274.pdf>.

Environmental and Disaster Monitoring and Forecasting),[221] *Kuaizhou* (快舟),[222] *TanSat* (碳卫星),[223] *Tansuo* (探索),[224] *Tianhui* (天绘),[225] *Yaogan* (遥感),[226] *Yunhai* (云海),[227] and *Ziyuan* (资源).[228]

Altogether, these measures appear especially aimed at serving the pursuit of two current space-related state preferences:

First, the combination of information presented in CSIDP[229] and the footnotes of the various satellite series introduced above suggests that most measures shall foster the pursuit of the government's space-related socioeconomic state preference, in particular the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for China. This is evident by references to the measures' application in such socioeconomically relevant areas like agriculture, climate change, disaster management, environmental monitoring and protection, forestry, geology, health, hydrology, land use, infrastructure, mapping and surveying, marine observation, meteorology, natural resources, pollution monitoring, public security, transportation, and urban planning.

221 Based on information in: '大事记 [Record of Major Events]' (*Ministry of Industry and Information Technology of the People's Republic of China*, 3 April 2009) <http://www.miit.gov.cn/n11293472/n11293877/n12221440/n12221472/12227839.html> accessed 1 September 2015; You Zhou, 'Small Satellite Constellation for Environment and Disaster Monitoring and Forecasting (SSCEDMF)' (Presentation, 52nd UNCOPUOS, Vienna, June 2009) <http://www.unoosa.org/pdf/pres/copuos2009/tech-12.pdf> accessed 21 November 2017.

222 'China Launches Satellite to Monitor Natural Disaster' (*CCTV*, 25 September 2013) <http://english.cntv.cn/20130925/103641.shtml> accessed 6 September 2015.

223 'China Launches TanSat to Study Atmospheric Carbon Dioxide Processes' (*SpaceDaily*, 28 December 2016) <http://www.spacedaily.com/reports/China_launches_TanSat_to_study_atmospheric_carbon_dioxide_processes_999.html> accessed 14 November 2017.

224 Brian Harvey, *China in Space. The Great Leap Forward* (Springer 2013) 202–204.

225 Based on information in: ibid 203; '天绘卫星遥感部 [Tianhui Satellite Remote Sensing Unit]' (*National Remote Sensing Center of China*) <http://www.nrscc.gov.cn/nrscc/ywfb/sjyzhfwl/201404/t20140418_32640.html> accessed 6 September 2015; Pollpeter and others (n 127) 67–68.

226 'China Launches Yaogan-25 Remote Sensing Satellite' (*SC*, 11 December 2014) <http://english.gov.cn/news/top_news/2014/12/11/content_281475022380549.htm> accessed 11 June 2015.

227 Andrew Jones, 'China's Second Launch of the Week Puts Yunhai-1 into Orbit' (*GBTIMES*, 12 November 2016) <https://gbtimes.com/chinas-second-launch-week-puts-yunhai-1-orbit> accessed 20 November 2017.

228 Based on information in: '资源一号 02C 卫星 [Ziyuan-1-02C Satellite]' (*China Centre for Resources Satellite Data and Application*, 25 July 2012) <http://www.cresda.com/n16/n1130/n175275/175577.html> accessed 13 June 2015; '资源三号卫星介绍 [Ziyuan-3 Satellite Introduction]' (*China Centre for Resources Satellite Data and Application*, 25 July 2012) <http://www.cresda.com/n16/n1130/n175290/175676.html> accessed 13 June 2015.

229 '国家民用空间基础设施中长期发展规划（2015-2025 年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (n 110) 6–9.

Second, there are indicators that these measures shall strengthen the pursuit of the government's space-related national security state preference, in particular the target area of enhancing the Chinese military's strategic support system. For one, while the government has never officially declared a set of domestic remote sensing satellites to be fully dedicated to national security objectives, various authors argue that some of the aforementioned satellite series like *Haiyang*,[230] *Yaogan*[231] and *Ziyuan*[232] (also) have an application in this direction. Additionally, there is the well-known fact that space-derived remote sensing data can serve military activities considerably. Lastly, such a direction is likely due to the government promoting an integrated civil and military development in space technology,[233] and CSDIP mentioning that the independent Chinese civil space infrastructure shall, despite having the word 'civil' in its name, contribute to China's national security.[234]

4.6.2.2 Major cooperative measures

There are various key areas of cooperation under the Chinese government's present space programme that concern the field of remote sensing.[235]

Based on this background and excluding measures falling primarily under the already introduced APRSAF and APSCO, this study has, without claiming completeness, identified these (more) specific current major government-promoted cooperative space-related remote sensing measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector:

China through CNSA is, alongside the space agencies of, among others, India, Japan and South Korea, a member of the esteemed 'International Charter "Space and Major Disasters"' (International Disaster Charter). As the document's name suggests, the charter

230 Jiang and Lin (n 220) 196.

231 Based on information in: Dinaker Peri, 'Yaogan Satellites and Chinese ASBM Capability' (2014) Spring 2014 Scholar Warrior 109; S Chandrashekar and Soma Perumal, 'China's Constellation of Yaogan Satellites & the Anti-Ship Ballistic Missile – An Update' (Report, International Strategic and Security Studies Programme, National Institute of Advanced Studies 02 January 2015) 10–12 <http://isssp.in/wp-content/uploads/2015/01/Yaogan-and-ASBM-January-2015-Report.pdf> accessed 11 June 2015; Pollpeter and others (n 127) 64.

232 Harvey (n 224) 185–187.

233 Lei Wang, 'China Names Key Areas of Military-Civilian Integration' (*China Global Television Network*, 21 June 2017) <https://news.cgtn.com/news/3d41444d7751444e/share_p.html> accessed 23 January 2018.

234 '国家民用空间基础设施中长期发展规划（2015-2025 年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (n 110) 1.

235 SCIO, 'CSA2016{eng}' (n 125) ch V.

shall strengthen international disaster management activities. The Chinese side apparently contributes remote sensing data from at least three satellites.[236] Notably, the latter encompass not only domestic satellites but also the *China-Brazil Earth Resource Satellite* (CBERS) series, which is jointly developed between China and Brazil.[237]

Chinese government-related entities engage in the Group on Earth Observations (GEO) alongside India, Iran, Japan and South Korea,[238] the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) alongside India, Iran and South Korea,[239] as well as the World Meteorological Organization (WMO) alongside India, Iran, Japan, North Korea and South Korea.[240]

China through CNSA has put forward the initiative to create the *BRICS*[241] *Remote Sensing Satellite Constellation*. In 2017, the space agencies of all members of the BRICS association, which also includes India, agreed to work jointly on implementing this measure. For the first phase, the partners envision the setup of a virtual constellation for remote sensing data sharing based on existing satellites. A future second phase might comprise the joint creation of a new satellite constellation. Reportedly, all that shall support the strategic partnership among BRICS members, as well as their socioeconomic development, e.g. in such areas like climate change, disasters management, environmental protection and the realisation of the so-called Sustainable Development Goals[242].[243] The Chinese government's current space programme even directly names the overall constellation a key area of cooperation.[244]

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236 'The International Charter Space and Major Disasters' (*The International Charter Space and Major Disasters*) 25 <https://disasterscharter.org/documents/10180/897997/Charter-Brochure.pdf/3d02801c-8e36-4c3b-bde3-e94013a9409c> accessed 9 June 2018.

237 Based on information in: 'CBERS / Ziyuan 1' (*China Space Report*) <https://chinaspacereport.com/spacecraft/cbers-ziyuan1/> accessed 26 January 2018; 'The International Charter Space and Major Disasters' (n 236).

238 'Member List' (*GEO*) <https://www.earthobservations.org/members.php> accessed 14 October 2018.

239 'China' (*UN-SPIDER Knowledge Portal*) <http://www.un-spider.org/network/national-focal-points/china> accessed 14 October 2018.

240 'Members' (*WMO*) <https://public.wmo.int/en/about-us/members> accessed 14 October 2018.

241 Reference to an intergovernmental association formed by Brazil, Russia, India, China and South Africa.

242 These goals have a strong socioeconomic orientation: 'Sustainable Development Goals' (*UN*) <https://www.un.org/sustainabledevelopment/sustainable-development-goals/> accessed 23 April 2018.

243 Based on information in: 'SA Joins BRICS Remote Sensing Satellite Constellation' (*South African National Space Agency*, 3 July 2017) <https://www.sansa.org.za/news/1701-sa-joins-brics-remote-sensing-satellite-constellation> accessed 7 October 2017; Hui Jiang, 'BRICS Remote Sensing Satellite Constellation' (Presentation, UN/UAE-High Level Forum, Dubai, 7 November 2017) <http://www.unoosa.org/documents/pdf/hlf/HLF2017/presentations/Day2/Session_7a/1._Progress_of_BRICS_Remote_Sensing_Satellite_Constellation-dubai.pdf> accessed 1 July 2018.

244 SCIO, 'CSA2016{eng}' (n 125) ch V.

The Sino-Indian ‘2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People’s Republic of China’ (Sino-Indian Space Cooperation Outline 2015) from 15.05.2015, which is linked to the ‘Memorandum of Understanding between Indian Space Research Organisation and China National Space Administration on Cooperation in the Peaceful Use of Outer Space’ from 18.09.2014, indicates a potential for (further) Sino-Indian collaboration in space-related remote sensing. More precisely, the two parties apparently consider collaboration on satellite data sharing for emergency responses during major disasters; satellite data-related collaboration regarding weather forecasting, tropical storm events and climate change studies; other reciprocal data sharing and exchange; reception of each others’ data by their respective ground stations; cross-calibration of data; cooperation regarding new EO science payloads; and information sharing and exchange of expertise in EO applications, e.g. for agriculture, environmental monitoring and protection, disaster management and water resources. Moreover, they want to discuss the effective application of a virtual constellation involving remote sensing satellites.[245] The latter is likely a reference to the aforementioned *BRICS Remote Sensing Satellite Constellation.*

China’s proposed construction of the *Belt and Road Initiative Space Information Corridor* (BRISIC), another directly named key area for cooperation under the government’s current space programme,[246] covers, among others, a Chinese interest in international cooperation regarding space-related remote sensing, presumably including with some other preeminent Asian governments in the space sector. In particular, the development of BRISIC seems to be aimed at setting up a better interaction and application of the currently available and upcoming (public and private) remote sensing, communications and broadcasting, and navigation satellites of the participants of the China-proposed *Belt and Road Initiative* (BRI)[247] in establishing and maintaining BRI’s so-called modern land-based ‘Silk Road Economic Belt’ and sea-based ‘21st-Century

245 For a copy of this outline and the information presented above, see: ‘2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People’s Republic of China’ (*Ministry of External Affairs, Government of India*) <http://www.mea.gov.in/Portal/LegalTreatiesDoc/CH15B2096.pdf> accessed 9 October 2017. This study was unable to obtain a copy of the MoU from 2014.

246 SCIO, ‘CSA2016{eng}’ (n 125) ch V.

247 BRI encompasses the creation of a modern land-based ‘Silk Road Economic Belt’ and sea-based ‘21st-Century Maritime Silk Road’. So far, the regional scope has only be very loosely determined. Ultimately, it can cover any country that the Chinese government wants to include.

Maritime Silk Road'. It is not necessarily a call for the joint development and application of dedicated new satellite systems, even though related activities are not excluded.[248]

In sum, except in the case of BRISIC, the Chinese government's interest and involvement in these cooperative measures seems to be primarily oriented towards serving the pursuit of its space-related socioeconomic state preference, in particular the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for China. Regarding BRISIC, the cooperation focus appears to be on supporting the pursuit of the government's space-related socioeconomic target area of enhancing Chinese entities' role in the international space market. After all, BRI, while remaining loosely defined, shall ultimately help to strengthen China's economic interaction with and the general economic development of the Asian region and some other parts of the world.[249]

Besides that, it is likely that the Chinese government hopes that the cooperative measures mentioned above also somewhat aid, e.g. by other states benefiting from Chinese contributions, the pursuit of its space-related political state preference of advancing China's international prestige and influence with its respective partners.

4.6.3 Communications and broadcasting

4.6.3.1 Major domestic measures

Within the context of the independent Chinese civil space infrastructure priority,[250] the current overarching major government-promoted domestic space-related communications and broadcasting measure is the establishment of 'a comprehensive [Chinese-controlled satellite-based] system capable of providing broadband communications, fixed communications, direct-broadcast television, mobile communications and mobile multimedia broadcast services.' In the future, it shall reach global coverage.[251]

248 Regarding BRISIC, see: SASTIND and NDRC, '加快推进"一带一路"空间信息走廊 建设与应用的指导意见 [Guidance for Accelerating the "Belt and Road" Spatial Information Corridor Construction and Application]' (*NDRC*, 22 October 2016) <http://www.ndrc.gov.cn/zcfb/zcfbqt/201611/t20161123_827548.html> accessed 23 April 2018; SCIO, 'CSA2016{eng}' (n 125) ch V; regarding BRI, see: 'Full Text: Action Plan on the Belt and Road Initiative' (*SC*, 30 March 2015) <http://english.gov.cn/archive/publications/2015/03/30/content_281475080249035.htm> accessed 25 April 2016.

249 'Full Text: Action Plan on the Belt and Road Initiative' (n 248).

250 SCIO, 'CSA2016{eng}' (n 125) ch V.

251 ibid ch III.

On a more specific level, prominent government-promoted domestic(ally controlled) communications and broadcasting satellite series in the 21st century, which presumably (partially) correspond to the creation of the aforementioned communications and broadcasting satellite system, seem to have comprised so far the following series (alphabetically, and without claiming completeness): *Fenghuo* (烽火), *Shentong* (神通), *Tiantong* (天通), *Xinnuo*[252] (鑫诺; dubbed *SinoSat*), *Yatai* (亚太; dubbed *ApStar*), *Yazhou* (亚洲; dubbed *AsiaSat*), *Zhongwei*[253] (中卫; dubbed *ChinaStar*) and *Zhongxing* (中星; dubbed *ChinaSat*).

Notably, even though more and more are domestic products, it is, in contrast to the China's remote sensing and navigation satellite series, quite common for satellites in several of the series above to be purchased or leased from abroad.[254] Also, many satellites in several of these series are operated by Chinese entities based on business models while meeting public needs.[255] As far as this study was able to ascertain, the country's most important communications and broadcasting satellite operators currently are China Satellite Communications Co. Ltd., APT Satellite Co. Ltd. and Asia Satellite Telecommunications Co. Ltd. To refer to their satellites as government-promoted measures is fair because these operators are, despite their commercial appearance, ultimately directly or indirectly linked to the Chinese state, in particular to state-owned conglomerates. While writing, the Chinese communications and broadcasting satellite system already covers the Asian region, including the Middle East, as well as Oceania and some other parts of the world.[256]

252 Later incorporated into *Zhongxing* series.
253 Later incorporated into *Zhongxing* series.
254 Based on information in: Harvey (n 224) 142-147,162-168; '中国通信卫星列表 [China's Communications Satellite List]' (*CGWIC*, 31 December 2013) <http://cn.cgwic.com/In-OrbitDelivery/CommunicationsSatellite/DFHList.html> accessed 9 September 2015; Pollpeter and others (n 127) 74; Tomasz Nowakowski, 'China Conducts Surprise Launch of Its First Tiantong-1 Satellite' (*SpaceFlight Insider*, 6 August 2016) <http://www.spaceflightinsider.com/organizations/china-national-space-administration/china-conducts-surprise-launch-first-tiantong-1-satellite/> accessed 29 November 2017; '"中星"卫星 ["Zhongxing" Satellites]' (中国航天科普网 *Spacemore*, 22 March 2016) <http://www.spacemore.com.cn/Article/Detail?id=514> accessed 1 July 2018; 'China Launches First Mobile Telecom Satellite' (*Xinhuanet*, 6 August 2016) <http://news.xinhuanet.com/english/2016-08/06/c_135567667.htm> accessed 29 November 2017; 'Fenghuo and Shentong' (*China Space Report*, 14 June 2016) <https://chinaspacereport.com/spacecraft/fenghuo-shentong/> accessed 11 November 2017; '卫星资源 [Satellite Resources]' (*China Satellite Communications Co. Ltd.*) <http://www.chinasatcom.com/n782704/index.html> accessed 9 September 2015; 'Fleets' (*AsiaSat*) <https://www.asiasat.com/technology/satellite-fleet> accessed 10 July 2018; 'Fleets – APSTAR' (*ApStar*) <http://www.apstar.com/en/apstar-fleet/> accessed 10 July 2018.
255 SCIO, 'CSA2016{eng}' (n 125) ch III.
256 Based on information in: Weimin Hao, 'Briefing on China's Satellite Communications Progress and Future' (2013) 10(10) China Communications vi, vi–vii; Harvey (n 224) 162–163; Pollpeter and others (n 127) 74; 'Company Profile' (*China Satellite Communications Co. Ltd.*) <http://english.csat.spacechina.com/n931656/n931661/index.html> accessed 12 July 2018; 'Company

Overall, the available material suggests that, altogether, the following current space-related state preferences underlie the measures above:

First, the pursuit of the government's current space-related socioeconomic state preference, including all related target areas, is palpable by the government allowing for the operation of many domestic(ally controlled) communications and broadcasting satellites based on business models and having them cover domestic and foreign markets. Moreover, several of the satellite series above and the comprehensive Chinese-controlled communications and broadcasting satellite system as a whole shall serve various socioeconomically relevant areas like agriculture, personal and business communications, disaster management, the marine and petroleum industry, radio and television services, tele-education, telemedicine and transportation.[257]

Second, there are signs for the pursuit of the government's current space-related national security state preference, especially regarding the target area of enhancing the Chinese military's strategic space support system. For example, the *Fenghuo*, *Shentong*, *Tiantong* and *Zhongxing* series have apparently seen some or even a strong application concerning that target area.[258] Additionally, even though exact data is hard to come by in the Chinese case, communications and broadcasting satellites are well-known to support, *inter alia*, military command and control. Finally, such a direction is likely considering that, as already introduced in Section 4.6.2.1, the independent Chinese civil space infrastructure shall aid China's national security and the government promotes an integrated civil and military development in space technology.

Third, this study deems it reasonable to assume that the government currently promotes its major domestic space-related communications and broadcasting measures partly to foster the pursuit of its two space-related political state preferences of securing the legitimacy of the CPC's rule over all of China and advancing China's international

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Profile' (*APT Satellite Co. Ltd.*) <http://www.apstar.com/en/about-apstar/> accessed 12 July 2018; 'About Us' (*Asia Satellite Telecommunications Co. Ltd.*) <https://www.asiasat.com/aboutus> accessed 12 July 2018.

257 Based on information in: SCIO, 'CSA2016{eng}' (n 125) ch II; '国家民用空间基础设施中长期发展规划（2015-2025 年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (n 110) 11–12.

258 Based on information in: Harvey (n 224) 146–147; Pollpeter and others (n 127) 7-8,12,74; Andrew Jones, 'China Launches Zhongxing-1C Military Satellite to Geostationary Orbit' (*GBTIMES*, 9 December 2015) <https://gbtimes.com/china-launches-zhongxing-1c-military-satellite-geostationary-orbit> accessed 14 November 2017; Nowakowski (n 254).

prestige and influence. After all, the government is surely aware that communications and broadcasting satellites allow spreading its message to all citizens across China's vast territory, as well as to Chinese communities and other audiences abroad quite easily.

4.6.3.2 *Tianlian* – a special domestic measure

A special current major government-promoted domestic space-related communications measure that differs from the measures outlined in the previous section is the domestic development and application of the *Tianlian* (天链) series. *Tianlian s*atellites shall form a system with global network operation providing data relay, measurement and control services for Chinese human spaceflight undertakings, data relay services for Chinese(-controlled) remote sensing-related resources satellites in medium- and low-Earth orbit, and measurement and control support for Chinese space launches.[259]

As such, the *Tianlian* series is likely aimed at aiding the pursuit of the particular space-related state preferences underlying the other measures to which it shall provide services.

4.6.3.3 Major cooperative measures

A few key areas of cooperation under the government's present space programme appear to concern the field of communications and broadcasting.[260]

Within this context, and excluding APRSAF and APSCO-related measures, this study has, without claiming completeness, identified these (more) specific current major government-promoted cooperative space-related communications and broadcasting measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector:

China is, alongside, for example, India, Iran, Japan, North Korea and South Korea, a member state of the International Telecommunication Union (ITU). The latter is a specialised UN agency that engages primarily in global radio spectrum and satellite orbit allocation, development of technical standards and improvement of underserved

259 Stephen Clark, 'China Launches Data Relay Satellite for Future Space Station Crews' (*Spaceflight Now*, 22 November 2016) <https://spaceflightnow.com/2016/11/22/china-launches-data-relay-satellite-for-future-space-station-crews/> accessed 19 November 2017. The resources satellites referred to here presumably belong primarily to the Ziyuan series. Ziyuan (资源) translates into 'natural resources'.
260 SCIO, 'CSA2016{eng}' (n 125) ch V.

communities' access to information and telecommunications technologies.[261] Since ITU shall bring order into the use of space in the field of communications and broadcasting, the Chinese government's participation presumably is, for the most part, directed towards serving the pursuit of each and every current state preference underlying its space-related communications and broadcasting measures.

The construction of BRISIC incorporates a Chinese interest in international cooperation regarding space-related communications and broadcasting, presumably including with other preeminent Asian governments in the space sector. The construction of BRISIC appears especially directed towards setting up a better interaction and application of the currently available and upcoming (public and private) remote sensing, communications and broadcasting, and navigation satellites of the participants of BRI in establishing and maintaining BRI's modern land-based Silk Road Economic Belt and sea-based 21st-Century Maritime Silk Road. It is not necessarily a call for the joint development and application of dedicated new satellite systems, even though related activities are not excluded. In the end, all that likely aims at supporting the pursuit of the government's space-related socioeconomic target area of enhancing Chinese entities' role in the international space market.[262]

A notable potential future major – somewhat government-promoted – cooperative space-related communications and broadcasting measure is the development of Iran's *National Communications Satellite.* Reportedly, a Chinese entity (presumably the government-related CGWIC) already competes for the commercial contract to build this high-profile satellite for Iran.[263] The Chinese government's interest in this contract likely falls within its space-related socioeconomic target area of improving Chinese entities' role in the international space market.

261 Based on information in: 'List of Member States' (*ITU*) <https://www.itu.int/online/mm/scripts/gensel8> accessed 14 October 2018; 'Overview' (*ITU*) <https://www.itu.int/en/about/Pages/overview.aspx> accessed 2 July 2018.

262 For more information on BRISIC and this argumentation, see this study's Section 4.6.2.2.

263 'Four Countries Interested in Building Iran's National Communication Satellite' (*SpaceWatch Middle East*, 5 October 2016) <https://spacewatchme.com/2016/10/four-countries-interested-building-irans-national-communication-satellite/> accessed 16 February 2018.

4.6.4 Navigation

4.6.4.1 Major domestic measures

The construction of the *BeiDou Navigation Satellite System* (BDS), which had its first development phase approved in 1994,[264] is the current main government-promoted domestic space-related navigation measure. It seems to be also one of the three primary components of the independent Chinese civil space infrastructure system that the government has given a development priority under its present space programme.[265]

To be completed by 2020, BDS shall ultimately consist of a constellation of 35 domestically developed and controlled satellites and a related set of ground facilities. It shall offer 'all-time, all-weather and high-accuracy positioning, navigation and timing services to global users.' It already provides services to China since 2000, and to the Asia-Pacific region since 2012.[266] The estimated allocated budget from 1994 to 2020 is around ¥56-66 billion ($9-10.5 billion).[267]

Overall, this study recognises the following current space-related state preferences to underlie BDS:

First, there is the obvious pursuit of the government's current space-related socioeconomic state preference, likely encompassing all related target areas. After all, CBDS suggests that BDS shall serve, among others, China's 'economic and social development.'[268] In particular, BDS's application is thought to support areas like agriculture, disaster management, exploration, fishery, forestry, hydrology, land resources, mapping and surveying, production, power dispatching, transportation, water conservation and weather forecasting.[269] Wilson further concludes that, in the context of BDS, the government wants to 'build a [comprehensive Chinese] commercial downstream satellite navigation industry to take advantage of the quickly expanding

264 SCIO, 'CBDS' (n 126) ch II.
265 Based on information in: '国家民用空间基础设施中长期发展规划（2015-2025 年）[National Medium- and Long-Term Civil Space Infrastructure Development Plan (2015-2025)]' (n 110); SCIO, 'CBDS' (n 126); SCIO, 'CSA2016{eng}' (n 125) ch III.
266 SCIO, 'CBDS' (n 126) preface,chs I-II. Citation in preface.
267 Pollpeter and others (n 127) 42–43.
268 SCIO, 'CBDS' (n 126) preface.
269 Based on information in: SCIO, 'CSA2016{eng}' (n 125) ch II; SCIO, 'CBDS' (n 126) preface,chs I,IV.

market.' The expected total output of China's navigation services sector by 2020 is ¥400 billion (ca. $58 billion).[270]

Second, there is the pursuit of the government's current space-related national security state preference. As CBDS indicates, BDS shall bolster 'the country's national security'.[271] Target area-wise, BDS appears to be especially aimed at enhancing the Chinese military's strategic space support system. For example, the system can reduce the Chinese military's overall navigational dependence on the US-controlled *Global Positioning System* (GPS) and improve Chinese weapon guidance systems. Some researchers even hold that 'Beidou is fundamentally a military-run program with civilian applications.'[272] In support of this national security narrative, it shall be reiterated here that Section 4.6.2.1 has already put forward that the independent Chinese civil space infrastructure supposedly shall benefit China's national security and the government promotes an integrated civil and military development in space technology.

Third, this study further contends that the Chinese government likely considers BDS useful for the pursuit of its current space-related political state preferences of securing the legitimacy of the CPC's rule over all of China, as well as advancing China's international prestige and influence. The government is surely aware that BDS, as one of only four global navigation satellite systems for the foreseeable future, is an excellent measure to showcase China's rise towards an internationally leading technological power under the guidance of the CPC to the domestic and the international audience alike. Moreover, by linking other states to BDS, China might be able to improve its influence over such states and its clout in international institutions relating to satellite navigation.[273]

4.6.4.2 Major cooperative measures

A few key areas of cooperation under the government's present space programme seem to (somewhat) concern the field of space-related navigation.[274] Regarding BDS in particular, CBDS points out that the government promotes international engagement of relevant

270 Jordan Wilson, 'China's Alternative to GPS and Its Implication for the United States' (Report, US-China Economic and Security Review Commission 05 January 2017) 2,6 <https://www.uscc.gov/sites/default/files/Research/Staff%20Report_China's%20Alternative%20to%20GPS%20and%20Implications%20for%20the%20United%20States.pdf> accessed 15 December 2017. Citation on 2.

271 SCIO, 'CBDS' (n 126) preface.

272 Based on information in: Pollpeter and others (n 127) vii,71,73. Citation on 71; Wilson (n 270) 2,5-6.

273 Wilson also sees an international prestige and influence motivation to partly underlie the construction of BDS: Wilson (n 270) 2,6,9.

274 SCIO, 'CSA2016{eng}' (n 125) ch V.

Chinese parties in pertinent multilateral settings, academic exchanges, education and training, and satellite applications. Also, the government apparently seeks international coordination of BDS-related frequencies and orbital slots, ratification of BDS by international standards, as well as the improvement of compatibility and interoperability between BDS and foreign navigation satellite systems.[275]

Within this context, and excluding APRSAF and APSCO-related measures, this study has, without claiming completeness, found these (more) specific current major government-promoted cooperative space-related navigation measures (with a presumed high potential for) involving preeminent Asian governments in the space sector:

Iranian Electronics Industries (also known as SAIran), a wholly-owned subsidiary of Iran's Ministry of Defence and Armed Forces Logistics (MODAFL),[276] and an unnamed Chinese entity – that presumably has the blessing of its government due to the latter's substantial involvement in BDS's development – signed a Memorandum of Understanding (MoU) in October 2015 to establish BDS ground stations and a BDS data centre in Iran.[277] Without much data upon which to draw, this study assumes that this MoU falls on the Chinese side partly into the pursuit of the government's current space-related socioeconomic, national security and political state preferences. For one, the activities covered in the MoU might help to enhance the (future) role of Chinese entities in the Iranian navigation satellite market, and consequently these entities' role in the international space market. The Chinese military's strategic space support system might also profit in accuracy, range, and resilience from BDS ground stations outside of China. Finally, the MoU's implementation might benefit the advancement of China's international prestige and influence. After all, access to BDS reduces Iran's navigational dependence on the (disliked) American GPS but, at the same time, increases the country's link to and navigational dependence on China.

275 SCIO, 'CBDS' (n 126) preface,chs I,V.

276 'Iran Electronics Industries (IEI)' (*Iran Watch*, 18 January 2018) <https://www.iranwatch.org/iranian-entities/iran-electronics-industries-iei> accessed 9 October 2018.

277 'Chinese BeiDou BDS to Transfer Satellite Tech. to Iran' (*Mehr News Agency*, 18 October 2015) <http://en.mehrnews.com/news/111132/Chinese-BeiDou-BDS-to-transfer-satellite-tech-to-Iran> accessed 14 October 2017.

The Sino-Indian Space Cooperation Outline 2015 indicates that the two sides want to discuss cooperation in the application, interoperability and signal compatibility of each others' navigation satellite systems.[278]

The construction of BRISIC incorporates a Chinese interest in international cooperation regarding space-related navigation, presumably including with other preeminent Asian governments in the space sector. The construction of BRISIC seems especially oriented towards setting up a better interaction and application of the presently available and upcoming (public and private) remote sensing, communications and broadcasting, and navigation satellites of the participants of BRI in establishing and maintaining BRI's modern land-based Silk Road Economic Belt and sea-based 21st-Century Maritime Silk Road. Again, it is not necessarily a call for the joint development and application of dedicated new satellite systems, even though related activities are not excluded. Ultimately, all that likely aims at supporting the pursuit of the government's space-related socioeconomic target area of enhancing Chinese entities' role in the international space market.[279]

4.6.5 Science and technology research

4.6.5.1 Major domestic measures

Science and technology research measures have received a more and more prominent place in the government's space programme over the past two decades.[280] According to CSA2016, the government currently promotes at least the development of technology experiment satellites, new electric propulsion technology, laser communications and new-generation communications satellite platforms. Moreover, it fosters the development of in-orbit servicing and maintenance systems for spacecraft, as well as the execution of in-orbit experiments on new theories, technologies and products. Also, it wants to 'implement a series of new space science satellite programs, establish a series of space

278 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

279 For more information on BRISIC and this argumentation, see this study's Section 4.6.2.2.

280 Based on the range of projects promoted throughout the various CSAs: SCIO, 'CSA2000{eng}' (n 119); SCIO, 'CSA2006{eng}' (n 121); SCIO, 'CSA2011{eng}' (n 123); SCIO, 'CSA2016{eng}' (n 125); additionally, see: 'Strategic Priority Program on Space Science' (*NSSC*) <http://english.nssc.cas.cn/missions/FM/> accessed 20 November 2017; also, STDP calls for research on the 'formation and evolution of black holes and diverse celestial bodies and structures': 'The National Medium- and Long-Term Program for Science and Technology Development (2006-2020) An Outline' (n 111) 41.

science satellites featuring sustainable development, and reinforce basic application research.'[281] Notably, CAS has later published a (non-binding) document proposing various space science missions for 2016-2030 that seem to build upon the topics above.[282]

With this in mind, this study has identified the following spacecraft (series) to constitute the specific major (mostly)[283] domestic space-related science and technology research measures that have been continued or commenced under the government's current space programme (alphabetically, and without claiming completeness): *Chuangxin* (创新),[284] *Dark Matter Particle Explorer* (DAMPE),[285] *Fengniao* (蜂鸟),[286] *Hard X-ray Modulation Telescope* (HXMT),[287] *Quantum Experiments at Space Scale* (QUESS; also dubbed: *Micius* (墨子号)),[288] *Shijian* (实践),[289] *Xinyan* (新验),[290] *X-ray Pulsar Navigation Satellite-1* (commonly referred to as XPNAV-1),[291] and *Zheda Pixing* (浙大皮星).[292] Additionally, the government has apparently also already signed off on the upcoming development of the following five (mostly) domestic space-related science and technology research missions: *Advanced Space-borne Solar Observatory* (commonly referred to as ASO-S), *Einstein-Probe*, *Gravitational Wave Electromagnetic Counterpart All-sky Monitor* (commonly referred to as GECAM), *Magnetosphere-Ionosphere-*

281 SCIO, 'CSA2016{eng}' (n 125) ch III.

282 季 [Ji] 吴 [Wu] and others, '2016-2030 年中国空间科学发展规划建议 [Prospect for Chinese Space Science in 2016-2030]' (2015) 30(6) 中国科学院院刊 [Bulletin of Chinese Academy of Sciences] 707.

283 Various spacecraft (series) introduced here have seen some collaboration with foreign partners, especially DAMPE and QUESS. This study has decided to treat them primarily as major government-promoted domestic space-related science and technology research measures due to the involved Chinese entities' strong leadership role and the fact that the mission proposals emerged domestically.

284 Pollpeter and others (n 127) 77.

285 Based on information in: 'Strategic Priority Program on Space Science' (n 280); Jane Qiu, 'China's Quest to Become a Space Science Superpower' (2017) 547 Nature 394.

286 Pollpeter and others (n 127) 276.

287 'Strategic Priority Program on Space Science' (n 280).

288 Based on information in: 'China Launches Quantum-Enabled Satellite Micius' (*BBC*, 16 August 2016) <http://www.bbc.co.uk/news/world-asia-china-37091833> accessed 19 November 2017; 'Strategic Priority Program on Space Science' (n 280); Qiu (n 285).

289 Based on information in: Pollpeter and others (n 127) 77–78; 'Strategic Priority Program on Space Science' (n 280).

290 Based on information in: '新技术验证卫星在轨两周年 [New Technology Verification Satellite in Orbit for Two Years]' (中国空间技术研究院 *China Academy of Space Technology*, 19 December 2014) <http://www.cast.cn/CastCn/Show.asp?ArticleID=48044> accessed 7 September 2015; Pollpeter and others (n 127) 76.

291 Andrew Jones, 'China's Launches X-Ray Pulsar Navigation Satellite and First Commercial Science Probe' (*GBTIMES*, 10 November 2016) <https://gbtimes.com/chinas-launches-x-ray-pulsar-navigation-satellite-and-first-commercial-science-probe> accessed 20 November 2017.

292 Based on information in: '浙大皮星一号 A 诞生记 [Zheda Picosat-1A Birth Record]' (浙江大学 *[Zhejiang University]*, 7 October 2010) <http://www.news.zju.edu.cn/news.php?id=31243> accessed 6 September 2015; Pollpeter and others (n 127) 77.

Thermosphere Coupling Exploration (commonly referred to as MIT), and *Water Cycle Observation Mission* (commonly referred to as WCOM).[293]

Altogether, the available information allows arguing that the measures above publicly aim at serving the pursuit of the government's current space-related science and technology state preference of advancing China's scientific and technological level per se. For example, the information points towards such measures' implementation to further China's capabilities and capacities in and the understanding of areas like astronomy, astrophysics, biology, the terrestrial water cycle system, life sciences, medicine, material research, microgravity studies, space weather research, communications satellite platform technology, electric propulsion technology, in-orbit servicing and maintenance systems for spacecraft, laser communications, pulsar X-ray radiation-based navigation, quantum communications and other aspects of quantum science, and remote sensing technology.[294]

However, at the same time, it needs to be noted here that the government presumably promotes such measures also with an eye to their potential future contribution to the pursuit of other space-related state preferences. For example, Pollpeter and others refer to speculations that the Chinese military has a hand in *Shijian* missions,[295] indicating that the latter might have some national security orientation. Chen suggests that reliable quantum communications technology, as tested through QUESS, has great economic and military potential.[296] Moreover, attempts to understand space weather better, which is well-known to interfere with spacecraft in orbit, fit the pursuit of the government's space-related autonomy-oriented state preference of ensuring the stable use of outer space for China.

293 Based on information in: Chi Wang, 'Latest Development of Space Science Programs of China' (Presentation, 54th UNCOPUOS STSC, Vienna, 2 February 2017) <http://www.unoosa.org/documents/pdf/copuos/stsc/2017/tech-26E.pdf> accessed 20 November 2017; Deyana Goh, 'China to Launch at Least 6 Scientific Spacecraft by 2021' (*SpaceTech Asia*, 25 April 2018) <http://www.spacetechasia.com/china-to-launch-at-least-6-scientific-spacecraft-by-2021/> accessed 19 July 2018.

294 Based on information presented in the respective footnotes of the various spacecraft (series) introduced above, as well as the information on the Chinese space-related science and technology measures in: SCIO, 'CSA2016{eng}' (n 125) ch III.

295 Pollpeter and others (n 127) 77–78.

296 Stephen Chen, 'How Quantum Satellite Launch Is Helping China Develop a Communications System That "Cannot Be Hacked"' (*South China Morning Post*, 12 June 2017) <http://www.scmp.com/news/china/article/2004560/how-quantum-satellite-launch-helping-china-develop-communications-system> accessed 19 November 2017.

4.6.5.2 Major cooperative measures

A few key areas of cooperation under the government's current space programme seem to (somewhat) relate to the field of science and technology research.[297]

However, excluding APRSAF and APSCO-related measures, (more) specific major government-promoted cooperative space-related science and technology research measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector appear to be still sparse:

In particular, it is the Sino-Indian Space Cooperation Outline 2015 that mentions that the two sides consider cooperation in astronomical observation and cross-calibration regarding China's HXMT and India's ASTROSAT mission. Furthermore, they apparently want to discuss collaboration concerning deep space exploration-related missions, instruments and individual technology.[298]

Without much information upon which to draw, this study thinks that the Chinese government might hope that such cooperation can, to some extent, foster the pursuit of its current space-related science and technology state preference and its current space-related political state preferences of advancing China's international prestige and influence.

4.6.6 Human spaceflight

4.6.6.1 Major domestic measures

Throughout the 21st century, the government has included human spaceflight as a segment of its overall space programme.[299] The current major government-promoted domestic human spaceflight measures take place primarily under the government's CMSP, which was approved in general on 21.09.1992 under the code name *Project 921* ('921 工程')[300]

297 SCIO, 'CSA2016{eng}' (n 125) ch V.

298 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

299 As indicated by the human spaceflight measures outlined in: SCIO, 'CSA2000{eng}' (n 119) ch III; SCIO, 'CSA2006{eng}' (n 121) ch III; SCIO, 'CSA2011{eng}' (n 123) ch III; SCIO, 'CSA2016{eng}' (n 125) ch III.

300 '中国载人航天工程简介 [Brief Overview of China Manned Space Engineering]' (n 133).

and is nowadays often colloquially termed *Shenzhou Programme*[301] in reference to the Chinese *Shenzhou* (神舟; Divine Vessel) spacecraft used for crewed flights.[302]

Presently, CMSP calls for the implementation of three consecutive strategic steps. In short, the first strategic step aims at launching a crewed spaceship, the second at launching and crewing a spacelab, and the third at setting up and crewing a fully-fledged space station.[303] Regarding CMSP's future strategic elements, Chinese entities reportedly deliberate on a twenty-year lunar and interplanetary exploration strategy that might, *inter alia*, call for a human lunar landing.[304]

CMSP's first two strategic steps have already been implemented successfully. Most prominently, the *Shenzhou-V* mission put China's first *taikonaut* into space in 2003. China launched its first spacelab, *Tiangong-I* (天宫一号; Heavenly Palace-I), in 2011, and crewed it the first time in 2013. China further launched and crewed *Tiangong-II*, the successor spacelab, in 2016. While writing, the government promotes the full implementation of CMSP's third strategic step by around 2022. An important measure towards that end was the successful test of the *Tianzhou* (天舟*;* Heavenly Ship) cargo freighter spacecraft series in 2017.[305] Arguably, all (named and unnamed) major measures under CMSP so far deserve the 'domestic' attribute because they were or still are primarily domestically developed and controlled.[306]

Overall, (the domestic side of) CMSP seems to be directed towards serving the pursuit of the government's following current space-related state preferences:

301 Dan Zhang, 'Shenzhou-10: A New Mission' (*CCTV*, 31 March 2013) <http://english.cntv.cn/program/newsupdate/20130331/103047.shtml> accessed 22 July 2018.

302 Pollpeter and others (n 127) 46–47.

303 Based on information in: 'CMSP' (*CMSE*) <http://en.cmse.gov.cn/list.php?catid=42> accessed 8 May 2015; 'China Space Station and Its Resources for International Cooperation' (n 133) 1.

304 Andrew Jones, 'China Aims for Pole Position in Lunar Exploration' (*GBTIMES*, 14 October 2016) <https://gbtimes.com/china-aims-pole-position-lunar-exploration> accessed 9 November 2017.

305 Based on information in: 'Missions' (*China Manned Space*) <http://en.cmse.gov.cn/col/col81/index.html> accessed 23 July 2018; Harvey (n 224) 271–305; Pollpeter and others (n 127) 45–53; SCIO, 'CSA2016{eng}' (n 125); 'SCIO Briefing on China's Tiangong 2 and Shenzhou 11 Manned Space Mission' (*China.org.cn*, 19 November 2016) <http://china.org.cn/china/2016-11/19/content_39742416.htm> accessed 8 November 2017; Stephen Clark, 'China's Tianzhou 1 Supply Vehicle Re-Enters Atmosphere' (*Spaceflight Now*, 22 September 2017) <https://spaceflightnow.com/2017/09/22/chinas-tianzhou-1-supply-vehicle-re-enters-atmosphere/> accessed 8 November 2017; Andrew Jones, 'Tianhe: A Look at the Core Module of the Chinese Space Station' (*GBTIMES*, 30 January 2018) <https://gbtimes.com/tianhe-a-look-at-the-core-module-of-the-chinese-space-station> accessed 23 July 2018; 'China Space Station and Its Resources for International Cooperation' (n 133) 2–8.

306 As indicated in: 'China Space Station and Its Resources for International Cooperation' (n 133) 2–8; Jones, 'Tianhe: A Look at the Core Module of the Chinese Space Station' (n 305).

First, CMSP-specific measures fit the pursuit of the government's space-related political state preferences of securing the legitimacy of the CPC's rule over all of China, as well as advancing China's international prestige and influence. For example, STDP states that human spaceflight and other major science and technology achievements 'have greatly enhanced the nation's comprehensive national strength [CNP], uplifted its international position, and inspired the whole nation.'[307] In 2011, then-State President Hu Jintao (胡锦涛) also contended that 'the CPC leadership and the socialist system provided a "political advantage" for the progress of the country's manned space program.'[308] Besides that, Stokes and Cheng reasonably argue that '[m]anned spaceflights are an internationally recognized symbol of progress and wealth, and China has made considerable efforts over the past two decades to send humans into space as a powerful icon of international prestige and national pride.'[309] Johnson-Freese concludes that the government uses the *Shenzhou* programme to increase the Chinese people's national pride and the one party-based government's legitimacy, as well as to popularise the perception of a China rising towards a regional and international top position.[310] Finally, Handberg and Li find that China's first crewed space mission in 2003 has put China visibly on par with previous achievements of such (former) world powers like the USA and the Soviet Union, and strengthened the perception that the country surpassed other potent regional states like India and Japan in space.[311]

Second, CMSP-specific measures appear to support the pursuit of the government's space-related science and technology state preference of advancing China's scientific and technological level per se, whereby there might be some additional intended spillover into the pursuit of some of its other space-related state preferences. After all, various missions under CMSP have encompassed or might in the future cover science and technology research activities fostering China's progress in such areas like aerospace medicine, astronomy and (astro)physics, biotechnology, disaster management, ecology, education,

307 'The National Medium- and Long-Term Program for Science and Technology Development (2006-2020) An Outline' (n 111) 9.

308 'China Celebrates Success of Space Docking Mission' (*Xinhuanet*, 16 December 2011) <http://news.xinhuanet.com/english/china/2011-12/16/c_131309987.htm> accessed 27 June 2015.

309 Mark A Stokes and Dean Cheng, 'China's Evolving Space Capabilities: Implications for U.S. Interests' (Report, US-China Economic and Security Review Commission 24 April 2012) 25 <http://project2049.net/documents/uscc_china-space-program-report_april-2012.pdf> accessed 9 February 2015.

310 Joan Johnson-Freese, 'China's Manned Space Program. What Is That All About?' (2002) 6(2) Harvard Asia Pacific Review 25, 26.

311 Roger Handberg and Zhen Li, *Chinese Space Policy. A Study in Domestic and International Politics* (Routledge 2007) 127-130,144.

the environment, EO and geoscience (including Earth weather monitoring), Earth resources, food security, human health, life science, human spaceflight (including human space exploration), materials science, microgravity science, (sustainable) social progress, space technology, and space weather monitoring and forecasting.[312] In this regard, the educational and space weather-related activities also arguably somewhat fit the pursuit of the government's two current space-related autonomy-oriented state preferences. The disaster management-, ecology-, environment-, food security-, health-, medicine-, social progress- and remote sensing-related activities further conform, to some extent, to the pursuit of the government's current socioeconomic state preference-related target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for China.

Third, there is a sign that the government hopes that, in the long run, Chinese human spaceflight undertakings assist the pursuit of its space industry and market-related target areas under its space-related socioeconomic state preference. For one, a joint Sino-UN document mentions that science and technology research results derived from experiments using the Chinese space station 'will be shared and transferred to promote industrial progress, providing new momentum for the sustained and healthy development of China's national economy.'[313]

Interestingly, the military involvement in the management and administration of CMSP[314] does not warrant the interpretation that the programme's implementation serves the pursuit of the government's space-related national security state preference. At most, some missions so far might have included 'limited, experimental military payloads.'[315]

4.6.6.2 Major cooperative measures

CSA2016 introduces the construction and use of China's spacelabs and space station as a key area of cooperation under the government's current space programme.[316] Based on this background, the Chinese government through CMSA has, on a more specific level, later declared a willingness to offer international partners, without excluding any other

312 'China Space Station and Its Resources for International Cooperation' (n 133) 2-3,8-9,11-12.
313 ibid 8.
314 As already argued in this study's Section 4.3.
315 Lan Chen, 'Is the Chinese Manned Space Program a Military Program?' (*The Space Review*, 30 March 2009) <http://www.thespacereview.com/article/1340/1> accessed 19 November 2017.
316 SCIO, 'CSA2016{ch}' (n 124) ch V.

state per se, the opportunity to collaborate with China within CMSP's scope 'in different areas including space science research,[especially by utilising the Chinese space station, as well as] astronaut selection, training and flight, and manned space technology and its applications.'[317] Notably, there is no evidence that the Chinese government is open to relinquishing its general domestic control over (the development and use of) Chinese human spaceflight capabilities and capacities concerning any of the topics above.

As far as this study was able to ascertain, only one (more) specific current major government-promoted cooperative human spaceflight measure (with a presumed high potential for) involving preeminent Asian governments in the space sector appears to have evolved within this overall context by now:

More precisely, the government through CMSA has entered into a framework agreement with the United Nations Office for Outer Space Affairs (UNOOSA) in 2016 'to enable United Nations Member States, particularly developing countries, to conduct space experiments on-board China's [upcoming] space station, as well as to provide flight opportunities for astronauts and payload engineers.'[318]

Lacking detailed information, this study contemplates that the following two current space-related state preferences might underlie the entering of this framework agreement on the Chinese government's side:

First, the Chinese government might anticipate that specified cooperative measures under this framework add to the pursuit of its space-related political state preference of advancing China's international prestige and influence. After all, China presents other states – at least within the near future – with a viable alternative to the International Space Station (ISS) to launch their citizens to a permanent space station and to conduct space science research onboard such a facility. It is likely that this improves China's standing with such states. In particular, states with conflictual relations with ISS project partners might be grateful to finally have an option to engage in such undertakings. Reportedly,

317 'China Space Station and Its Resources for International Cooperation' (n 133) 3,27-28. Citation on 27.
318 'United Nations and China Agree to Increased Space Cooperation' (*UNOOSA*, 16 June 2016) <http://www.unoosa.org/oosa/en/informationfor/media/2016-unis-os-468.html> accessed 5 October 2017.

Iran has already entered discussions with China regarding the potential of sending Iranian astronauts to the upcoming Chinese space station.[319]

Second, the pursuit of the government's current space-related science and technology state preference might benefit from results obtained from others' space experiments onboard China's space station.

4.6.7 Lunar exploration

4.6.7.1 Major domestic measures

The current major government-promoted domestic lunar exploration measures take all place under the government's *China Lunar Exploration Programme* (CLEP; '中国探月工程'), first approved in 2004 and colloquially referred to as *Chang'e Programme* ('嫦娥工程').[320] Similar to CMSP, the government has always treated CLEP as a segment of its overall space programme.[321]

Presently, CLEP entails the implementation of three consecutive strategic steps. The first step mainly aims at orbiting a satellite around the Moon, the second at achieving a soft-landing of a rover on the lunar surface, and the third at returning a lunar sample safely back to Earth.[322] Concerning the time after, the government reportedly works on a twenty-year lunar and interplanetary exploration strategy that might, among others, propose a manned lunar landing, the robotic exploration of lunar poles, in-situ resource utilisation and technology demonstration.[323]

By the end of 2017, the government has already successfully implemented CLEP's first two strategic steps, especially through the *Chang'e-1*, *Chang'e-2*, *Chang'e-3*, which

319 'Iran Abandons Its Human Spaceflight Ambitions' (*SpaceWatch Middle East*, 2 June 2017) <https://spacewatchme.com/2017/06/iran-abandons-human-spaceflight-ambitions/> accessed 16 February 2018. However, these discussions might (so far) take place outside of the CMSA-UNOOSA framework agreement.

320 Based on information in: '中国嫦娥工程的"大三步"和"小三步" [China's Chang'e Programme's "Three Large Steps" and "Three Small Steps"]' (中国新闻网 *[China News Service]*, 1 December 2013) <http://www.chinanews.com/mil/2013/12-01/5565595.shtml> accessed 14 May 2015; 'China Lunar Exploration Programme' (*China Space Report*) <https://chinaspacereport.com/programmes/china-lunar-exploration/> accessed 26 January 2018.

321 As indicated by the lunar exploration measures outlined in: SCIO, 'CSA2006{eng}' (n 121) ch III; SCIO, 'CSA2011{eng}' (n 123) ch III; SCIO, 'CSA2016{eng}' (n 125) ch III.

322 '我国月球探测工程的发展规划 [China's Lunar Exploration Project's Development Plan]' (*CNSA*, 18 May 2011) <http://www.cnsa.gov.cn/n1081/n7499/n314807/n330895/331346.html> accessed 15 May 2015.

323 Jones, 'China Aims for Pole Position in Lunar Exploration' (n 304).

included the *Yutu* lunar rover, and *Chang'e-5-T1* missions. While writing, the government promotes the implementation of the measures, particularly the *Chang'e-5* mission, pertinent to achieve the third strategic step by 2019. Before that, the government also wants to attempt the world's first soft landing on the lunar far-side with the *Chang'e-4* mission by the end of 2018. So far, all (named and unnamed) major measures under CLEP can be considered domestic measures because they were or are still primarily domestically developed and controlled. If any, foreign involvement has been limited.[324]

In sum, (the domestic side of) CLEP appears to be directed towards serving the pursuit of the following current space-related state preferences:

First, observers agree that the pursuit of the government's space-related political state preferences is central to CLEP.[325] This is reasonable considering that only a few countries have ever engaged in lunar exploration. The prestige and influence-related arguments presented in the context of CMSP make sense here as well.[326]

Second, there is the pursuit of the government's current space-related science and technology state preference. After all, STDP lists the Chinese lunar probe as one of the government's major special projects to foster China's scientific and technological progress.[327] Moreover, various CLEP-related missions have contributed to lunar and other fields of space science.[328] Also, the implementation of CLEP has reportedly led to domestic breakthroughs in key technologies and technological progress on topics like

324 Based on information in: Harvey (n 224) 315–325; Pollpeter and others (n 127) 55–60; Joel Raupe, 'Chang'e-5 T1 Service Module Completes Orbital Tests' (*Lunar Networks*, 9 February 2015) <http://lunarnetworks.blogspot.com/2015/02/change-5-t1-service-module-completes.html> accessed 17 May 2015; SCIO, 'CSA2016{eng}' (n 125) chs II-III; Jones, 'China Aims for Pole Position in Lunar Exploration' (n 304); Andrew Jones, 'Ten Years Ago China Began Its Long March to the Moon – and Its Plans Are Evolving' (*GBTIMES*, 27 October 2017) <https://gbtimes.com/ten-years-ago-china-began-its-long-march-to-the-moon-and-its-plans-are-evolving> accessed 9 November 2017; Nola Taylor Redd, 'Chang'e-4: Visiting the Far Side of the Moon' (*Space.com*, 25 May 2018) <https://www.space.com/40715-change-4-mission.html> accessed 30 June 2018.

325 For example: 'Jade Rabbit Moon Rover Landing Marks New Leap for China' (*The Hindu Business Line*, 13 December 2013) <http://www.thehindubusinessline.com/news/science/jade-rabbit-moon-rover-landing-marks-new-leap-for-china/article5455188.ece> accessed 18 May 2015; Pollpeter and others (n 127) v,24,54.

326 For the arguments presented in the context of CMSP, see this study's Section 4.6.6.1.

327 'The National Medium- and Long-Term Program for Science and Technology Development (2006-2020) An Outline' (n 111) 10-11,32-33.

328 Lin Xu and Ziyuan Ouyang, 'Scientific Progress in China's Lunar Exploration Program' in Hejun Yin and others (eds), *Space Science Activities in China. National Report 2012-2014* (CNCOSPAR 2014) <http://english.nssc.cas.cn/ns/NU/201410/W020141016603613596668.pdf>.

‘carrier rockets, deep space communication[s], remote control, artificial intelligence, robotics, new materials and new energy[...].’[329]

Third, there are indicators that the government’s space industry and market-related target areas under its current space-related socioeconomic state preference might, in the near future, become an additional driving factor behind its promotion of CLEP-related measures. The government is apparently willing to involve private companies in lunar exploration to ‘break the monopoly in the space field, accelerate technological innovation, reduce the government’s investment and improve efficiency.’[330] Some Chinese scientist further deliberate the industrial exploitation of lunar resources.[331]

4.6.7.2 Major cooperative measures

According to CSA2016, the Chinese government is open to engaging in international cooperation regarding lunar exploration.[332]

However, this study has merely been able to identify one (more) specific engagement that somewhat falls under the category of a current major government-promoted cooperative lunar exploration measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector:

In short, the parties to the Sino-Indian Space Cooperation Outline 2015 seemingly agreed to consider ‘jointly carry[ing] out studies on the scientific objectives of lunar exploration’, and to deliberate on collaboration on payload development and piggybacking of payloads or instruments regarding China’s *Chang’e-4* lunar mission.[333]

Having been unable to obtain much data in this regard, this study thinks that the Chinese government might believe that all the above can aid the pursuit of its current space-related

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329 Ningzhu Zhu, ‘China Explores Moon for Science, Technology Advancement’ (*Xinhuanet*, 16 December 2013) <http://news.xinhuanet.com/english/china/2013-12/16/c_132971550.htm> accessed 24 June 2015.

330 Lei Zhao, ‘Private Companies Asked to Join Moon Program’ (*China Daily*, 17 March 2015) <http://www.chinadaily.com.cn/china/2015-03/17/content_19828198.htm> accessed 26 June 2015.

331 Pollpeter and others (n 127) 54.

332 SCIO, ‘CSA2016{eng}’ (n 125) ch V.

333 ‘2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People’s Republic of China’ (n 245).

science and technology state preference, as well as its current space-related political state preference of advancing China's international prestige and influence.

4.6.8 Exploration of other celestial bodies

4.6.8.1 Major domestic measures

The Chinese government's first attempt in Mars exploration was its participation in the failed Russia-led *Phobos-Grunt* mission from 2011.[334] Afterwards, the Chinese government decided to implement a primarily domestically developed and controlled Mars mission, with a launch date around 2020. This mission shall include an orbiter, lander and rover. Besides that, the government presently also promotes initial studies on future Chinese projects involving the retrieval of a Mars sample, the exploration of asteroids and the Jovian system and planetary flyby exploration.

On the one hand, the available information suggests that these current(ly studied) major government-promoted domestic measures regarding the exploration of other celestial bodies than the Moon presumably aim at supporting the pursuit of the government's current space-related science and technology state preference. For example, they shall help to understand the evolution of the solar system and assist in the search for extraterrestrial life. In particular, the Mars mission's specific tasks reportedly are the generation of data on the planet's atmosphere, environment, inner structure, morphology, and water and ice distribution, as well as the search for signs of life.[335]

On the other hand, the measures above shall arguably further bolster the pursuit of the government's current space-related political state preferences. For example, the Chinese rover shall arrive on Mars in 2021, which coincides with the 100th anniversary of the CPC's foundation and the deadline for the Chinese Dream's first Centenary Goal.[336] Moreover, China would become the first Asian state with a rover on Mars. As such, it would – finally – outperform India in planetary exploration other than the Moon and

334 Harvey (n 224) 330–335.

335 Based on information in: Andrew Jones, 'China Unveils Its Mars 2020 Probe and Science Goals' (*GBTIMES*, 23 August 2016) <https://gbtimes.com/china-unveils-its-mars-2020-probe-and-science-goals> accessed 19 November 2017; SCIO, 'CSA2016{eng}' (n 125) ch III.

336 'Mars Exploration Mission' (*China Space Report*) <https://chinaspacereport.com/spacecraft/mars-mission/> accessed 19 November 2017.

presumably outshine India's international acclaim for the first successful Asian Mars orbiter mission in 2014.[337]

4.6.8.2 Major cooperative measures

CSA2016 indicates that the Chinese government deems cooperation in Mars and other deep space exploration a key area of cooperation under its current space programme.[338]

Yet, as of 2017, this study has found no evidence for the government's current promotion of a major cooperative measure in this regard (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

4.6.9 Stable use of outer space

4.6.9.1 Major domestic measures

The Chinese government promotes various major domestic measures under its current space programme that seem to be primarily directed towards fostering the pursuit of its space-related autonomy-oriented state preference of ensuring the stable use of outer space for China.

For example, it engages in increasing the protection of Chinese spacecraft, as well as enhancing China's near-earth object (including space debris) monitoring facilities and related early warning and emergency response platform and online service system. Presumably linked to that, the government further wants to extend China's space debris database, improve its related data-sharing model, as well as upgrade its standardisation system for space debris, other near-earth objects and space climate.[339] Additionally, the government might want to advance its already established initial domestic regulatory regime addressing the space debris issue.[340]

337 Binglin Chen, 'China's First Mission to Mars Will Be Hugely Ambitious and Be a Chance to "Outshine India", Says Beijing's Chief Space Scientist' (*South China Morning Post*, 19 January 2016) <http://www.scmp.com/news/china/society/article/1902837/chinas-first-mission-mars-will-be-hugely-ambitious-and-be-chance> accessed 19 November 2017.

338 SCIO, 'CSA2016{eng}' (n 125) ch V.

339 ibid ch III.

340 Based on information in: Li, 'The Role of International Law in Chinese Space Law and Its Relevance to Pacific Rim Space Law and Activities' (n 128) 545–547; Zhao, *National Space Law in China* (n 114) 205–227.

Besides that, the test of the domestic *Aolong-1* (遨龙一号) satellite in 2016 also indicates that the government wants to promote the development and implementation of active space debris removal technology. Reportedly, the satellite has a robotic arm to help with de-orbiting other satellites. Notably, despite *Aolong-1*'s potential utility to attack other state's satellites, this study has found no solid evidence that the mission was conducted in the pursuit of the government's current space-related national security state preference.[341]

4.6.9.2 Major cooperative measures

The government names the areas of space weather, as well as space debris monitoring, early warning, mitigation and protection, as key areas of cooperation under its current space programme.[342]

Yet, excluding APRSAF and APSCO-related measures, this study has, without claiming completeness, only found one activity that arguably constitutes a (more) specific current major government-promoted cooperative measure in this regard (with a presumed high potential for) involving other preeminent Asian governments in the space sector:

This is CNSA's participation in the Inter-Agency Space Debris Coordination Committee (IADC). The latter involves, *inter alia*, also the space agencies of India, Japan and South Korea.[343]

4.6.10 Launchers

4.6.10.1 Major domestic measures

One part of the current major government-promoted domestic measures in the field of space launchers is the domestic maintenance and enhancement of the four main space launching sites on Chinese soil.

Another part is the continued domestic development and use of China's main launcher family called *Changzheng* (CZ;长征) – which in English publications is, following the

341 Morris Jones, 'Chinese Space Garbageman Is Not a Weapon' (*SpaceDaily*, 28 June 2016) <http://www.spacedaily.com/reports/Chinese_Space_Garbageman_is_not_a_Weapon_999.html> accessed 19 April 2018.

342 SCIO, 'CSA2016{eng}' (n 125) ch V.

343 Based on information in: 'Inter-Agency Space Debris Coordination Committee' (*IADC*) <http://www.iadc-online.org/> accessed 9 September 2015; SCIO, 'CSA2016{eng}' (n 125) ch V.

literal translation of *Changzheng*, also often referred to as *Long March* (LM) –, as well as the quite newly established and commercially-oriented Chinese launcher family called *Kuaizhou* (KZ;快舟; Speedy Vessel). Ultimately, the domestic development and launch of both these launcher families involve various government-related entities.

A third part, which likely interlinks to a large degree with the previous two parts, is the domestic development of 'medium-lift launch vehicles which are non-toxic and pollution-free', the domestic development of a 'new-generation launch vehicle family', the enhancement of Chinese launcher reliability, and domestic research into technologies for heavy-lift launch vehicles, low-cost launch vehicles, a new upper stage and a reusable space transportation system to low Earth orbit (LEO).

As the fourth and last part, the government apparently also promotes the creation of a broader Chinese commercial space launch service industry, including through private launch providers.[344]

The following current space-related state preferences arguably drive these measures:

First, there is the pursuit of the government's current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. After all, there is no autonomous implementation of the government's other domestic space undertakings possible without domestic launch capabilities and capacities.

Second, there is the pursuit of the government's space-related socioeconomic state preference, especially regarding the space industry and market-related target areas. For one, as mentioned above, the government apparently promotes the creation of a broader

344 Based on information in: Pollpeter and others (n 127) 78–86; SCIO, 'CSA2016{eng}' (n 125) chs II-IV. Citations in ch III; 'Kuai Zhou (Fast Vessel)' (*China Space Report*, 22 May 2016) <https://chinaspacereport.com/launch-vehicles/kuaizhou/> accessed 19 April 2018; Stephen Clark, 'Kuaizhou Rocket Lifts off on First Commercial Mission' (*Spaceflight Now*, 9 January 2017) <https://spaceflightnow.com/2017/01/09/kuaizhou-rocket-lifts-off-on-first-commercial-mission/> accessed 1 July 2018; Andrew Jones, 'Chinese Commercial Rocket Company Secures 1.2bn Yuan Investment, Multiple Launches Set for 2018' (*GBTIMES*, 19 December 2017) <https://gbtimes.com/chinese-commercial-rocket-company-secures-12bn-yuan-investment-multiple-launches-set-for-2018> accessed 26 July 2018; 'Chang Zheng Data Sheet' (*Space Launch Report*, 9 October 2018) <http://www.spacelaunchreport.com/cz.html> accessed 10 October 2018.

Chinese commercial space launch service industry, including through private launch providers. Also, the KZ launcher family has a commercial orientation. Moreover, CGWIC has been (solely) authorised by the Chinese government to provide, among others, commercial launch services to domestic and foreign customers using China's CZ/LM launcher family.[345]

Third, it is reasonable to assume that the measures above shall add to the pursuit of the government's two current space-related political state preferences. After all, there are still only a limited number of states, especially in the Asian region, with a broad range of domestic launching capabilities and capacities. The domestic maintenance and enhancement of such capabilities and capacities can function as a very visible reminder to the Chinese people that the CPC brings them great technological progress, and to the international community that China rises and is on its way to becoming one of the world's technological powerhouses.

4.6.10.2 Major cooperative measures

CSA2016 suggests that the Chinese government is currently open to entering cooperation in the areas of launcher and carrier services, space TT&C support, as well as import and export of and technical cooperation regarding sub-systems, spare parts and electronic components of launch vehicles.[346]

Ultimately, this study has, without claiming completeness, only come across one activity that might be referred to as a (more) specific current major government-promoted cooperative measure in the field of space launchers (with a presumed high potential for) involving other preeminent Asian governments in the space sector:

In short, the parties of the Sino-Indian Space Cooperation Outline 2015 seem to have agreed to consider '[c]ooperation on providing launch services for satellites as co-passengers'. However, considering that the leading entity on each side has a commercial

345 Based on information in: 'Company Profile' (*CGWIC*) <http://www.cgwic.com/About/index.html> accessed 21 November 2017; 'Space Transportation' (*CGWIC*) <http://www.cgwic.com/Launchservice/LM2C.html> accessed 26 July 2018.

346 SCIO, 'CSA2016{eng}' (n 125) ch V.

orientation, such cooperation might in the end always be more of a commercial exchange than real intergovernmental collaboration.[347]

Consequently, the pursuit of the Chinese government's space-related socioeconomic state preference, in particular the international market-related target area, might play a central role in this regard.

4.6.11 Human resources

4.6.11.1 Major domestic measures

CSA2016 states that under the government's current space programme '[t]he mechanisms related to the training, assessment, flow of and incentives for professional personnel are being improved in an effort to form a well-structured contingent of highly qualified personnel in the course of construction of important projects and major programs, which consists of strategic scientists, leading researchers and technicians, entrepreneurs and high-caliber professionals, as well as experts in international cooperation.'[348] As such, it is no surprise that a simple online search in Chinese and English presents every researcher with a broad selection of current major government-promoted domestic space-related measures concerning the development of space-related human resources in China. To name just one element, there are several Chinese universities offering education and training in areas ranging from astronautics to space law.[349]

Overall, these measures seem to primarily fit the pursuit of the government's current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. The autonomous implementation of domestic space undertakings rests on access to the relevant experts within the country.

347 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

348 SCIO, 'CSA2016{eng}' (n 125) ch IV.

349 For example: '北京航空航天大学 宇航学院 Beihang University School of Astronautics' (*Beihang University School of Astronautics*) <http://www.sa.buaa.edu.cn/> accessed 1 July 2018; 'School of Law' (*Beijing Institute of Technology*, 30 October 2016) <http://english.bit.edu.cn/ensite/law/about/lawlaw/index.htm> accessed 1 July 2018.

4.6.11.2 Major cooperative measures

The government's current space programme apparently incorporates the exchange of personnel and joint training activities as key areas of cooperation.[350]

Yet, excluding APRSAF and APSCO-related measures, the (more) specific current major government-promoted cooperative space-related human resources measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector seem so far, and without claiming completeness, to only encompass the following:

Based on the Sino-Indian Space Cooperation Outline 2015, the two sides want to engage in training and exchange of experts in space science, technology and application, as well as in improving the interaction between the China-based RCSSTEAP and the India-based CSSTEAP[351] in terms of curricula and teachers.[352]

RCSSTEAP, established in 2014, is a UN-affiliated centre hosted at Beihang University in China. It covers joint science and technology-related training and education in a wide range of activity fields in the space sector among its ten member states, namely Algeria, Argentina, Bangladesh, Bolivia, Brazil, China, Indonesia, Pakistan, Peru and Venezuela.[353] As far as this study has been able to ascertain, RCSSTEAP does not prohibit the joining of other preeminent Asian governments in the space sector per se.

Lacking detailed information, this study thinks that the Chinese government might consider the measures above as somewhat beneficial to the pursuit of its following two current space-related state preferences:

First, the government might see them as a way to temporarily aid the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

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350 SCIO, 'CSA2016{eng}' (n 125) ch V.

351 For more information on CSSTEAP, see this study's Section 5.6.11.2.

352 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

353 'Introduction' (*RCSSTEAP*) <http://www.rcssteap.org/Article/lists/category/27.html> accessed 19 April 2018.

Second, it is not out of the question that the Chinese government hopes that by offering space-related education and training opportunities to other states, the latter might see China in a more positive light and become more dependent on China. As such, this can foster the pursuit of the government's space-related political state preference of advancing China's international prestige and influence.

5 Republic of India (India)

5.1 Analytical considerations

This study's main challenge in its particular assessment of the Indian government's current space programme is that, while this programme seems to be quite broad, the government appears to have only drafted and published a few domestic space-specific political and legal documents. Moreover, those that exist are rather limited in their scope. As such, this study looks at a plethora of material addressing aspects of the government's current space programme to achieve plausible findings concerning its primary research interest. It is helpful that English is in common usage by the Indian government and Indian researchers.

5.2 Main domestic political and legal documents

As of 2017, no overarching Indian national space law[354] or all-encompassing government space policy document has been adopted.[355] Without claiming completeness, this study finds based on the available material that at least the following domestic political and legal documents strongly guide the Indian government's current space programme. Their known content warrants special attention throughout this chapter.

Until it ran its course on 31.03.2017,[356] the '12th Five-Year Plan', which was the last of the government's Five-Year Plans developed by a now dissolved Planning Commission,[357] determined many core elements of the government's space programme.[358] Nowadays

354 The strongest attempt for the development of an overarching national space law has so far been ISRO's draft of a 'Space Activities Bill'. Published in November 2017, ISRO has sought comments from stakeholders and the public. Since it has remained only a draft in 2017, this study has not included it into its analysis. For the bill draft, see: 'Seeking Comments on Draft "Space Activities Bill, 2017" from the Stake Holders/Public -Regarding.' (*ISRO*, 21 November 2017) <https://www.isro.gov.in/sites/default/files/seeking_comments_on_draft_space_activities_bill201710.pdf> accessed 16 January 2018.

355 See also: Kiran Krishnan Nair, 'The Challenge of Indian National Space Policy' (2016) 14(2–3) Astropolitics 177.

356 'Vision, Strategy and Three Year Action Agenda of NITI Aayog' (*GKTODAY*, 24 December 2017) <https://academy.gktoday.in/article/vision-strategy-and-three-year-action-agenda-of-niti-aayog/> accessed 8 January 2018.

357 'The End of Five-Year Plans: All You Need to Know about This Big Policy Change' (*The Economic Times*, 13 April 2017) <https://economictimes.indiatimes.com/news/economy/policy/the-end-of-five-year-plans-all-you-need-to-know-about-this-big-policy-change/articleshow/58162236.cms> accessed 16 January 2018.

358 For the space-related part of this plan, see: Planning Commission, Government of India, *Twelfth Five Year Plan (2012–2017) Faster, More Inclusive and Sustainable Growth*, vol I (SAGE Publications India PvT Ltd 2013) 264–268 <http://planningcommission.gov.in/plans/planrel/12thplan/pdf/12fyp_vol1.pdf> accessed 8 January

however, the National Institution for Transforming India (NITI Aayog), created on 01.01.2015 as the government's primary political think tank and chaired by the Prime Minister, is tasked to provide major guidance for government programmes, whereby it needs to be noted that its publications have no legal force or immediate effect on budget allocation.[359] Presently, NITI Aayog's most relevant assignment is the drafting of three interacting, flexible policy and strategy documents outlining general objectives and strategies for India's national development over the next 15 years. At the centre shall be the – by the end of 2017 not yet finalised – long-term 'Fifteen Year Vision' ranging until 2031-32[360]. The vision's medium-term realisation in the next seven years shall be led by a – by the end of 2017 also not yet finalised – 'Seven Year Strategy'. Finally, the vision's short-term realisation is based on an already developed 'Three Year Action Agenda' running from 2017-2020.[361] Presumably, the government's current and future space programme shall follow these documents' direction. After all, the agenda already addresses, at least to a very limited degree, space-related matters.[362]

The most prominent domestic space-specific documents currently in play supposedly are the government's 'Frame-work for Satellite Communication Policy' (Satcom Policy) from 1997,[363] and the 'Remote Sensing Data Policy' (RSDP) from 2011.[364] They are complemented by regulatory documents detailing the Satcom Policy's implementation procedure and determining Indian satellite registration issues.[365] Besides that, this study

2018.

359 'Overview' (*NITI Aayog, Government of India*) <http://niti.gov.in/content/overview> accessed 8 January 2018.

360 Arvind Panagariya, 'India 2031-32: Vision, Strategy and Action Agenda' (Presentation, NITI Aayog, Government of India, New Delhi, 23 April 2017) <http://www.niti.gov.in/writereaddata/files/new_initiatives/Revised_Presentation.pdf> accessed 8 January 2018.

361 Based on information in: 'Vision, Strategy and Three Year Action Agenda of NITI Aayog' (n 356); NITI Aayog, Government of India, *India Three Year Action Agenda 2017-18 to 2019-20* (NITI Aayog, Government of India 2017) i,181 <http://niti.gov.in/writereaddata/files/coop/India_ActionAgenda.pdf> accessed 8 January 2018.

362 NITI Aayog, Government of India (n 361) 32,86-87,104,106,109-110.

363 For a copy the policy, see: 'Satcom Policy' (*ISRO*) <https://www.isro.gov.in/sites/default/files/article-files/indias-space-policy-0/satcom-policy.pdf> accessed 16 December 2017.

364 For a copy the policy, see: 'Remote Sensing Data Policy (RSDP – 2011)' (*ISRO*) <https://www.isro.gov.in/indias-space-policy-0> accessed 16 December 2017.

365 For copies of these regulatory documents, see: 'The Norms, Guidelines and Procedures for Implementation of the Policy Frame-Work for Satellite Communications in India' (*ISRO*) <https://www.isro.gov.in/sites/default/files/article-files/indias-space-policy-0/satcom-ngp.pdf> accessed 16 December 2017; 'Guidelines for INSAT/GSAT Capacity Reservation' (*ISRO*) <https://www.isro.gov.in/sites/default/files/dos_guidelines_for_insat-gsat_capacity_reservation_-_release_2.pdf> accessed 16 December 2017; 'INSAT/GSAT Capacity Request Format (ICRF)' (*ISRO*) <https://www.isro.gov.in/sites/default/files/icrf_format_-_release_2_-_04092017.pdf> accessed 16 December 2017; 'Application Format and Guidelines for Registering an Indian Satellite System' (*ISRO*) <https://www.isro.gov.in/sites/default/files/article-files/node/6116/caiss-6_application_format_08-07-2016.pdf> accessed 16 December 2017.

has found references to domestic space-specific policies and strategies dealing with, for example, industry participation, commercialisation, international cooperation, human resource development, technology transfer and intellectual property.[366]

5.3 Basic domestic decision-making system

The basic domestic decision-making system behind the formulation and implementation of the Indian government's present space programme is no secret. For the purpose of this study, it is sufficient to be aware of the following elements.

The primary entities determining the formulation and implementation of the government's current space programme are the Space Commission under the Prime Minister, the Department of Space (DOS), both established in June 1972, three more government-related space-specific committees and the Indian Space Research Organisation (ISRO). First established in August 1969, the latter is under the control of DOS since September 1972 and constitutes India's national space agency.

In short, the inter-ministerial Space Commission, consisting of the DOS Chairman, other high-level government members, e.g. the Finance Secretary and the Foreign Secretary, as well as several top experts in the field,[367] 'formulates the policies and oversees the implementation of the Indian space programme to promote the development and application of space science and technology for the socio-economic benefit of the country.' Under this commission, DOS is mainly responsible for 'promoting development and application of space science and technology to assist in all-round development of the nation.'[368] Interlinked with these institutions, the three national level space-specific committees (INSAT Coordination Committee; Planning Committee on National Natural Resources Management System; Advisory Committee on Space Sciences) focus on coordinating the creation of user-oriented Indian space capabilities and applications in the

366 Based on information in: Malay Adhikari, 'India's Role in the Legal Regulation of Private Actors in Space' (2016) 14(2–3) Astropolitics 203, 211. Adhikari further presents a long list of other domestic but less space-specific regulations that potentially have an affect on private space actors in India. They don't need to be included in this study; PG Diwakar, 'Indian Space Programme: Achievements and Plans' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <https://aprsaf.org/annual_meetings/aprsaf24/data/day16/2_2_India.pdf> accessed 16 December 2017.

367 'Space Commission' (*ISRO*) <https://www.isro.gov.in/about-isro/space-commission> accessed 14 January 2018.

368 'Department of Space and ISRO HQ' (*ISRO*) <https://www.isro.gov.in/about-isro/department-of-space-and-isro-hq> accessed 14 January 2018.

fields of communications, remote sensing and space sciences.[369] Technical implementation of the government-approved space undertakings mostly takes place through ISRO, including its specialised subordinate institutions and facilities like Vikram Sarabhai Space Centre, National Remote Sensing Centre, ISRO Telemetry, Tracking and Command Network, Indian Institute of Remote Sensing, and various autonomous bodies connected with DOS.[370] Notably, in September 1992, the government further established Antrix Corporation Limited (Antrix), a wholly government-owned company under the administrative control of DOS. It acts as ISRO's commercial and marketing arm.[371]

5.4 Space-related state preferences

5.4.1 Socioeconomic state preferences

The government's current space-related socioeconomic state preference appears to be the advancement of India's socioeconomic development.

Vikram Sarabhai, the founding father of India's space programme, stipulated early on 'that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society.'[372] The present government seemingly builds on that. A government press release at the end of 2015, at which point current Prime Minister Modi has already assumed office, explained point-blank that a 'primary objective of the Indian Space Programme/Mission is [...] to execute programmes/missions for the socio-economic development of the country'.[373] Indian space policy expert Lele also concluded in 2016 that, '[i]n India's case, space-program development is primarily for socioeconomic reasons.'[374] Adding to that, such a direction of the government's current space programme is plausible considering that NITI Aayog's Fifteen Year Vision, which shall guide India's

369 Based on information in: K Kasturirangan, 'India's Space Enterprise - A Case Study in Strategic Thinking and Planning' in JHA Raghbendra (ed), *The First Ten K R Narayanan Orations: Essays by Eminent Persons on the Rapidly Transforming Indian Economy* (ANU E Press 2006) 194; 'Department of Space and ISRO HQ' (n 368).

370 'Department of Space and ISRO HQ' (n 368).

371 Based on information in: 'Antrix Corporation Limited' (*ISRO*) <https://www.isro.gov.in/about-isro/antrix-corporation-limited> accessed 14 January 2018; 'Antrix Corporation Limited' (*Antrix*) <http://www.antrix.co.in/> accessed 14 January 2018.

372 'Dr. Vikram Ambalal Sarabhai (1963-1971)' (*ISRO*) <https://www.isro.gov.in/about-isro/dr-vikram-ambalal-sarabhai-1963-1971> accessed 23 April 2018.

373 'Indian Space Programme' (*Press Information Bureau, Government of India*, 2 December 2015) <http://pib.nic.in/newsite/PrintRelease.aspx?relid=132224> accessed 23 April 2018.

374 Ajey Lele, 'Power Dynamics of India's Space Program' (2016) 14(2–3) Astropolitics 120, 131.

overall national development and related undertakings until the early 2030s, shall be coherent with Prime Minister Modi’s following, and to a great part socioeconomically oriented statement: ‘By 2031-2032, we must transform India into a prosperous, highly educated, healthy, secure, corruption-free, energy-abundant, environmentally clean and globally influential nation.’[375] Moreover, this vision shall apparently be aligned with the UN Sustainable Development Goals[376] that have a strong socioeconomic tendency. In short, they encompass ‘a set of goals to **end poverty**, **protect the planet** and **ensure prosperity for all** […].’[377]

One target area under this state preference arguably is the development and application of space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India. This results, in particular, from this study’s findings on current major government-promoted space-related measures. There apparently are various measures addressing issues in such socioeconomically relevant areas like agriculture, the climate, coastal management, disaster management, the environment, fishery, forestry, health, mapping, meteorology, natural resources, rural development, telecommunications and broadcasting services, transportation, urban planning and water management.[378]

Besides that, three more – and somewhat interlinked – target areas relating to the space-related advancement of India’s socioeconomic development arguably are the expansion of the domestic (private) space industry’s involvement in the government-promoted space-related upstream sector, and, to a limited degree, the extension of the domestic space market and the enhancement of Indian entities’ role in the international space market in both the upstream and downstream sector. This emerges from the following narrative.

The strengthening of the domestic (private) space industry, domestic space market and the Indian footprint in the international space market have received much attention from Indian space-related academics and professionals in recent years, not least due to the world-wide emergence of and socioeconomic opportunities associated with NewSpace

375 Panagariya (n 360).
376 ‘Vision, Strategy and Three Year Action Agenda of NITI Aayog’ (n 356).
377 ‘Sustainable Development Goals’ (n 242) (bold words as in source).
378 See especially this study’s Sections 5.6.1-4.

actors.[379] However, the government has not introduced any holistic plan or engaged in a clearly structured approach in this regard.

Nonetheless, there are some references indicating that the government pushes for increased involvement of the domestic (private) space industry in the assembly, integration and testing of the government-promoted *Polar Satellite Launch Vehicle* (PSLV) series, as well as in the development and construction of government-promoted satellite systems that, as shown in the upcoming sections, have a strong socioeconomic orientation. Also, the government seems to consider the privatisation of PSLV operations by 2020, yet while still involving wholly government-owned Antrix.[380]

Combining this upstream aspect with the already existing industry and market-related provisions in the context of the government's Satcom Policy and RSDP,[381] the content of NITI Aayog's Three Year Action Agenda and Antrix's assigned tasks, it surfaces that the government presumably further strives at this time for some limited expansion of India's domestic space market and Indian entities' role in the international space market in both the upstream[382] and downstream[383] sector. For example, according to the Three Year Action Agenda, ISRO and other domestic institutions shall over the next few years 'pilot 5 partnership agreements with private institutions to ensure dissemination of some [… commercially viable, cutting edge] technologies into the society.'[384] Antrix's assigned tasks encompass '**a)** Provisioning of communication satellite transponders to various

379 For example: Narayan Prasad Nagendra, 'Industry Participation and India's Space Program: Current Trends and Perspectives for the Future' (2016) 14(2–3) Astropolitics 237; Ashok Gubbi Venkateshmurthy and Narayan Prasad Nagendra, 'India's Space Legislation: The Private Sector Speaks' (2016) 14(2–3) Astropolitics 224; Adhikari (n 366); Rajeswari Pillai Rajagopalan and Narayan Prasad (eds), *Space India 2.0. Commerce, Policy, Security and Governance Perspectives* (Observer Research Foundation 2017) <https://www.orfonline.org/wp-content/uploads/2017/02/Space2.0_Final_24Feb.pdf> accessed 12 December 2017.

380 Based on information in: Prasad Nagendra (n 379). See especially 239-242; Narayan Prasad, 'Space 2.0 India: Leapfrogging Indian Space Commerce' in Rajeswari Pillai Rajagopalan and Narayan Prasad (eds), *Space India 2.0. Commerce, Policy, Security and Governance Perspectives* (Observer Research Foundation 2017). See especially 2-6; 'Traditional Space and NewSpace Industry in India: Current Outlook and Perspectives for the Future' in Rajeswari Pillai Rajagopalan and Narayan Prasad (eds), *Space India 2.0. Commerce, Policy, Security and Governance Perspectives* (Observer Research Foundation 2017). See especially 12-17; Chethan Kumar, 'In First Major Contract, Isro Lets Industry Make 27 Satellites' (*The Times of India*, 18 July 2018) <https://timesofindia.indiatimes.com/india/in-1st-major-contract-isro-lets-industry-make-27-satellites/articleshow/65043079.cms> accessed 21 August 2018.

381 For links to the Satcom Policy, RSDP and related regulations see this study's Section 5.2.

382 Apparently especially regarding the launching business and by technology transfers to private actors.

383 Apparently especially in the fields of space-related remote sensing and communications and broadcasting.

384 NITI Aayog, Government of India (n 361) 109–110.

users, **b)** Providing launch services for customer satellites, **c)** Marketing of data from Indian and foreign remote sensing satellites, **d)** Building and marketing of satellites as well as satellite sub-systems, **e)** Establishing ground infrastructure for space applications, and **f)** Mission support services for satellites.'[385]

5.4.2 Political state preferences

This study holds that one of the government's two current space-related political state preferences is the advancement of India's international prestige and influence.

Various researchers have already reasonably argued towards or concluded that the government has used its modern national space programme to improve the international perception of India's power and to increase its international influence.[386] Moreover, the advancement of India's international prestige and influence makes for a reasonable (partial) explanation for the implementation of some current major government-promoted space-related measures.[387]

One target area under this state preference appears to be the advancement of India's international prestige and influence in its direct neighbourhood in South Asia. Presumably somewhat interlinked with that, another related target area seems to be the counterbalancing of China's striving for influence in the Asian region.[388] Notably, Goswami even argued in 2017 that in Asia a 'race for regional diplomatic influence between India and China, utilizing their outer space capabilities, has only just started.'[389]

The second current space-related political state preference that this study takes into account at least tentatively is the increase of public support for the democratically elected Indian government.

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385 'About Us' (*Antrix*) <http://www.antrix.co.in/about-us> accessed 21 August 2018 (bold numbering as in source).

386 Based on information in: Lele, 'Power Dynamics of India's Space Program' (n 374) 125; Narayan Reddy, 'Exploring Space as an Instrument in India's Foreign Policy and Diplomacy' in Vidya Sagar Rajagopalan and Narayan Prasad (eds), *Space India 2.0. Commerce, Policy, Security and Governance Perspectives* (Observer Research Foundation 2017) 169-170,174; Namrata Goswami, 'China and India's Diplomatic Space Race' (*The Diplomat*, 12 May 2017) <https://thediplomat.com/2017/05/china-and-indias-diplomatic-space-race/> accessed 23 April 2018.

387 See especially this study's Sections 5.6.7-8.

388 As indicated in this study's Section 5.6.3.2.

389 Goswami (n 386).

After all, while lacking hard evidence on which to draw, it is a plausible assumption that any democratically elected Indian government is aware that successfully implemented space undertakings, especially technologically complex ones (e.g. a Mars orbiter mission), allow presenting itself to its people as the driver of national progress. This might translate into higher support for the government among the Indian people.

5.4.3 National security state preferences

So far, the government has seldom linked its space programme to national security in public. According to Lele, '[t]here is no specific document like a white paper, doctrine or policy paper providing the rationale behind India's defence-specific investments in space.'[390] Yet, there are strong indicators that the national security state preference of safeguarding India's national security, including up to three target areas, underlies the government's current space programme.

Two of these target areas seem to be the enhancement of the Indian military's strategic support system, as well as the prevention of the weaponisation of and an arms race in outer space. Additionally, some signs point towards the presence of the third target area of hedging against potential enemies' use of their space capabilities during armed conflict with India. However, this study has decided to consider the latter target area only tentatively in its final assessment. There is still a lack of solid evidence for its existence, e.g. in the form of visible activities or an official confirmation by the government.

All this emerges from the following narrative.

First, this study has identified several current major government-promoted space-related measures that (partially) appear to serve India's military,[391] and consequently the country's national security. According to Reddy, ISRO's acknowledgement in 2016 that images derived from its CARTOSAT series aided the Indian military 'highlighted, for the first time, its role in India's national security.'[392]

390 Ajay Lele, 'India's Strategic Space Programme: From Apprehensive Beginner to Ardent Operator' in Rajeswari Pillai Rajagopalan and Narayan Prasad (eds), *Space India 2.0. Commerce, Policy, Security and Governance Perspectives* (Observer Research Foundation 2017).

391 See especially this study's Sections 5.6.2-4.

392 Vidya Sagar Reddy, 'ISRO's Commitment to India's National Security' (*The Space Review*, 31 October 2016) <http://www.thespacereview.com/article/3092/1> accessed 23 April 2018. Citation based on first link; that Reddy refers to the CARTOSAT series in his article becomes clear through this news report: Chethan Kumar, 'Surgical Strikes: First Major Use of Cartosat Images for Army' (*The*

Second, an Indian government representative has publicly reiterated the country's national security-related position in early 2018 that it opposes the weaponisation of outer space, and 'supports collective efforts to strengthen the safety and security of space-based assets'. Moreover, she stated that, '[w]hile transparency and confidence- building measures are important in themselves, we believe that they cannot be a substitute for concluding substantive legal measures to ensure the prevention of an arms race in outer space, which should continue to be a priority for the international community'.[393]

Third, the Indian government, military and research community seem generally aware of other states' space-related capabilities' potential to support their military activities during a conflict with India, as well as the potential for a future military contest in space. However, this study was unable to determine how much of a priority the Indian government presently gives to addressing these topics properly. The chief of India's Defence Research and Development Organisation may have declared in 2012 'that India has all the building blocks in place to integrate an anti-satellite weapon to neutralize hostile satellites in low earth and polar orbits.' Yet, so far, there has been no Indian ASAT test proving that the government is serious about it.[394] In 2008, then-Defence Minister Antony also announced the establishment of an Integrated Space Cell under the Integrated Defence Staff Headquarters to address threats against Indian space assets, while referring to, e.g., the development of counterspace systems in India's neighbourhood.[395] But the information available to this study has offered no proof that this follows a coherent government-approved strategy and has seen much governmental attention since.

Times of India, 30 September 2016) <https://timesofindia.indiatimes.com/india/Surgical-Strikes-First-major-use-of-Cartosat-images-for-Army/articleshow/54596113.cms> accessed 25 August 2018.

393 'Opposed to "Weaponisation" of Outer Space: India to UN' (*The Economic Times*, 4 April 2018) <https://economictimes.indiatimes.com/news/defence/opposed-to-weaponisation-of-outer-space-india-to-un/articleshow/63607905.cms> accessed 22 August 2018.

394 Based on information in: Harsh Vasani, 'India's Anti-Satellite Weapons' (*The Diplomat*, 14 June 2016) <https://thediplomat.com/2016/06/indias-anti-satellite-weapons/> accessed 12 December 2016; Rajeswari Pillai Rajagopalan, 'India Needs a More Determined Military Space Policy' (2016) IV(1) Space Alert 2; Rajeswari Pillai Rajagopalan and Narayan Prasad Nagendra, 'Creation of a Defence Space Agency: A New Chapter in Exploring India's Space Security' (*Observer Research Foundation*, 23 February 2017) <https://www.orfonline.org/expert-speak/creation-of-a-defence-space-agency-a-new-chapter-in-exploring-indias-space-security/> accessed 22 August 2017; Rajaram Nagappa, 'Space Security in India' in Kai-Uwe Schrogl and others (eds), *Handbook of Space Security. Policies, Applications and Programs* (Springer 2015) 461–464. Citation based on first link.

395 Based on information in: Pillai Rajagopalan (n 394) 3; Nagappa (n 394) 462; Sudha Ramachandran, 'India Goes to War in Space' (*Asia Times Online*, 18 June 2008) <http://www.atimes.com/atimes/South_Asia/JF18Df01.html> accessed 8 June 2018.

5.4.4 Science and technology state preferences

The government's current space-related science and technology state preference arguably is the advancement of India's scientific and technological level per se; whereby the reference to 'per se' indicates here more of a basic research and knowledge gathering orientation.

ISRO indicates this with its declared engagement in 'research in areas like astronomy, astrophysics, planetary and earth sciences, atmospheric sciences and theoretical physics.'[396] Moreover, this study has found some current major government-promoted space-related measures that seem to be (partially) directed towards the pursuit of such a state preference.[397]

At the same time, it shall be noted at this point that the Indian government's actual pursuit of this state preference appears to still subsist in a limited fashion. The identifiable number and scope of current major government-promoted space-related measures serving the pursuit of this state preference seemingly are rather limited within the Indian government's overall space programme, as well as in comparison to the pursuit of a similar state preference in the Chinese and Japanese cases.[398]

5.4.5 Autonomy-oriented state preferences

There are signs that the government currently pursues two space-related autonomy-oriented state preferences.

The first one appears to be to ensure the stable use of outer space for India. After all, based on a presentation by an ISRO representative in 2016, ISRO seems to be aware of the dangers emanating from space debris and a more and more congested outer space for Indian space activities. As such, it has decided to engage in measures to reduce space debris resulting from its space undertakings and to improve space situational awareness, including through international coordination.[399] Section 5.6.9 introduces – at least as far

396 'Space Science & Exploration' (*ISRO*) <https://www.isro.gov.in/spacecraft/space-science-exploration> accessed 23 April 2018.

397 See especially this study's Sections 5.6.5 and 5.6.7-8.

398 Compare especially the findings on these governments' current major government-promoted space-related measures in this study's Sections 4.6, 5.6 and 7.6.

399 Based on information in: MV Dhekane, 'Indian Space Programme Ensuring Stable Use of Outer Space' (Presentation, International Symposium on Ensuring Stable Use of Outer Space, Tokyo, 04.03 2016) <http://www.jsforum.or.jp/stableuse/2016/pdf/13.%20Dhekane.pdf> accessed 23 April 2018; 'How Isro Is Safeguarding India's Space Assets in Orbit' (*The Times of India*, 23 June 2017)

as the available information has allowed for it – the current major government-promoted measures in this regard.

The government's second space-related autonomy-oriented state preference arguably is the development and maintenance of the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

One indicator is the government's statement in 2015 that a 'primary objective of the Indian Space Programme/Mission is to achieve self-reliance in Space Technology'.[400] Another is ISRO slowly increasing its engagement with domestic private actors to improve India's capacity in meeting the growing demand for space services.[401] Finally, this state preference is somewhat evident by this study illustrating that the government presently puts more emphasis on promoting major domestic than major cooperative space-related measures.[402]

5.5 Basic pol. & leg. framework concerning IGO-based regional space cooperation

Lacking a comprehensive national space law or policy document, it is no surprise that this study has not found much definite information about the Indian government's current basic political and legal framework concerning IGO-based regional space cooperation.

Based on the accessed material, the Indian government seems not to have actively striven towards entering IGO-based regional space cooperation in recent years. At the same time, there are indicators that the Indian government excludes a more institutionalised collaboration with other Asian governments, including the other preeminent Asian governments in the space sector, not completely. For example, India hosts CSSTEAP, which counts, *inter alia*, Iran, North Korea and South Korea among its members as well.[403] Furthermore, Indian government-related (as well as non-governmental entities)

<https://timesofindia.indiatimes.com/india/how-isro-is-safeguarding-indias-space-assets-in-orbit/articleshow/59278126.cms> accessed 23 April 2018.

400 'Indian Space Programme' (n 373).

401 Rajeswari Pillai Rajagopalan, 'What's Next for India's Space Program?' (*The Diplomat*, 20 January 2018) <https://thediplomat.com/2018/01/whats-next-for-indias-space-program/> accessed 23 April 2018. See also this study's Section 5.4.1's determination that the government seeks to strengthen and expand the domestic (private) space industry's involvement in the government-promoted space-related upstream sector.

402 See the findings throughout this study's Section 5.6.

403 'Background' (*CSSTEAP*) <http://www.cssteap.org/background> accessed 10 January 2018.

have participated in APRSAF,[404] which has also seen the involvement of, among others, Chinese, Japanese and South Korean government-related entities.[405]

Concerning the set of principles guiding the Indian government's current intergovernmental space cooperation, it can be, at a minimum, argued that this government follows, similar to the other preeminent Asian governments in the space sector, the principles outlined in the main international space agreements. More specifically, India has ratified the Outer Space Treaty, the Rescue Agreement, the Liability Convention and the Registration Convention. Additionally, and in contrast to all other preeminent Asian governments in the space sector, it has signed (but never ratified) the Moon Agreement.[406]

Lastly, it is notable here that India is a partner of the Missile Technology Control Regime (MTCR) alongside, among others, Japan and South Korea.[407] In short, 'MTCR, [which primarily rests upon voluntary adherence,] seeks to limit the risks of proliferation of weapons of mass destruction (WMD) by controlling exports of goods and technologies that could make a contribution to delivery systems (other than manned aircraft) for such weapons. In this context, the Regime places particular focus on rockets and unmanned aerial vehicles capable of delivering a payload of at least 500 kg to a range of at least 300 km and on equipment, software, and technology for such systems.'[408] If it strictly abides by this regime, the Indian government thus probably has only a limited current potential to engage cooperatively with non-partners of MTCR like China, Iran and North Korea in the field of space launcher development.

5.6 Major domestic and cooperative space-related measures

5.6.1 APRSAF

The participation of Indian government-related (and non-governmental) entities in Japanese-led APRSAF can be somewhat considered a current major Indian government-

404 'REPUBLIC OF INDIA' (*APRSAF*) <https://www.aprsaf.org/participants/countries/india.php> accessed 10 January 2018.

405 'Countries and Regions' (*APRSAF*) <https://www.aprsaf.org/participants/> accessed 27 September 2018.

406 UNCOPUOS (Legal Subcommittee) 'Status of International Agreements relating to activities in outer space as at 1 January 2018' (9 April 2018) A/AC.105/C.2/2018/CRP.3 6.

407 'MTCR Partners' (*MTCR*) <http://mtcr.info/partners/> accessed 13 October 2018.

408 'Frequently Asked Questions (FAQs)' (*MTCR*) <http://mtcr.info/frequently-asked-questions-faqs/> accessed 13 October 2018.

promoted institutionalised regional cooperative space-related measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

The primary specific Indian government-promoted cooperative space-related measures under APRSAF in recent years appear to have been contributions to *Sentinel Asia* and *Regional Readiness Review For Key Climate Missions* (Climate R^3).[409]

Within *Sentinel Asia*, which is directed towards advancing disaster management in the Asia-Pacific region and also involves contributions from, among others, Chinese, Japanese and South Korean government-related (and non-governmental) entities, India is a Data providing Node, Capacity building Node and User Node. For example, it responded to emergency requests by, among others, Bangladesh, Indonesia, Japan, Pakistan and Vietnam in 2015.[410]

Climate R^3, which is already completed, had among its participants – presumably somewhat government-approved – entities from India, Japan and South Korea. It focussed on determining the ability of APRSAF-involved countries and institutions to benefit from certain upcoming climate-related satellite missions.[411]

Similar to the Chinese case, the data above as well as the more detailed introduction of APRSAF in Section 7.6.1 suggest that the Indian government's engagement in APRSAF is seemingly oriented to support the pursuit of its current space-related socioeconomic state preference, in particular the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India.

409 For more information on APRSAF and these two specific measures, see this study's Section 7.6.1.

410 Based on information presented in this study's Section 7.6.1 and in: 'Bilateral Cooperation in the Field of Science & Technology between India and Japan' (*Embassy of India, Tokyo, Japan*) <https://www.indembassy-tokyo.gov.in/jp/st_cooperation_jp.html> accessed 12 July 2017; 'JPT Members' (*Sentinel Asia*) <https://sentinel.tksc.jaxa.jp/sentinel2/MB_HTML/JPTMember/JPTMember.htm> accessed 29 July 2016; 'S&T Cooperation' (*Embassy of India, Tokyo, Japan*, December 2016) <https://www.indembassy-tokyo.gov.in/st_cooperation.html#> accessed 12 July 2017.

411 Based on the information presented in this study's Section 7.6.1 and in: 'Twentieth Session of the Asia-Pacific Regional Space Agency Forum (APRSAF-20) Climate R^3 (Regional Readiness Review for Key Climate Missions) Proposed Outline' (*APRSAF*) <http://aprsaf.org/annual_meetings/aprsaf20/pdf/initiatives/ClimateR3_proposed_putline.pdf> accessed 30 July 2016.

Moreover, it is not out of the question that the Indian government considers participation in APRSAF, in particular in *Sentinel Asia*, as a way to add to the pursuit of its current space-related political state preference of advancing India's international prestige and influence. Arguably, other – especially technology-wise less developed – participants in *Sentinel Asia* might be thankful for the Indian contribution to their disaster management, which might improve India's status among them.

Finally, and due to an apparently broader involvement in APRSAF initiatives than the Chinese government, the Indian government might recognise APRSAF as temporarily advantageous to the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining India's domestic human, industrial, scientific and technological capacities and capabilities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. After all, APRSAF is open to the participation of governmental and non-governmental entities, including regional companies, universities and research institutes, shall involve the exchange of information and opinions on space programmes and has seen its plenary meeting hosted by India in 2007 and 2017.[412]

5.6.2 Remote Sensing

5.6.2.1 Major domestic measures

The development and application of a comprehensive domestic(ally controlled) remote sensing satellite system appears to be the overarching major domestic space-related remote sensing measure under the government's current space programme.

Since the launch of its first experimental remote sensing satellite, *Bhaskara-1*, in 1979, ISRO has set up a wide, primarily domestically controlled constellation of remote sensing satellites involving various imaging techniques and covering low, medium and high-resolution imaging capabilities. On a more specific note, most satellites have fallen under the domestically developed CARTOSAT, OCEANSAT, RESOURCESAT, RISAT and SCATSAT series. Additionally, as introduced under Section 5.6.3, there are several domestic communications and broadcasting-oriented satellites that include some remote sensing capabilities (INSAT-3A, *Kalpana-1*, INSAT-3D and -3DR) but are officially part

412 Based on information in this study's Section 7.6.1 and in: 'About APRSAF' (*APRSAF*) <https://www.aprsaf.org/about/> accessed 14 October 2018.

of India's communications and broadcasting satellite system.[413] Overall, the government-promoted operational remote sensing system has encompassed 17 satellites by November 2017.[414] Looking ahead, the government seems to be especially interested in developing and adding satellite-based high-resolution, hyperspectral, TIR, L&S, SAR and geo-imaging capabilities.[415] A prominent development project of ISRO in this regard is the *Geo Imaging Satellite* (GISAT) for disaster management support.[416]

Altogether, these measures appear to mainly serve the pursuit of two current space-related state preferences:

First, there is the pursuit of the government's space-related socioeconomic state preference, especially regarding the target area of developing and applying the space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India. After all, the satellites shall be applied in such socioeconomically relevant areas like agriculture, business activities, cartography, coastal management, climate and environment, decentralised planning and governance, disaster management, fishery, forestry, housing, (groundwater) mapping, natural land and water resources, livelihood security, natural resource management, ocean state forecasting, postal services, rural development, urban planning, water management and weather forecasting.[417]

Second, there is the pursuit of the government's space-related national security state preference, especially the target area of enhancing the Indian military's strategic support system. For example, there are indicators that the majority of the specific remote sensing satellites (13 by June 2017, e.g. from the CARTOSAT and RISAT series) further aids the Indian military by providing it with reconnaissance of the region.[418] Notably, there is no reliable reference that India has a purely dedicated military satellite among its 17 operational satellites.

413 'Earth Observation Satellites' (*ISRO*) <https://www.isro.gov.in/spacecraft/earth-observation-satellites> accessed 5 January 2018; 'List of Earth Observation Satellites' (*ISRO*) <https://www.isro.gov.in/spacecraft/list-of-earth-observation-satellites> accessed 5 January 2018.
414 Diwakar (n 366).
415 ibid.
416 Planning Commission, Government of India (n 358) 277.
417 Based on information in: ibid 266–267; Diwakar (n 366); 'Earth Observation Satellites' (n 413).
418 Surendra Singh, 'Military Using 13 Satellites to Keep Eye on Foes' (*The Times of India*, 26 June 2017) <https://timesofindia.indiatimes.com/india/military-using-13-satellites-to-keep-eye-on-foes/articleshow/59314610.cms> accessed 18 February 2018.

5.6.2.2 Major cooperative measures

Without claiming completeness, and excluding APRSAF-related measures, the current major government-promoted cooperative space-related measures (with a presumed high potential for) involving preeminent Asian governments in the space sector arguably take place in the following context:

India through ISRO contributes, alongside the space agencies of, among others, China, Japan and South Korea, remote sensing data from several domestic(ally controlled) satellites to the International Disaster Charter.[419]

Indian government-related entities engage in GEO alongside China, Iran, Japan and South Korea,[420] UN-SPIDER alongside China, Iran and South Korea,[421] as well as WMO alongside China, Iran, Japan, North Korea and South Korea.[422]

As already introduced in the China chapter, the Sino-Indian Space Cooperation Outline 2015, which is linked to a Sino-Indian MoU from 2014, includes the potential for (further) collaboration in space-related remote sensing. Apparently, the two parties consider especially collaboration on satellite data sharing for emergency responses during major disasters; satellite data-related collaboration regarding weather forecasting, tropical storm events and climate change studies; other reciprocal data sharing and exchange; reception of each others' data by their respective ground stations; cross-calibration of data; cooperation regarding new EO science payloads; and information sharing and exchange of expertise in EO applications, e.g. for agriculture, environmental monitoring and protection, disaster management and water resources. Furthermore, they want to discuss the effective application of a virtual constellation involving remote sensing satellites, which is likely a reference to the multilateral socioeconomically-oriented *BRICS Remote Sensing Satellite Constellation* project including, among others, the space agencies of China and India. The project might in a second phase cover the joint creation of a new satellite constellation.[423]

419 'The International Charter Space and Major Disasters' (n 236) 17.

420 'Member List' (n 238).

421 'India' (*UN-SPIDER Knowledge Portal*) <http://www.un-spider.org/network/national-focal-points/india> accessed 14 October 2018.

422 'Members' (n 240).

423 For this and more information on the outline and the BRICS-specific project, see this study's Section 4.6.2.2.

The Indian-Japanese 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) concerning cooperation in the field of outer space' (Indian-Japanese MoU 2016), signed on 11.11.2016, promotes, among others, (further) Indian-Japanese collaboration in EO applications, presumably especially to reap socioeconomic benefits.[424]

The Indian-South Korean 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (Indian-South Korean MoU 2010), presumably signed in 2010, indicates that the two parties are open to exchanging information and entering discussions for (further) cooperation in, *inter alia*, remote sensing and its application.[425]

Overall, the available information allows suggesting that the Indian government's interest and involvement in these cooperative measures are mainly directed towards serving the pursuit of its current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India.

On a more tentative note, the Indian government might additionally hope that the cooperative measures introduced above somewhat support, e.g. by India contributing to others' disaster management, the pursuit of its space-related political state preference of advancing India's international prestige and influence with its respective partners.

424 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (*Ministry of External Affairs, Government of India*) <http://mea.gov.in/images/attach/MoU_ISRO_JAXA_Japan.pdf> accessed 12 July 2017.

425 For a copy of the MoU, see: 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (*Ministry of Education, Republic of Korea*) 2 <http://www.moe.go.kr/boardCnts/fileDown.do?m=03&s=english&fileSeq=a6cc09b914ffa01c132e1bfd92fb8c6c>. Even though it is a word document, its content is likely correct since it is made available on the homepage of the South Korean Ministry of Education; apparently, the MoU was signed in 2010: 'India–Republic of Korea Joint Statement: Towards a Strategic Partnership' (*Ministry of External Affairs, Government of India*, 25 January 2010) <http://mea.gov.in/bilateral-documents.htm?dtl/3301/IndiaRepublic+of+Korea+Joint+Statement+Towards+a+Strategic+Partnership> accessed 11 January 2018; also, there seems to be an 'Implementing Agreement Between The Indian Space Research Organization And The Korea Aerospace Research Institute For Cooperation In The Peaceful Uses Of Outer Space' connected to the MoU: 'India-Republic of Korea Joint Statement for Expansion of the Strategic Partnership' (*Ministry of External Affairs, Government of India*, 16 January 2014) <http://www.mea.gov.in/bilateral-documents.htm?dtl/22752> accessed 8 January 2018. However, this study was unable to access this document.

5.6.3 Communications and broadcasting

5.6.3.1 Major domestic measures

The development and application of a broad domestic(ally controlled) communications and broadcasting satellite system is the current overall major government-promoted domestic space-related communications and broadcasting measure.

While writing, the most important part of this overall system is the *India National Satellite* (INSAT) system. The latter constitutes a multi-agency, multi-purpose satellite system developed through a joint venture of India's DOS, Department of Telecommunications, Department of Science and Technology and the Ministry of Information and Broadcasting. It is managed by the INSAT Coordination Committee. It consists of domestically developed satellites (15 operational satellites by November 2017)[426] but can also include transponders leased from foreign satellite systems. With the exception of the *Kalpana-1* satellite (originally: METSAT), the INSAT system's satellites have usually born the designator INSAT or GSAT. GSAT-9 is further known as *South Asia Satellite*[427] for reasons explained under Section 5.6.3.2. By now, the INSAT system has developed into one of the largest communications and broadcasting satellite systems in the Asia-Pacific region, whereby it needs to be noted that some of the satellites also have remote sensing technology added to them.[428] For the future, the government apparently wants to especially work towards improving the capability of India's communications and broadcasting satellite system in fields like DTH, HTS, optical communication, space-to-space communication and global communications.[429]

Two space-related state preferences seem to drive these measures for the most part:

First, the INSAT system shall serve the pursuit of the government's current space-related socioeconomic state preference, including all related target areas. For example, ISRO introduces the system's application for such socioeconomically relevant areas like 'telecommunications, television broadcasting, satellite newsgathering, societal

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426 Diwakar (n 366).

427 ibid.

428 Based on information in: 'The Norms, Guidelines and Procedures for Implementation of the Policy Frame-Work for Satellite Communications in India' (n 365) 1–2; 'Communication Satellites' (*ISRO*) <https://www.isro.gov.in/spacecraft/communication-satellites> accessed 24 December 2017; 'List of Communication Satellites' (*ISRO*) <https://www.isro.gov.in/spacecraft/list-of-communication-satellites> accessed 23 December 2017. HAMSAT was never part of the system.

429 Diwakar (n 366).

applications, weather forecasting, disaster warning and Search and Rescue operations.'[430] Also, the Satcom Policy aims at offering the INSAT infrastructure 'to a larger segment of the economy and population […]. Encouraging the private sector investment in the space industry in India and attracting foreign investments in this area are other specific goals.'[431]

Besides that, the INSAT system apparently aids the pursuit of the government's current space-related national security state preference, especially the target area of enhancing the Indian military's strategic support system. For example, a government regulatory document determines the Indian Ministry of Defence and Indian security agencies as major users of INSAT capacities.[432] The Indian Navy uses GSAT-7 for real-time communications.[433]

5.6.3.2 Major cooperative measures

As far as this study was able to ascertain, the current major government-promoted cooperative space-related communications and broadcasting measures (with a presumed high potential for) involving preeminent Asian governments in the space sector encompass the following:

The Indian-Japanese MoU 2016 promotes cooperation in the application of satellite-based communications, presumably especially to reap socioeconomic benefits.[434]

The Indian-South Korean MoU 2010 holds that the two sides want to exchange information and enter discussions for cooperation, among others, in the field of communications.[435]

With no more detailed information upon which to draw, it is likely that the Indian government engages in these measures primarily in the pursuit of its space-related socioeconomic state preference, in particular the target area of developing and applying

430 'Communication Satellites' (n 428).
431 'Satcom Policy' (n 363) 1.
432 'The Norms, Guidelines and Procedures for Implementation of the Policy Frame-Work for Satellite Communications in India' (n 365) 2–3.
433 Singh (n 418).
434 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).
435 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India.

Also, but only tentatively, it can be considered that the Indian government hopes that these measures somewhat serve the pursuit of its space-related political state preference of advancing India's international prestige and influence (with Japan and South Korea).

Besides that, it shall not be forgotten here that India is, alongside all the other preeminent Asian governments in the space sector, a member state of ITU. Similar to the Chinese case, this shall presumably aid the pursuit of all space-related state preferences underlying the Indian government's space-related communications and broadcasting measures.[436]

Even though the project is no cooperative measure as searched for within this study, it is reasonable to introduce the so-called *South Asia Satellite* (or GSAT-9), launched on 05.05.2017 onboard an Indian launcher,[437] at this point because this adds to the understanding of the Indian government's space-related political state preferences.

Indian Prime Minister Modi initially proposed the development of a communications satellite for the South Asian Association for Regional Cooperation (SAARC) in 2014.[438] At first, this was welcomed by all SAARC members (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka). Subsequently, the Indian government declared to develop and implement the project and cover the related costs.[439] Reportedly, the latter range in the area of ₹450 crore ($70 million). The other project members needed only to establish their own ground infrastructure, whereas India is willing to provide assistance for that as well.[440] However, after Pakistan ultimately decided to opt out from the project, India had to take the project out of the SAARC context and rebranded the satellite into

436 For more information, see this study's Section 4.6.3.3.

437 'GSLV Successfully Launches South Asia Satellite' (*ISRO*) <https://www.isro.gov.in/update/05-may-2017/gslv-successfully-launches-south-asia-satellite> accessed 6 January 2018.

438 'Modi's Space Diplomacy Puts India into New Orbit' (*The Times of India*, 30 April 2017) <http://timesofindia.indiatimes.com/india/modis-space-diplomacy-puts-india-into-new-orbit/articleshow/58442281.cms> accessed 7 January 2018.

439 Ajey Lele, 'India Launches a South Asia Satellite' (*The Space Review*, 8 May 2017) <http://www.thespacereview.com/article/3233/1> accessed 7 January 2018.

440 'What Is South Asia Satellite: India's ₹235-Crore Gift to Neighbours' (*The Indian Express*, 30 April 2017) <http://indianexpress.com/article/what-is/what-is-south-asia-satellite-indias-%e2%82%b9235-crore-gift-to-neighbours-4634421/> accessed 7 January 2018.

the *South Asian Satellite*.[441] In the end, India has decided to grant each partner access to at least one of the satellite's twelve Ku-band transponders.

In terms of space-related state preferences underlying the Indian government's development of this satellite, the official statements point towards the pursuit of its space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India. After all, the multi-purpose satellite is thought to serve the partners' in such socioeconomically relevant areas like disaster management, natural resource mapping, tele-education, telemedicine, telecommunication, television broadcasting and weather forecasting.[442] Modi further declared that this Indian gift shall foster growth and prosperity in South Asia and among its more than one-and-a-half billion people.[443]

Yet, the Indian government likely also wants to employ this satellite to foster the pursuit of its space-related political state preference of advancing India's international prestige and influence. In particular, considering President Modi's 'Neighbourhood First' policy, the specific user states of the *South Asian Satellite*, as well as some reasonable references in two (news) articles, it is possible to infer that the government is most interested in

441 Pakistan wanted India to make the satellite project a real cooperative effort within the SAARC framework. Presumably, Pakistan hoped by that to reduce India's political gains by presenting the satellite as an 'invaluable gift' to its neighbours and, being less advanced in satellite development, improve its technological capabilities by the cooperation with India. Observers further note that Pakistan might have feared Indian espionage and tense relations between the two states in the past years. All based on information in: 'How Pakistan Responded to India's Successful Launch of South Asian GSAT-9 Satellite' (*The Indian Express*, 6 May 2017) <http://indianexpress.com/article/india/india-successfully-launches-gsat-9-satellite-how-pakistan-responded-4642889/> accessed 7 January 2018 ; 'SAARC Satellite to Be Launched on May 5' (*The Hindu*, 1 May 2017) <http://www.thehindu.com/news/national/isro-to-launch-south-asia-satellite-on-may-5/article18332816.ece> accessed 7 January 2018; Lele, 'India Launches a South Asia Satellite' (n 439).

442 'Modi's Space Diplomacy Puts India into New Orbit' (n 438). Concerning some states' considerations, see: Vidya Sagar Reddy Avuthu, 'Improving Space Cooperation among South Asian Countries' (*Observer Research Foundation*, 28 March 2016) <http://www.orfonline.org/research/improving-space-cooperation-among-south-asian-countries/> accessed 7 January 2018; Lele, 'India Launches a South Asia Satellite' (n 439).

443 'Opening Remarks of the Prime Minister at the Video Conference with Heads of Government from South Asian Nations to Mark the Launch of the South Asia Satellite (May 5, 2017)' (*Ministry of External Affairs, Government of India*, 5 May 2017) <http://mea.gov.in/Speeches-Statements.htm?dtl/28441/opening+remarks+of+the+prime+minister+at+the+video+conference+with+heads+of+government+from+south+asian+nations+to+mark+the+launch+of+the+south+asia+satellite+may+5+2017> accessed 7 January 2018.

using this satellite to advance its prestige and influence in its direct neighbourhood in the South Asian region, and to counter China's influence in India's neighbourhood.[444]

5.6.4 Navigation

5.6.4.1 Major domestic measures

The Indian government's current space programme incorporates two major domestic space-related navigation measures.

One is the development and maintenance of *GPS Aided Geo Augmented Navigation* (GAGAN), a *Satellite Based Augmentation System* (SBAS) set up by ISRO and the Airport Authority of India. It is the world's fourth regional SBAS and, after Japan, the second operated by an Asian state. In short, it consists of navigation technology integrated into – currently – three Indian INSAT-related satellites (GSAT-8,-10,-15)[445] and various ground facilities. It is interoperable with other international SBAS systems and supports, in particular, civil aviation and air traffic management in India's airspace and across the region.[446] Furthermore, it shall support Indian defence and security activities, its telecommunications industry, its transportation sector and personal user applications.[447] According to the government's 'National Civil Aviation Policy' from 2016, all aircraft registered in India have to be GAGAN-enabled by 01.01.2019.[448]

Based on the application areas, it is reasonable to assume that GAGAN shall, on the one hand, serve the pursuit of the government's current space-related socioeconomic state preferences, especially regarding the target area of developing and applying space-related

444 Based on information in: 'Modi's Space Diplomacy Puts India into New Orbit' (n 438); Shounak Set, 'India's Regional Diplomacy Reaches Outer Space' (*Carnegie India*, 3 July 2017) <https://carnegieindia.org/2017/07/03/india-s-regional-diplomacy-reaches-outer-space-pub-71402> accessed 23 April 2018; For more information on the Neighbourhood First Policy and India's striving for countering China's influence in its region, see also the following two links: Dhruva Jaishankar, 'India's Five Foreign Policy Goals: Great Strides, Steep Challenges' (*The Wire*, 26 May 2016) <https://thewire.in/38708/indias-five-foreign-policy-goals-great-strides-steep-challenges/> accessed 8 January 2018; Christian Wagner and Siddharth Tripathi, 'Indiens Antwort Auf Die Chinesische Seidenstraßeninitiative [India's Response to the Chinese Silk Road Initiative]' (2018) January 2018(01) SWP-Aktuell 1.

445 'List of Communication Satellites' (n 428).

446 Based on information in: 'Satellite Navigation' (*ISRO*) <https://www.isro.gov.in/spacecraft/satellite-navigation> accessed 23 December 2017; 'GAGAN - GPS Aided GEO Augumented Navigation' (*ISAC*, 21 April 2016) <http://www.isac.gov.in/navigation/gagan.jsp> accessed 5 January 2018.

447 'GAGAN - GPS Aided GEO Augumented Navigation' (n 446).

448 'National Civil Aviation Policy 2016' (*Ministry of Civil Aviation, Government of India*) 20 <http://www.civilaviation.gov.in/sites/default/files/Final_NCAP_2016_15-06-2016-2_1.pdf> accessed 5 January 2018.

capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India. On the other hand, it shall presumably support the pursuit of the government's national security state preference, in particular the target area of enhancing the Indian military's strategic support system.

The government's second major domestic space-related navigation measure is the development and maintenance of the domestic *Indian Regional Navigation Satellite System* (IRNSS), which Prime Minister Modi christened *Navigation with Indian Constellation* (NavIC) in 2016. Reportedly, it has a total price tag of ₹1,420 crore (ca. $224m).[449] The first IRNSS satellite was launched in 2013. By the end of 2017, the constellation consisted of seven satellites (IRNSS-1A,-1B,-1C,-1D,-1E,-1F,-1G; IRNSS-1H suffered a launch failure in August 2017) and relevant ground segments. Overall, the system offers positioning, navigation and timing services in India and some parts of the Asian region (currently with a primary service area up to 1500km from the Indian border) through a publicly available service and a restricted, encrypted service for authorised users.[450] Public market access with an accuracy better than GPS shall be available by early 2018.[451]

Overall, NavIC appears to be primarily linked to the pursuit of the government's current space-related socioeconomic and national security state preferences. On the military side, the particular target area presumably is the enhancement of the Indian military's strategic support system. On the socioeconomic side, the particular target areas are likely the development and application of space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India, as well as the extension of the domestic space market and the enhancement of Indian entities' role in the international space market in both the upstream and downstream sector. After all, a major reason for the investment into IRNSS was India's experience during the Kargil War with Pakistan in 1999 when the Indian military was denied GPS data from the USA. Domestically operated NavIC gives the Indian military but also civil and commercial

449 Based on information in: Planning Commission, Government of India (n 358) 266; Surendra Singh, 'Get Ready! India's Own GPS Set to Hit the Market Early next Year' (*The Times of India*, 28 May 2017) <https://timesofindia.indiatimes.com/home/science/get-ready-indias-own-gps-set-to-hit-the-market-early-next-year/articleshow/58876680.cms> accessed 6 January 2018.

450 Based on information in: 'Satellite Navigation' (n 446); 'Indian Regional Navigation Satellite System (IRNSS) : NavIC' (*ISRO*) <https://www.isro.gov.in/irnss-programme> accessed 6 January 2018; 'List of Navigation Satellites' (*ISRO*) <https://www.isro.gov.in/spacecraft/list-of-navigation-satellites> accessed 6 January 2018.

451 Singh (n 449).

users in the country access to navigation, positioning and timing capabilities independently from others, thus making Indian civil, commercial and military services more reliable and less susceptible to international pressure in crises situations.[452] Moreover, particular service areas covered by NavIC might be such socioeconomic and militarily relevant areas like aerial, marine and terrestrial navigation, disaster management, mapping, tracking and transport.[453] The restricted service might further aid the Indian military's missile systems.[454]

5.6.4.2 Major cooperative measures

Without claiming completeness, this study has found the following current major government-promoted cooperative navigation measures (with a presumed high potential for) involving preeminent Asian governments in the space sector:

The Sino-Indian Space Cooperation Outline 2015 determines that the two sides want to discuss cooperation in application, interoperability and signal compatibility of each others' navigation satellite systems.[455]

The Indian-Japanese MoU 2016 promotes cooperation in the application of satellite-based navigation, presumably especially to reap socioeconomic benefits.[456]

The Indian-South Korean MoU 2010 holds that the two sides want to exchange information and enter discussions for cooperation in, *inter alia*, the field of navigation.[457] In particular, they seem to engage in collaboration to establish interoperability between the Indian GAGAN and the *Korea Augmentation Satellite System* (KASS), as well as to share their experience in using their respective system.[458]

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452 Based on information in: Ishan Srivastava, 'How Kargil Spurred India to Design Own GPS' (*The Times of India*, 5 April 2014) <https://timesofindia.indiatimes.com/home/science/How-Kargil-spurred-India-to-design-own-GPS/articleshow/33254691.cms> accessed 6 January 2018; Singh (n 449).

453 'Indian Regional Navigation Satellite System (IRNSS) : NavIC' (n 450).

454 Singh (n 449).

455 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

456 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

457 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

458 'India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)' (*Ministry of External Affairs, Government of India*, 18 May 2015) <http://mea.gov.in/bilateral-documents.htm?dtl/25261/India__Republic_of_Korea_Joint_Statement_for_Special_Strategic_Partnership_May_18_20

With little information available, the Indian government likely sees these measures primarily serving the pursuit of its space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for India.

Moreover, the Indian government presumably considers that these measures can aid the pursuit of its space-related political state preference of advancing India's international prestige and influence (with China, Japan and South Korea).

5.6.5 Science and technology research

5.6.5.1 Major domestic measures

So far, there have been only a limited number of major Indian government-promoted domestic space-related science and technology research measures outside of the lunar and planetary exploration missions.[459]

The most prominent measure in recent years was the launch of ASTROSAT for astronomical research in September 2015.[460] For the next few years, the government further invests in *Aditya L1,* a mission focussing on the observation of the sun (to be launched around 2019-2020),[461] and *XpoSAT*, a project to study cosmic radiation.[462]

They mostly fit the pursuit of the government's current space-related science and technology state preference of advancing India's scientific and technological level per se.

5.6.5.2 Major cooperative measures

Without claiming completeness, the major government-promoted cooperative space-related science and technology research measures (with a presumed high potential for)

15> accessed 11 January 2018. For more information on KASS, see this study's Section 9.6.4.

459 Based on information in: 'Experimental Satellites' (*ISRO*) <https://www.isro.gov.in/spacecraft/experimental-satellites> accessed 31 December 2017; 'List of Scientific and Exploration Spacecraft' (*ISRO*) <https://www.isro.gov.in/spacecraft/list-of-scientific-and-exploration-spacecraft> accessed 31 December 2017.

460 'AstroSat MISSION' (*ISRO*) <https://www.isro.gov.in/astrosat-0> accessed 18 February 2018.

461 'Aditya - L1 First Indian Mission to Study the Sun' (*ISRO*) <https://www.isro.gov.in/aditya-l1-first-indian-mission-to-study-sun> accessed 18 February 2018.

462 Chelsea Gohd, 'India's First-Ever Moon Mission to Launch in 2018' (*Futurism*, 2 December 2017) <https://futurism.com/india-land-moon-rover-2018/> accessed 18 February 2018.

involving preeminent Asian governments in the space sector presumably take place within India's MoUs with China, Japan and South Korea.

The Sino-Indian Space Cooperation Outline 2015 explains that the two sides think about cooperation in astronomical observation and cross-calibration regarding China's HXMT and India's ASTROSAT mission, as well as discuss collaboration concerning deep space exploration-related missions, instruments and individual technology.[463]

The Indian-Japanese MoU 2016 promotes cooperation in space exploration and science, as well as research and development regarding space systems and technology. This is likely primarily directed towards creating scientific benefits, including to understand outer space better.[464] Notably, the Indian and Japanese space agencies already entered into an agreement for cooperation on space x-ray observations in 2007.[465]

The Indian-South Korean MoU 2010 holds that the two sides want to exchange information and enter discussions for cooperation in, among others, the field of space science.[466]

Overall, these measures appear to especially suit the pursuit of the Indian government's current space-related science and technology state preference.

However, it is not out of the question that the Indian government considers them also useful in the pursuit of its space-related political state preference of advancing India's international prestige and influence (with China, Japan and South Korea).

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463 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

464 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424) preamble,arts 2-3.

465 'Joint Statement On the Roadmap for New Dimensions to the Strategic and Global Partnership between India and Japan' (*Ministry of External Affairs, Government of India*, 22 August 2007) <http://mea.gov.in/bilateral-documents.htm?dtl/5885/Joint+Statement+On+the+Roadmap+for+New+Dimensions+to+the+Strategic+and+Global+Partnership+between+India+and+Japan> accessed 13 January 2018.

466 'India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)' (n 458); 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

5.6.6 Human spaceflight

According to ISRO Chairman A.S. Kiran Kumar, human spaceflight is no priority under the government's space programme as of 2017 and has only received limited funding. However, it is notable that ISRO has already engaged in the domestic development of a space flight suit, an environmentally controlled manned chamber, crew module re-entry, space capsule recovery and pad-aborts during launches.[467] Also, the GSLV-MK III launcher, which is still under development, might be capable to support autonomous Indian launches of human space missions if the government decides to give human spaceflight more attention.[468]

Within the available data, the most likely state preferences underlying the (future) development of domestic human spaceflight capabilities are the Indian government's current space-related political state preferences. After all, only a few countries conduct human spaceflight. As such, Indian human spaceflight capabilities might increase the domestic standing of the democratically elected Indian government, as well as India's international prestige and influence.

5.6.7 Lunar exploration

5.6.7.1 Major domestic measures

A major domestic measure under the government's current space programme is the preparation of a second Indian lunar exploration mission.

Approved by the government in November 2003, ISRO launched India's first lunar exploration mission on 22.10.2008 onboard a domestic PSLV C-11. The *Chandrayaan-1* mission, despite merely functioning ten out of the 24 scheduled months,[469] achieved most of its scientific objectives and contributed to the chemical, mineralogical and geological research of the Moon. A major outcome was the detection of water molecules on the lunar surface.[470]

467 '"Satellites Are Our Priority Now, Not Human Space Flight"' (*Outlook*, 24 July 2017) <https://www.outlookindia.com/magazine/story/satellites-are-our-priority-now-not-human-space-flight/299103> accessed 3 January 2018.

468 'ISRO Readying GSLV-Mk III for Human Space Flight: Kasturirangan' (*The Economic Times*, 9 June 2017) <https://economictimes.indiatimes.com/news/science/isro-readying-gslv-mk-iii-for-human-space-flight-kasturirangan/articleshow/59071917.cms> accessed 4 January 2018.

469 Pallava Bagla, 'India Moon Mission Is "Mixed Success"' (*BBC*, 31 August 2009) <http://news.bbc.co.uk/1/hi/world/south_asia/8230230.stm> accessed 31 December 2017.

470 Based on information in: 'Chandrayaan-1' (*ISRO*) <https://www.isro.gov.in/Spacecraft/chandrayaan-1> accessed 31 December 2017; 'CHANDRAYAAN India's First Lunar Exploration Mission' (*ISRO*)

A second mission that was already promoted throughout the government's previous 11th and 12th Five-Year Plan is now on its way.[471] Presumably launched in 2018, the *Chandrayaan-2* mission, will be a completely indigenous Indian space science undertaking involving an orbiter, lander and rover. The rover shall be deployed on the surface through a soft landing manoeuvre. The mission shall support scientific research on 'lunar topography, mineralogy, elemental abundance, lunar exosphere and signatures of hydroxyl and water-ice.'[472]

Overall, these measures appear to be especially aimed at fostering the pursuit of the government's current space-related science and technology state preference.

However, there are various indicators that the domestic lunar programme further involves the pursuit of the government's space-related political state preferences of advancing India's international prestige and influence, as well as of increasing public support for the democratically elected government. After all, with the *Chandrayaan-1* mission, India became the first nation to successfully orbit a spacecraft around the Moon and send an impactor to the surface during its maiden lunar mission. The impactor also carried an Indian flag, making the country the first Asian state and the fourth party overall (after the USA, the Soviet Union and ESA) to put its flag to the Moon. Finally, India surely hoped to gain international recognition for opening its mission for international payloads. In the end, *Chandrayaan-1* included five Indian and six foreign scientific payloads from Europe and the USA.[473]

5.6.7.2 Major cooperative measures

Without claiming completeness, the current major government-promoted cooperative space-related lunar exploration measures (with a presumed high potential for) involving preeminent Asian governments in the space sector appear to consist of the following:

<https://www.isro.gov.in/pslv-c11-chandrayaan-1> accessed 31 December 2017; 'Results from Chandrayaan-1 Mission' (*Vikram Sarabhai Space Centre*) <http://www.vssc.gov.in/VSSC_V4/index.php/chandrayaan-1/55-science/1005-chandrayaan-1mission> accessed 2 January 2018; Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 64,163.

471 Planning Commission, Government of India (n 358) 268.

472 'GSLV-F10/Chandrayaan-2 Mission' (*ISRO*) <https://www.isro.gov.in/gslv-f10-chandrayaan-2-mission> accessed 18 January 2018.

473 Bagla, 'India Moon Mission Is "Mixed Success"' (n 469).

The two parties to the Sino-Indian Space Cooperation Outline 2015 have agreed to consider ‘ jointly carry[ing] out studies on the scientific objectives of lunar exploration’, and to deliberate on collaboration on payload development and piggybacking of payloads or instruments regarding China’s Chang’e-4 lunar mission.[474]

There seems to be a South Korean-Indian agreement involving the sharing of lunar surface and radiation data gathered by the Indian *Chandrayaan-1* mission.[475]

The Indian-Japanese MoU 2016 promotes cooperation on space exploration and science, as well as research and development regarding space systems and technology for presumably scientific purposes and to better the understanding of outer space.[476] Evidence that this includes lunar exploration is the announcement of the Japanese and Indian space agencies that they commenced discussions about a joint mission to explore the lunar polar regions for water. Mission results might be important for the development of future human lunar habitations. Their mission proposal may be finalised around early 2019.[477]

These measures fit the pursuit of the government’s current space-related science and technology state preference.

Moreover, the Indian-Japanese discussion for cooperation might be further guided by the Indian and Japanese governments political desire to address China’s regional rise.[478] This suits the pursuit of the Indian government’s political state preference of advancing its international prestige and influence, especially the target area of counterbalancing China’s striving for influence in the Asian region.

474 ‘2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People’s Republic of China’ (n 245).
475 ‘India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)’ (n 458).
476 ‘Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space’ (n 424) preamble,arts 2-3.
477 Robin Harding and Amy Kazmin, ‘India and Japan Prepare Joint Mission to the Moon’ (*Financial Times*, 4 January 2018) <https://www.ft.com/content/e1556a6c-e6ef-11e7-97e2-916d4fbac0da> accessed 13 January 2018.
478 ibid.

5.6.8 Exploration of other celestial bodies

5.6.8.1 Major domestic measures

The government's current space programme includes the exploration of Mars and maybe Venus as major cooperative space-related measures regarding the exploration of other celestial bodies than the Moon.

Announced by former Prime Minister Manmohan Singh in August 2012,[479] India launched its first spacecraft to Mars, dubbed *Mars Orbiter Mission* or *Mangalyaan*,[480] on 05.11.2013 onboard a domestic PLSV-C25. The spacecraft arrived in Martian orbit in 2014. Its scientific tasks have encompassed observing the Martian surface and studying the Martian atmosphere, in particular by scanning for methane.[481]

The development of a second Mars exploration mission, including the landing of a lander and maybe even a rover on Martian soil around 2021-2022, is in the planning stage. Some scientific hardware in this regard might be developed with French help. Adding to that, ISRO reportedly deliberates on a future Venus exploration mission.[482]

Besides the apparent contribution of all these missions to the pursuit of the government's current science and technology state preference, observers argue that there is a strong national and international prestige element behind something like a Mars mission. It allows showcasing Indian technological prowess to the world and especially to the Asian region. The *Mangalyaan* mission made India the first Asian state to successfully send a spacecraft into Martian orbit and only the fourth space actor to do so overall. What is more, India is the sole state to achieve this feat with its first attempt.[483] As such, the major

479 Pallava Bagla, 'The Mars Milestone - India Takes a Giant Interplanetary Leap Ahead of China' (*New Delhi Television*, 24 September 2014) <https://www.ndtv.com/blog/the-mars-milestone-india-takes-a-giant-interplanetary-leap-ahead-of-china-670088> accessed 3 January 2018.

480 Andrew Jones, 'India at Mars: MOM's the Word' (*GBTIMES*, 25 September 2014) <https://gbtimes.com/india-mars-moms-word> accessed 3 January 2018.

481 Based on information in: 'India's Mars Orbiter Mission Completes 3 Years in Orbit' (*The Economic Times*, 25 September 2017) <https://economictimes.indiatimes.com/news/science/indias-mars-orbiter-mission-completes-3-years-in-orbit/articleshow/60830412.cms> accessed 2 January 2018; 'Mars Orbiter Mission Spacecraft' (*ISRO*) <https://www.isro.gov.in/Spacecraft/mars-orbiter-mission-spacecraft> accessed 2 January 2018.

482 Pallava Bagla, 'India Eyes a Return to Mars and a First Run at Venus' (*American Association for the Advancement of Science*, 17 February 2017) <http://www.sciencemag.org/news/2017/02/india-eyes-return-mars-and-first-run-venus> accessed 18 February 2018.

483 Based on information in: Jones, 'India at Mars: MOM's the Word' (n 480); Bagla, 'The Mars Milestone - India Takes a Giant Interplanetary Leap Ahead of China' (n 479).

domestic measures introduced above presumably have an additional strong orientation towards serving the government's current two space-related political state preferences.

5.6.8.2 Major cooperative measures

There are opportunities for major government-promoted cooperative space-related measures (with a presumed high potential for) involving preeminent Asian governments in the space sector regarding the exploration of other celestial bodies than the Moon based on the space exploration references in India's respective agreements with China and Japan.[484] Yet, this study was unable to identify clear steps in this direction as of 2017.

Overall, any (future) steps in this direction might serve the pursuit of the government's current science and technology state preference, as well as its two current space-related political state preferences.

5.6.9 Stable use of outer space

5.6.9.1 Major domestic measures

ISRO seems to be aware of the dangers of space debris and a more and more congested outer space. It has already taken some major domestic measures to reduce space debris resulting from its space undertakings and to improve space situational awareness, and thus to foster the pursuit of the government's space-related autonomy-oriented state preference of ensuring the stable use of outer space for India. Most prominently, ISRO established the *Multi-Object Tracking Radar.* In operation since 2015, its main task appears to be the tracking of space debris.[485]

5.6.9.2 Major cooperative measures

This study has found only one current major government-promoted cooperative space-related measure (with a presumed high potential for) involving preeminent Asian governments in the space sector that is primarily aimed at serving the pursuit of the

484 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245); 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

485 Dhekane (n 399); 'How Isro Is Safeguarding India's Space Assets in Orbit' (n 399).

government's autonomy-oriented state preference of ensuring the stable use of outer space for India.

More specifically, ISRO participates in IADC that involves, *inter alia*, also the space agencies of China, Japan and South Korea.[486]

On a less specific note, and offering a potential for future regional cooperation in this field, the Indian and Japanese governments are reportedly committed to cooperate on safeguarding the global commons, including outer space.[487]

5.6.10 Launchers

5.6.10.1 Major domestic measures

The Indian government's current major domestic launcher measures are the maintenance and further enhancement of the two domestic launcher families, namely PSLV and Geosynchronous Satellite Launch Vehicle (GSLV), as well as of the relevant facilities, including two operational launch pads on Indian soil.[488] The (future) development focus is on semi-cryogenic engine technology, air-to-space launch technology and the development of a modular launch vehicle, a small satellite launch vehicle and a reusable launch vehicle. India especially wants to reduce the costs of domestic space launches.[489]

Various space-related state preferences seem to underlie these measures:

First, these measures fall into the pursuit of the government's space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. After all, the autonomous implementation of the government's other domestic space undertakings depends on domestic launch capabilities and capacities.

486 'Inter-Agency Space Debris Coordination Committee' (n 343).

487 'Joint Statement on India and Japan Vision 2025: Special Strategic and Global Partnership Working Together for Peace and Prosperity of the Indo-Pacific Region and the World(December 12, 2015)' (*Ministry of External Affairs, Government of India*, 12 December 2015) <http://www.mea.gov.in/bilateral-documents.htm?dtl/26176/Joint_Statement_on_India_and_Japan_Vision_2025_Special_Strategic_and_Global_Partnership_Working_Together_for_Peace_and_Prosperity_of_the_IndoPacific_R> accessed 22 July 2017.

488 'Launchers' (*ISRO*) <https://www.isro.gov.in/launchers> accessed 18 February 2018.

489 Diwakar (n 366).

Second, these measures appear directed towards fostering the pursuit of the government's space-related socioeconomic state preference, especially the space industry and market-related target areas. As mentioned in Section 5.4.1, the government pushes for increased involvement of the domestic (private) space industry in the assembly, integration and testing of the government-promoted PSLV launchers, as well as considers the privatisation of PSLV operations by 2020, yet while still involving wholly government-owned Antrix. Moreover, Antrix already offers space launch services using domestic launchers to domestic and foreign customers.

Third, these measures shall presumably add to the pursuit of the government's two space-related political state preferences. After all, there are still only six Asian states, namely those chosen in this study, with domestic launching capabilities and capacities. As such, Indian launching capabilities and capacities can help to improve the domestic standing of the democratically elected Indian government, as well as to showcase India's (technological) rise to the international community.

5.6.10.2 Major cooperative measures

This study has found only two instances for current major government-promoted cooperative launcher measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector:

The parties to the Sino-Indian Space Cooperation Outline 2015 have agreed to consider '[c]ooperation on providing launch services for satellites as co-passengers'. Yet, since the leading entity on each side has a commercial orientation, such collaboration might in the end always be more of a commercial exchange.[490]

India and South Korea apparently agree that there might be a potential for technical cooperation in satellite launching.[491] However, the Indian side seems to focus here as well on declaring a commercial availability of its launching services for South Korean satellites.[492]

490 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).

491 'India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)' (n 458).

492 'India- Republic of Korea Joint Statement for Expansion of the Strategic Partnership' (n 425).

Overall, the available information allows suggesting that these cooperative measures are especially aimed at improving the Indian government's space-related socioeconomic state preference, in particular the international market-related target area.

5.6.11 Human resources

5.6.11.1 Major domestic measures

The government promotes a variety of major domestic space-related measures to develop human resources in the Indian space sector. For example, there are several Indian entities, most prominently the Indian Institute of Space Science and Technology, offering education and training in a wide range of space-specific activity fields.[493]

Without question, such measures mostly aid the pursuit of the government's space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. The independent implementation of national space undertakings is impossible without the government's domestic access to relevant experts.

5.6.11.2 Major cooperative measures

The major government-promoted cooperative space-related human resources-specific measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector seem to encompass at least the following:

First of all, there is CSSTEAP, a UN-affiliated centre established in 1995 in Bengaluru, India. It offers joint training and education in a variety of activity fields in the space sector among its member states, which, besides India, encompass three more preeminent Asian governments in the space sector, namely Iran, North Korea and South Korea, as well as the states of Bangladesh, Indonesia, Kazakhstan, Kyrgyzstan, Malaysia, Mongolia, Myanmar, Naru, Nepal, the Netherlands, the Philippines, Sri Lanka, Thailand

493 For example, see: 'About Us' (*Indian Institute of Space Science and Technology*) <https://www.iist.ac.in/aboutus/institute> accessed 11 October 2018; 'Education and Training' (*Vikram Sarabhai Space Centre*) <http://isrohq.vssc.gov.in/VSSC_V4/index.php/education-training> accessed 11 October 2018; 'Centre for Air and Space Law' (*Nalsar University of Law*) <https://nalsar.ac.in/centre-air-and-space-law> accessed 11 October 2018.

and Uzbekistan.[494] Notably, while not a member, the Japanese side supported ISRO's initiative in establishing CCSTEAP in India.[495]

Second, based on the Sino-Indian Space Cooperation Outline 2015, the two sides consider engaging in training and exchange of experts in space science, technology and application. Moreover, they want to improve the interaction between the India-based CSSTEAP and the China-based RCSSTEAP[496] in terms of curricula and teachers.[497]

Third, the Indian-Japanese MoU 2016 promotes the exchange of personnel, joint organisation of workshops and training programmes regarding the two sides' cooperative undertakings.[498]

Fourth, the Indian-South Korean MoU 2010 has them exchange information and enter discussions concerning personnel exchange.[499]

Similar to the Chinese case, the Indian government presumably considers these measures as a temporarily useful tool in the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

However, it is very reasonable to assume that the Indian government also hopes to profit from these measures, e.g. by offering space-related education and training opportunities to other states, in the pursuit of its space-related political state preference of advancing India's international prestige and influence with its respective partners.

494 'Background' (n 403).
495 'Bilateral Cooperation in the Field of Science & Technology between India and Japan' (n 410).
496 For more information on RCSSTEAP, see this study's Section 4.6.11.2.
497 '2015-2020 Space Cooperation Outline between the Indian Space Research Organisation of the Republic of India and the China National Space Administration of the People's Republic of China' (n 245).
498 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424) art 3.
499 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

6 Islamic Republic of Iran (Iran)

6.1 Analytical considerations

This study's two main challenges in its particular analysis of the Iranian government's current space programme are as follows: Iranian space-related political and legal documents are, with a few exceptions, not publicly available in an (unofficial) English translation. Furthermore, and somewhat coherent with what some observers have experienced before,[500] it is not always easy to ascertain whether information on the government's space programme presented in foreign media articles and the English academic literature is reliable or based on misunderstandings or even hearsay.

Consequently, this study cautiously consults a wide range of English material addressing aspects of the government's current space programme to achieve robust findings concerning its primary research interest. Due to his first-hand knowledge of the Iranian space sector, Tarikhi's book on Iranian space endeavours until around 2015 is given special attention in this regard.[501] Additionally, this study has profited immensely from Iranian space law expert Younes Hosseini's input. In 2015, he graciously informed this study's author about the content of several domestic space-related political and legal documents that are only publicly available in their Farsi original.[502]

6.2 Main domestic political and legal documents

Without claiming completeness, this study concludes based on the accessed material and the input of Mr Hosseini that, at a minimum, the following domestic political and legal documents firmly guide the Iranian government's space programme as of 2017. Naturally, their known substance merits special consideration throughout this chapter.

Despite lacking a direct reference to the space sector, 'Iran's Twenty-year Vision Decree'[503] (Vision Decree) can be deemed pivotal here. Issued by Iran's Supreme Leader

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500 For example: Brian Harvey, Henk HF Smid and Théo Pirard, *Emerging Space Powers. The New Space Programs of Asia, the Middle East, and South America* (Springer 2010) xiv,285; John B Sheldon, 'A Really Hard Case: Iranian Space Ambitions and the Prospects for U.S. Engagement' (2006) 4(2) Astropolitics 229, 230–231.

501 Parviz Tarikhi, *The Iranian Space Endeavor. Ambitions and Reality* (Springer 2015). His book needs to be also treated with some caution because he had a problematic relationship with or did not agree with activities by certain officials. For example, see ix-xii,209-226,271-284.

502 See also this study's 'Acknowledgements' chapter. Any mistakes in this study are its author's alone.

503 For an unofficial English translation, see: Tarikhi (n 501) 118.

Ali Khamenei in 2002 after consultation with the Expediency Discernment Council, an influential advisory body, and being implemented since 2005, this document decrees Iran's overall national development goals over the next 20 years. Such goals pertain to any government programme, and thus surely also its space programme.[504] The Vision Decree's implementation strategy apparently involves Iran to 'gain access to new technologies including nanotechnology, biotechnology, information and communication technology, environmental technology, and aerospace and nuclear technology.'[505]

In terms of more space-specific political documents, the government has reportedly set out two consecutive ten-year space programmes within the timeframe of and presumably in line with the Vision Decree. The first covered 2006-2015. The second and currently active ten-year space programme runs from 2016 to 2025.[506] Notably, these programmes seem to be somewhat interlinked with the government's five-year development plans.[507]

The 'Comprehensive Document Regarding Iranian Aerospace' (2013 Aerospace Document) from 08.01.2013, prepared by the country's high-level Supreme Council of the Cultural Revolution and passed under the direction of the 'Iranian Comprehensive Scientific Plan', probably continues to be relevant within the government's present space programme. This study has at least not come across any evidence that suggests otherwise. In short, this document pushes for the development and expansion of the Iranian aerospace industry and technology.[508]

Iran has had no overarching national space law by 2017. Instead, as far as this study was able to ascertain, the most relevant domestic legal documents with a direct connection to the government's current space programme are the 'Law for Tasks and Authorisation of

504 Based on information provided by Mr Hosseini in 2015. Similarly indicated in: ibid 117–118.

505 ibid 117; see also: Harvey, Smid and Pirard (n 500) 271.

506 Based on information in: 'Iran National Space Administration Announced Its Programs' (*INSA*, 10 July 2016) <http://en.insa.ir/news/news/16057/Iran+National+Space+Administration+announced+its+programs> accessed 14 February 2018; '200 Technologies Required in the Aviation Field of the Country Will Be Developed' (*National Foundation of Elites*, 24 December 2017) <http://insf.org/index.aspx?siteid=38&pageid=7442&newsview=30086> accessed 5 April 2018. This study was unable to obtain English translations of these documents.

507 As indicated regarding the fourth and fifth such plan in: Harvey, Smid and Pirard (n 500) 271; Tarikhi (n 501) 117. This study was unable to obtain an English translation of the currently active Sixth Five-Year Development Plan ranging until 2021.

508 Based on information provided by Mr Hosseini in 2015. This study was unable to obtain an English translation of this document. For the original version, see: '«مصوبه «سند جامع توسعه هوافضاي كشور [Comprehensive Document Regarding Iranian Aerospace]' <http://www.iranculture.org/fa/simpleView.aspx?provID=1846> accessed 14 July 2015.

the Ministry of Communications and Information Technology’[509] (MCIT Law) from 2003, the ‘Statute of the Iranian Space Agency’[510] (ISA Statute), first adopted in 2005 and revised in 2008, and the ‘Letter of the President to his Deputy on Scientific and Technology Matters’[511] (2014 Presidential Letter) from 01.12.2014.

6.3 Basic domestic decision-making system

This study was unable to unearth an English publication delivering a full picture of the basic domestic decision-making system behind the formulation and implementation of the Iranian government’s present space programme. This is no surprise because the Iranian political system per se is highly complex and not particularly transparent to outsiders. It incorporates Islamic theocratic and democratic republican characteristics. It has somewhat parallel institutions, involves elected and appointed government officials, knows a Supreme Leader and a President, and experiences factionalism and strong informal networks.[512] Also, Iranian space-related professionals and academics themselves acknowledge that domestic political and legal developments over the past decade have created vague or overlapping responsibilities amongst several Iranian space-related entities.[513] In the end, this study holds that the following knowledge suffices for its particular assessment of the government’s present space programme.[514]

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509 Based on information provided by Mr Hosseini in 2015. This study was unable to obtain an English translation of this law. For the original version, see: ‘قانون وظایف و اختیارات وزارت ارتباطات و فناوری اطلاعات [The Law for Tasks and Authorisations of the Ministry of Communications and Information Technology]’ (*Islamic Parliament Research Center*) <http://rc.majlis.ir/fa/law/show/93987?keyword=%D9%88%D8%B8%D8%A7%DB%8C%D9%81%20%D9%88%20%D8%A7%D8%AE%D8%AA%D8%A8%D8%A7%D8%B1%D8%A7%D8%AA%20%D9%88%D8%B2%D8%A7%D8%B1%D8%AA%20%D8%A7%D8%B1%D8%AA%D8%A8%D8%A7%D8%B7%D8%A7%D8%AA> accessed 14 July 2015. Arts 8,9 seem to be of particular relevance here.

510 For a copy of the original version and an unofficial English translation of the ISA Statute as of 2005 and 2008, see: Tarikhi (n 501) 237–245.

511 Based on information provided by Mr Hosseini in 2015. This study was unable to obtain an English translation of this document. For the original version, see: ‘[Letter of the President to His Deputy on Scientific and Technology Matters]’ (*Tabnak*) <http://cdn.tabnak.ir/files/fa/news/1393/10/22/461252_468.jpg> accessed 16 July 2015.

512 David E Thaler and Alireza Nader, ‘Deep-Seated Entanglements The Web of Iranian Leadership Can Be Negotiated, Not Unraveled’ (2010) Spring 2010 RAND Review <https://www.rand.org/pubs/periodicals/rand-review/issues/spring2010/iran.html> accessed 15 February 2018.

513 Based on information provided by Mr Hosseini in 2015 and in Tarikhi’s writings: Tarikhi (n 501) 125-126,129,131-132; Parviz Tarikhi, ‘Guest Blogger Parviz Tarikhi: Is There a Need for New Space Law?’ (*Res Communis*, 9 November 2008) <https://rescommunis.wordpress.com/2008/11/09/guest-blogger-parviz-tarikhi-is-there-a-need-for-new-space-law/> accessed 17 July 2015. The Iranian government’s continued implementation of a variety of space undertakings over the past few decades suggests that, even though a more streamlined decision-making process might have improved the overall efficiency, it has always found ways in practice to resolve such issues or to work around them.

514 For some additional information about other but presumably less dominant actors in the Iranian space sector than those introduced below, see: Tarikhi (n 501).

One of the two top-tier domestic institutions behind the formulation and implementation of the government's present space programme appears to be the Space Supreme Council (SSC) under the Iranian President. Established in accordance with MCIT Law, it 'shall seek to apply space technologies for peaceful uses in space and protect the national interests and the sustainable exploitation of space science and technologies for the economic, cultural, scientific and technical development of the country.' It formulates policies on space technology development and application, approves mid- and long-term programmes, fosters private and cooperative sector collaboration for the efficient use of space, provides guidance for international cooperation, works out Iran's international space-related positions, and strengthens coordination among relevant domestic space-related entities.[515] Its primary members are the Iranian President, the Ministers heading the Ministry of Communications and Information Technology (MCIT), the Ministry of Science, Research, and Technology, MODAFL, the Ministry of Foreign Affairs, the Ministry of Industry, Mines and Trade and the Ministry of Roads and Urban Development, as well as the Director of Islamic Republic of Iran Broadcasting (IRIB) and the President of the Iranian Space Agency (ISA). The latter is also Deputy Minister of MCIT and functions as the Secretary of SSC. Besides that, SSC can allow the participation of a selected group of observers and advisors.[516] This group might include military-related personnel, e.g. from the Islamic Revolution Guards Corps that is known to be involved in Iran's ballistic missile programme.[517] With the 2014 Presidential Letter, the Iranian President put the responsibility of administrating SSC sessions in the hands of his Deputy on Scientific and Technology Matters.[518]

Additionally, the 2014 Presidential Letter called for the foundation of a national space centre that supports the government's space-related policy-making, planning, coordination and supervision.[519] As far as this study was able to ascertain, the Iran National Space Administration (INSA) has taken on this centre's role and become the second top-tier domestic institutions behind the formulation and implementation of the government's present space programme alongside SSC. After all, its English webpage

515 Based on information provided by Mr Hosseini in 2015 and in: ibid 120–121. Citation on 120. Tarikhi speaks of long-term and short-term programmes. According to Mr Hosseini, it should read 'mid-term' instead of 'short-term'.

516 ibid 121.

517 Based on information in: Lee Kass, 'Iran's Space Program: The Next Genie In A Bottle?' (2006) 10(3) The Middle East Review of International Affairs 15, 15,17; Gopalaswamy Bharath and Harsh V Pant, 'The Strategic Dimension of Iran's Leap into Space' (2008) 2(1) Journal of Defence Studies 122, 123.

518 Information provided by Mr Hosseini in 2015.

519 Information provided by Mr Hosseini in 2015.

introduces it as an institution affiliated with the Presidential Deputy mentioned in the letter. Indicating some overlap with SSC's tasks, the webpage describes INSA's general tasks as contributing to the development of Iran's space technology and application capabilities, especially to bolster the country's national power, wealth and quality of life; strengthening the domestic science and industry relationship in the field of space technology and applications; commercially developing space technology achievements in Iran; raising public awareness and establishing a culture of space technology and application development in Iran; and enhancing Iran's science, technology, innovation and international communication regarding space technology and applications.[520]

INSA should not be confused with ISA. The latter is the government's – officially civilian – space agency. First established in 2004, ISA received full organisational status with the adoption of the ISA Statute in 2005.[521] It is currently an MCIT-affiliated institution with legal personality and financial independence.[522] While, as mentioned above, the ISA President is a member of the policy-making SSC, the agency's primary role is actually on the implementation side. Its broad range of responsibilities includes, among others, contributing to the development and application of Iranian space launchers and space-related communications and remote sensing technology, setting up other space programme-relevant domestic facilities, and promoting pertinent international cooperation.[523] Notably, with Tarikhi pointing out that persons related to Iran's non-civilian sector have held influential positions in ISA since its establishment, the agency likely goes in practice beyond its ascribed civilian status and also relates to Iran's military security sector.[524]

6.4 Space-related state preferences

6.4.1 Socioeconomic state preferences

Several indicators allow concluding that the government's current space-related socioeconomic state preference is the advancement of Iran's socioeconomic development.

520 'About INSA' (*INSA*) <http://en.insa.ir/page/about+insa> accessed 13 February 2018.

521 Tarikhi (n 501) 31,237-241.

522 ibid 241–245. See especially MCIT Law art 9 in combination with ISA Statute (as of 2008) art 2.

523 ibid 31,241-243. See especially ISA Statute (as of 2008) art 3; some tasks are also outlined in: International Astronautical Federation (2015) 2/2015 International Astronautical Federation News 21 <http://www.iafastro.org/wp-content/uploads/2014/04/IAF_NL-June2015.pdf> accessed 1 August 2015. The latter further mentions a reorganisation of ISA's relationship with some ministries.

524 Tarikhi (n 501) 123–134.

Section 6.3 has already pointed out that important domestic space-related entities like SSC and INSA are partially directed towards bolstering Iran's economic development, national wealth and quality of life. Also, INSA Chairman Manouchehr Manteghi referred in 2016 to space technology as to be able to take on a key role in Iran's economic growth and social development.[525] He further mentioned that the government's space programme for 2016-2025 focuses on the 'development of space-based services for the society'[526] and the 'use of space achievements in different economic sections'.[527] Additionally, the government's 2013 Aerospace Document links Iran's aerospace-related development to wealth generation.[528] Finally, such a state preference is plausible considering that the Vision Decree wants Iran to achieve a high welfare, social security, nutrition security and safety status, as well as a top economic rank in South-West Asia by 2025.[529]

At least three target areas seem to exist under this state preference.

First of all, this chapter's findings on the current major government-promoted space-related measures, especially in Sections 6.6.1-3, suggest that one target area is the development and application of space-related capacities and capabilities to deal with a broad set of socioeconomically relevant issue-areas for Iran. For example, some measures appear, in general terms, to cover issues in such areas like agriculture, biotechnology, the climate (e.g. by references to atmospheric studies and greenhouse gas emission monitoring), disaster management, energy, the environment, forestry, geology, health, land use, mapping and surveying, meteorology, natural resources, oceanography, telecommunications and broadcasting, transportation, and urban development.

The second socioeconomically-oriented target area of expanding the domestic non-governmental space industry materialises from the 2013 Aerospace Document's call to prioritise the non-governmental sector in Iranian space undertakings and its support for the development and privatisation of an Iranian science-based space industry.[530]

525 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (*INSA*, 10 July 2016) <http://en.insa.ir/news/news/16059/Systematic+satellite+launching+will+be+implemented+in+the+country+starting+2016> accessed 16 February 2018.

526 'Iran National Space Administration Announced Its Programs' (n 506).

527 'The Second Ten-Year Space Program of the Country Was Compiled' (*INSA*, 15 June 2016) <http://en.insa.ir/news/news/15845/The+Second+Ten-Year+Space+Program+of+the+Country+Was+Compiled> accessed 13 February 2018.

528 Information provided by Mr Hosseini in 2015.

529 Tarikhi (n 501) 118.

530 Information provided by Mr Hosseini in 2015.

Finally, INSA's tasks outlined in Section 6.3 allow arguing that there is the third target area of extending the domestic commercialisation of space technology.

6.4.2 Political state preferences

There are signs that the government currently pursues two space-related political state preferences. One is to increase the Iranian people's national pride and support for the authoritarian political system. The other is to advance Iran's international prestige and influence.

The first one emerges from the Vision Decree setting out the national development goal of increasing the Iranian people's national pride,[531] while INSA Chairman Manteghi holds that acquiring space technology can serve national pride in Iran.[532] Moreover, the Vision Decree puts forth the national development goal of ensuring regime stability,[533] whereby it is reasonable to assume that the political leadership considers successfully implemented government-promoted space missions as useful to create a favourable view of and consequently to increase support for the country's authoritarian political system (with theological and democratic elements) amongst the Iranian people. For example, the government referred to the successful domestic *Omid* communications satellite project as a result of the Supreme Leader's leadership. The launch of *Omid* was also scheduled to take place during the celebrations of the 30th anniversary of the Iranian Revolution.[534] Furthermore, the Iranian President and the Minister of MODAFL took part at the unveiling of the domestic remote sensing satellites *Rasad* and *Fajr* in 2011,[535] while the launch date of domestic remote sensing satellites *Navid* and *Fajr* fell into the celebrations marking the 33rd and 36th anniversary of the Iranian Revolution, respectively.[536]

531 Tarikhi (n 501) 118.

532 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (n 525).

533 Tarikhi (n 501) 118.

534 Based on information in: Robert C Harding, *Space Policy in Developing Countries. The Search for Security and Development on the Final Frontier* (Routledge 2013) 131–132; 'Iran's Omid Satellite Launched into Orbit' (*Tehran Times*, 4 February 2009) <http://www.tehrantimes.com/index_view.asp?code=188488> accessed 10 August 2015; Tarikhi (n 501) 173.

535 Based on information in: 'Iran Unveils New Satellites and Rocket' (*Tehran Times*, 8 February 2011) <http://www.tehrantimes.com/index_View.asp?code=235389> accessed 13 August 2015; 'Iran Shows Off Space Hardware [Tehran Times]' (*SpaceNews*, 1 October 2011) <http://spacenews.com/iran-shows-space-hardware-tehran-times/> accessed 13 August 2015.

536 Based on information in: 'Iran Launches New Home-Made Satellite into Orbit' (*SpaceDaily*, 10 February 2012) <http://www.spacedaily.com/reports/Iran_Launches_New_Home_Made_Satellite_into_Orbit_999.html> accessed 12 August 2015; 'Iran Launches Fourth Satellite into Orbit' (*SpaceDaily*, 9 February 2015) <http://www.spacedaily.com/reports/Iran_launches_fourth_satellite_into_orbit_999.html> accessed 12 August 2015.

The second space-related political state preference of advancing Iran's international prestige and influence is, for one, somewhat signified by the launch of Iranian satellites onboard of domestic space launchers between 2011 and January 2016 despite United Nations Security Council (UNSC) sanctions determining that Iran shall not undertake launches using ballistic missile technology.[537] It is not farfetched to interpret this space-related defiance of international sanctions as a deliberate governmental display of Iran as an independently powerful state on the world stage in an attempt to increase its prestige and influence in a challenging international environment. Adding to that, the 2013 Aerospace Document puts forward the arguably international prestige and influence-oriented goal of Iran attaining the regional first place in the conquest of space.[538] In 2016, INSA Chairman Manteghi further mentioned the undoubtedly prestigious goal that Iran wants to be a top ten space-faring nation in the world by 2025.[539]

Notably, these two latter goals not only underline the striving for the space-related advancement of Iran's international prestige and influence but they appear to constitute also target areas of this second space-related political state preference. In terms of the regional scope referred to by the goal of Iran attaining the regional first place in the conquest of space, this study deems a look into the Vision Decree as helpful. According to this decree, Iran shall become an evermore influential state in the Islamic world and a leader in science and technology matters in South-West Asia, whereby the latter apparently covers the Middle East and neighbouring states, Central Asia and the Caucasus region.[540]

6.4.3 National security state preferences

This study argues that the government's current space-related national security state preference is the safeguarding of Iran's national security.

First, there is the Vision Decree's call for an Iran that is '[s]ecure, independent and powerful with a defense system based on holistic prevention[...]'.[541] Second, INSA Chairman Manteghi mentioned in 2016 that space technology can serve Iran's security

537 For more information on these sanctions, see this study's Section 6.5.
538 Information provided by Mr Hosseini in 2015.
539 'Iran National Space Administration Announced Its Programs' (n 506).
540 Tarikhi (n 501) 118.
541 ibid.

development.[542] Third, the 2013 Aerospace Document refers to a role of the Iranian aerospace sector concerning the country's national security status.[543] Fourth, a national security-orientation of the Iranian government's space programme is indicated by, as mentioned in Section 6.3, MODAFL and other military-related personnel's linkage to SSC and non-civilians having filled influential positions at ISA.

This study's findings on the involvement of military-related entities in the development and its assumptions about military support applications of some major government-promoted space-related measures suggest that one target area under this state preference is the enhancement of the Iranian military's strategic support system.[544]

A second related target area that this study wants to take into account at least tentatively is the establishment of efficient domestic long-range (nuclear-armed) ballistic missile strike capabilities. After all, the Iranian use of domestic space launches to foster the development of such capabilities is a concern raised by, e.g., the USA.[545] As Nadimi explains, a space launch vehicle 'incorporates many common technologies with intercontinental ballistic missiles (ICBMs), and a[n Iranian] Simorgh-type ballistic missile is estimated by rocket engineers to have a 7,500-kilometer range with a 700-kilogram warhead.'[546] Similarly, Hildreth and Jabbari hold that 'ICBMs share many similar technologies and processes inherent in a space launch program[...].'[547] However, except for Iranian space launchers presumably having somewhat evolved from Iran's *Shahab* ballistic missile family,[548] this study has, other than in the North Korean case,[549] been ultimately unable to draw a robust connection between the Iranian government's present investments into domestic space launchers and a current development of domestic long-range (nuclear-armed) ballistic missile strike capabilities. Future research might

542 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (n 525).
543 Information provided by Mr Hosseini in 2015.
544 See especially this study's Sections 6.6.2-4.
545 'U.S. Says Iran Rocket Test Breaches U.N. Resolution' (*Reuters*, 27 July 2017) <https://www.reuters.com/article/us-iran-satellite/iran-successfully-tests-space-launch-vehicle-state-tv-idUSKBN1AC1YY> accessed 3 September 2018; Steven A Hildreth and Cyrus A Jabbari, 'Iran's Ballistic Missile and Space Launch Programs' (CRS In Focus IF10938, 2018) 2 <https://fas.org/sgp/crs/nuke/IF10938.pdf> accessed 3 September 2018.
546 Farzin Nadimi, 'Iran's Space Program Emerges from Dormancy' (*The Washington Institute*, 1 August 2017) <http://www.washingtoninstitute.org/policy-analysis/view/irans-space-program-emerges-from-dormancy> accessed 14 April 2018.
547 Hildreth and Jabbari (n 545) 2.
548 See especially this study's Section 6.6.9.
549 See especially this study's Section 8.4.5.

have better information available to clarify the existence of this state preference beyond the 'tentative' status.

In support of its findings regarding the Iranian government's other space-related state preferences, this study further wants to add here that it is short-sighted to try to understand this government's current space programme merely from a ballistic missile development perspective. As Hildreth and Jabbari's argue in their analysis of the Iranian ballistic missile and space launch programme around 2018, 'many years ago Iran outlined a long-term dedicated space launch effort (that has since slowed considerably) that is not simply a cover for ICBM development. In addition, no country has developed an ICBM from its space launch technology base; space launch programs have generally developed from military ballistic missile programs.'[550] Lastly, renowned ballistic missile expert Schiller has found in the context of the DPRK's *Unha-3* rocket that this deliberately deployed North Korean space launcher has specifications that limit its overall contribution to the development of domestic long-range ballistic missile capabilities.[551] The same is likely true for Iran's dedicated space launchers considering that they put several satellites into orbit successfully.

6.4.4 Science and technology state preferences

The government's current space programme appears to include the pursuit of the science and technology state preference of advancing Iran's scientific and technological level per se; whereby the reference to 'per se' indicates here more of a basic research and knowledge gathering orientation.

One indicator is that, as introduced in Section 6.3, SSC shall exploit space science and technology for, among others, Iran's scientific and technical development. Another one is that the 2013 Aerospace Document puts forward the goal of improving the knowledge about the world and the skies.[552] Also, ISA's 'tasks and authorizations' apparently include, among others, '[r]easearching, design[ing], manufactur[ing], and launch[ing] of […] scientific and research satellites[...]', '[p]lan[ing] to conduct and develop the peaceful uses of outer space, celestial bodies, astronomy and space technology[...]', as

550 Hildreth and Jabbari (n 545) 2.
551 See especially this study's Section 8.4.5.
552 Information provided by Mr Hosseini in 2015.

well as '[s]tudy[ing], research[ing], develop[ing] technologies and apply[ing] specific education in the development of space science and technologies.'[553]

At the same time, it shall be noted here that the Iranian government's actual pursuit of this state preference appears to still subsist in a limited fashion. The main reason for this verdict is that this study has been unable to identify a current undertaking involving the Iranian government that deserves to be called a major government-promoted space-related measure regarding the pursuit of such a state preference. (Complex) space-related scientific and technological development seems to be mostly part of the pursuit of other space-related state preferences.

6.4.5 Autonomy-oriented state preferences

The government's present space programme seems to incorporate the pursuit of two autonomy-oriented state preferences.

The first one apparently is to ensure the stable use of outer space for Iran. This primarily emerges from this study's identification of some major government-promoted space-related measures that are arguably directed towards serving the pursuit of such a state preference.[554]

The second space-related autonomy-oriented state preference seemingly is the development and maintenance of the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

The argumentative foundation is the 2013 Aerospace Document stipulating the use of internal capabilities to the greatest extent possible in conducting Iranian space endeavours. Moreover, and as already mentioned before, the document calls for the prioritisation of the non-governmental sector in Iranian space undertakings and supports the development and privatisation of a science-based space industry.[555] According to INSA Chairman Manteghi, the government's space programme between 2006-2015 also already involved 'to develop the space infrastructures so that we become able to use these

553 Tarikhi (n 501) 241–242. See especially ISA Statute (as of 2008) art 3.
554 See especially this study's Section 6.6.1 and 6.6.8.
555 Information provided by Mr Hosseini in 2015.

infrastructures for developing technologies for designing and producing different types of satellites, launchers and ground bases for sending and receiving satellites' information.' He further stated that the government wants satellite launchers to be designed locally.[556] Besides that, and as described in Section 6.3, INSA's general tasks include, among others, the raising of public awareness and establishing a culture of space technology and application development in Iran, as well as the enhancement of Iran's science, technology and innovation regarding space technology and applications. Additionally, this state preference is somewhat evident by this study determining that the government currently puts more emphasis on promoting major domestic than major cooperative space-related measures.[557] Finally, the start of the Iran-critical Trump Presidency in the USA in January 2017 and the US government's subsequent unilateral withdrawal from the international agreement regarding the lift of UNSC sanctions against Iran has made the Iranian government likely even more aware of the necessity to develop and maintain robust domestically controlled space capabilities and capacities to guarantee its continued utilisation of outer space. As introduced in the next section, these sanctions can interfere with the country's potential to partake in international space cooperation.[558]

6.5 Basic pol. & leg. framework concerning IGO-based regional space cooperation

The Iranian government currently appears receptive to engage in IGO-based regional space cooperation. Most prominently, Iran through ISA has already joined two space-specific IGOs with a regional focus, namely APSCO[559] and ISNET[560], as a full member. Besides that, it is also a member of CSSTEAP. By 2017, Iran has shown no indication that it wants to relinquish any of these memberships. Instead, a statement by INSA Chairman Manteghi in 2016 even highlights a government interest for better cooperation through APSCO.[561]

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556 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).

557 See the findings throughout this study's Section 6.6.

558 On the US decision, see: Kevin Liptak and Nicole Gaouette, 'Trump Withdraws from Iran Nuclear Deal, Isolating Him Further from World' (*CNN*, 9 May 2018) <https://www.cnn.com/2018/05/08/politics/donald-trump-iran-deal-announcement-decision/index.html> accessed 29 May 2018. For more information on these sanctions, see Section 6.5.

559 For more information on Iran's membership in APSCO, see this study's Section 6.6.1.

560 Since it does not involve any other preeminent Asian government in the space sector, ISNET does not receive special attention in this study. For detailed information about this IGO, see: 'About ISNET' (n 29).

561 'Sanctions Have Had Two Contrasting Impacts on the Countrys Space Technology' (*INSA*, 10 July 2016) <http://en.insa.ir/news/news/16058/Sanctions+have+had+two+contrasting+impacts+on+the+countrys+space+technology+> accessed 16 February 2018.

Regarding the principles governing the Iranian government's current intergovernmental space cooperation, the 2013 Aerospace Document indicates that the government deems it important that cooperation leads to mutual benefit. Also, the government considers space resources a common good of humanity that needs to be utilised under a just legal system.[562]

Additionally, the principles outlined in the main international space agreements presumably are, similar to the other preeminent Asian governments in the space sector, active when it comes to the Iranian government's current intergovernmental space cooperation. Iran signed the Outer Space Treaty in 1967, signed the Rescue Agreement in 1968 and ratified it in 1970, signed the Liability Convention in 1972 and ratified it in 1974, as well as signed the Registration Convention in 1975.[563] Notably, even though these signatures and ratifications occurred during the pre-revolutionary Shah era, and two of these documents are only signed and not ratified, no post-revolutionary Iranian government seems to have declared them to be void.

What complicates the Iranian government's current (potential to engage in) intergovernmental space cooperation from a legal and political perspective the most is the present status of the UNSC sanctions imposed on the country since 2006.

More specifically, based on an international agreement from 2015 that came into effect on 16.01.2016, these sanctions should have been lifted within specific timeframes and under certain conditions.[564] However, the US government under President Trump announced in May 2018, after various statements throughout 2017 already suggesting such a decision, that it unilaterally withdraws from this agreement.[565] In the end, this situation likely limits

562 Information provided by Mr Hosseini in 2015.

563 Based on information in: 'United Nations Treaty Series Online Collection' (*UNTC*) <https://treaties.un.org/pages/UNTSOnline.aspx?id=1> accessed 23 March 2015; 'UK Depositary Status List: Agreement on the Return of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space' <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/269992/11._Rescue_of_Astronauts_1968_Status_List.docx> accessed 5 August 2015; 'UK Depositary Status List: Convention on International Liability for Damage Caused by Space Objects' <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/336893/10._Damage_caused_by_Space_Objects__1972__Status_List.pdf> accessed 5 August 2015.

564 An assessment of the international agreement is provided here: Kenneth Katzman, 'Iran Sanctions' (CRS Report for Congress RS20871, 2018) <https://fas.org/sgp/crs/mideast/RS20871.pdf> accessed 15 February 2018. See especially p39.

565 Liptak and Gaouette (n 558).

other states' acceptance of Iran as an intergovernmental space cooperation partner in the development and application of space launchers and satellites.

After all, while other states might be open for space cooperation and want to keep word regarding the abolishment of the UNSC sanctions on paper, they might, in practice, have to continue to abide by the (space-related stipulations of) these sanctions against Iran or risk getting into trouble with the USA, the world's most powerful state. Most relevant in terms of outer space, and although Iran has never considered the UNSC sanctions to rightfully cover its space programme as the various domestic space launches since 2006 showcase,[566] UNSC Resolution 1929 from 09.06.2010 stipulates: 'Iran shall not undertake any activity related to ballistic missiles capable of delivering nuclear weapons, including launches using ballistic missile technology, and that States shall take all necessary measures to prevent the transfer of technology or technical assistance to Iran related to such activities[...]'.[567] This provision can reasonably be interpreted to include engagements towards domestic and cooperative development and use of Iranian space launchers and satellites.[568]

In contrast to that, under Paragraph 3 of Annex B to UNSC Resolution 2231 from 20.07.2015 that is the primary UNSC document linked to the implementation of aforementioned international agreement from 2015, other states (would) have to deal with much fewer restrictions in partnering with Iran on space launcher and satellite-related issues. There, it merely reads in a non-binding fashion: 'Iran is called upon not to undertake any activity related to ballistic missiles designed to be capable of delivering nuclear weapons, including launches using such ballistic missile technology, until the date eight years years after the JCPOA Adoption Day [(16.01.2016)] or until the date on which the IAEA submits a report confirming the Broader Conclusion, whichever is earlier.'[569]

In sum, the Iranian government's current potential to engage in space cooperation on space launcher and satellite-related topics with other governments, including the

566 See the various Iranian satellite missions between 2006 and 2016 introduced in the upcoming sections, as well as the information in: 'Sanctions Have Had Two Contrasting Impacts on the Countrys Space Technology' (n 561).

567 UNSC Res 1929 (9 June 2010) UN Doc S/RES/1929.

568 Traditional space launchers commonly use ballistic missile-related technology. Also, satellites capabilities and capacities can, for example, help with target selection and missile guidance.

569 UNSC Res 2231 (20 July 2015) UN Doc S/RES/2231.

preeminent Asian governments in the space sector, ultimately depends on the latter's respective interpretation of the UNSC sanctions, as well as their respective willingness to cross the USA and abide by the international agreement from 2015. So far, China and India seem to have at least opted not to count (certain) satellite-related undertakings with Iran to fall under the UNSC sanctions, as evidenced by the Sino-Iranian activities within APSCO since 2006 and Iran's participation in the India-based CSSTEAP.

6.6 Major domestic and cooperative space-related measures

6.6.1 APSCO

APSCO is the Iranian government's current main institutionalised cooperative space-related measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

The Iranian government was one of the initial eight signatories of the APSCO Convention on 28.10.2005. It ratified the convention on 28.11.2006, which made it APSCO's sixth full member state. Nowadays, APSCO has eight full members, including one other preeminent Asian government in the space sector, namely China.[570]

In short, APSCO's official purpose covers capability building of its members in space science, space technology and their peaceful applications, as well as the advancement of its members' socioeconomic development. The latter part appears to include especially the areas of disaster management, environmental protection and the development of competitive national space-related industries.[571]

Overall, but without claiming completeness, the specific major Iranian government-promoted cooperative space-related measures under APSCO since 2006 seem to have encompassed the following:

Reportedly, Iran leads three joint activities on earthquakes, landslides and droughts within the *Framework for Researches on Application of Space Technology for Disaster Monitoring in the APSCO Member States* project.[572]

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570 Zhang and others (n 17) 29.
571 For more information, see this study's Section 4.6.1.2.
572 Aorpimai (n 207) slide 13.

Iran and Mongolia have introduced the idea for an *APSCO Geo-Telecommunications Satellite Project* in 2010.[573] Yet, the project apparently has not taken off as of 2017. At least one potential application area was identified as telemedicine.[574]

Iran plans to become more active regarding APSCO's DSSP project that, while probably depending strongly on the Chinese side's contributions, supports the sharing and application of remote sensing data among the APSCO member states within the organisation's official purpose, e.g. for disaster management.[575]

Iran participates in the SMMS project. The latter shall, for example, involve contributions from APSCO members' existing domestic satellites and the project-specific development of additional, small-, micro- and nano-satellites. Notably, China already plays a strong role in this regard.[576]

While the Chinese side presumably is the key actor, Iran has agreed to host a telescope for the APOSOS project and become an Observation and Training Node within the project since 2016.[577]

Iran partakes in APSCO's joint educational and training activities as well, whereby the latter likely depends heavily on the contributions from the Chinese side. For example, a number of Iranian students have participated in APSCO-promoted Master and PhD programmes.[578] Moreover, Iran engages, e.g. through the Amir Kabir and Khajeh Nassir

573 Zhang and others (n 17) 127–129.

574 'The Third Expert Group Meeting on the Feasibility Study of APSCO' (*APSCO*, 27 February 2014) <http://apsco.int/NewsOne.asp?ID=317> accessed 7 September 2015.

575 Based on information in: 'Iran Plans to Join 2 APSCO Projects' (*Financial Tribune*, 18 September 2017) <https://financialtribune.com/articles/economy-sci-tech/72519/iran-plans-to-join-2-apsco-projects> accessed 15 October 2017; Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) slides 12-13; Aorpimai (n 207) slides 6-10. For additional information on DSSP, see this study's Section 4.6.1.2.

576 Based on information in: Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) slides 33-35; 'Asia-Pacific Space Cooperation Organisation Site Visit to Iran for SMMS Programme' (*SpaceWatch Middle East*, 11 May 2017) <https://spacewatchme.com/2017/05/asia-pacific-space-cooperation-organisation-site-visit-iran-smms-programme/> accessed 13 July 2017; 'The Signing Ceremony of Contract on SMMS Program between APSCO and CNSA' (n 209). For additional information on SMMS, see this study's Section 4.6.1.2.

577 Based on information in: Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) slides 21-24; 'Successful Installation of the Third APOSOS Telescope in Iran' (*APSCO*, 12 January 2017) <http://apsco.int/sitesearchOne.asp?ID=511> accessed 15 April 2017. For additional information on APOSOS, see this study's Section 4.6.1.2.

578 Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) slide 39.

Universities, in APSCO's SSS project for hands-on training of students and facilities in small satellite development.[579]

In sum, the combination and interpretation of the information presented above and on APSCO under Section 4.6.1.2 allows concluding that the Iranian government's engagement within APSCO presumably serves especially the pursuit of its following current space-related state preferences:

First, the government's participation in APSCO is somewhat in line with the pursuit of its current space-related socioeconomic state preference, in particular the target areas of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Iran, as well as of expanding the domestic non-governmental space industry.

Second, the APOSOS project fits the pursuit of the government's current space-related autonomy-oriented state preference of ensuring the stable use of outer space for Iran.

Third, since APSCO shall encompass the joint improvement of capabilities in space science, technology and their peaceful applications and has already seen joint educational and training activities, the Iranian government presumably considers the organisation as temporarily useful for the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining Iran's domestic human, industrial, scientific and technological capacities and capabilities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

Fourth, and corresponding to one of its space-related political state preferences, the Iranian government might hope that its contributions within APSCO help to some degree to advance its international prestige among and influence over other APSCO members.

579 Based on information in: 'Positive Impacts of APSCO Chairmanship: Dr. Bahrami' (*MCIT*, 4 October 2017) <http%3a%2f%2fwww.ict.gov.ir%2fen%2fnews%2f25403%2fPositive-Impacts-of-APSCO-Chairmanship-Dr-Bahrami> accessed 15 April 2018; Li, 'Realizing SPACE 2030 Through Multi-Lateral Cooperation' (n 207) slides 38,41; 'APSCO Small Student Satellite Project' (n 214). For additional information on such educational and training activities, see this study's Section 4.6.1.2.

6.6.2 Remote Sensing

6.6.2.1 Major domestic measures

According to INSA, the Iranian government's current space programme for 2016-2025 concentrates, *inter alia*, on further developing and applying domestic – maybe primarily small –[580] mensural[581] satellites.[582] In this regard, specific major government-promoted domestic space-related remote sensing measures in the pipeline by the end of 2017 apparently cover, without claiming completeness, the following:

First, there is microsatellite *Amir Kabir*, also called AUTSAT. Developed with a budget of around $10 million by the Amir Kabir University of Technology in collaboration with ISA, it shall have a resolution of around 80m and support Iran's disaster management within its 3-5 year mission.[583]

Second, there is microsatellite *Zafar* (Triumph). Developed by the Iran University of Science and Technology, it shall have a resolution of around 80m and serve areas like meteorology, river topography and water border demarcation.[584]

Third, and similarly within a $10 million budget, the Sharif University of Technology and ISA develop the microsatellite *Doosti* (Friendship). Apparently previously referred to as *SharifSat* or SUTSat, it shall have a resolution of fewer than 10 meters.[585] No specific application areas are known.

Fourth, the government promotes the development of the 150kg small satellite *Soha*, 'an electro-optical remote sensing satellite with a resolution of 15 metres, a considerable

580 As indicated in: 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (n 525).

581 Considering the many remarks to remote sensing in Iranian source material and the various Iranian remote sensing satellite missions, 'mensural' presumably refers to remote sensing.

582 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).

583 Based on information in: Tarikhi (n 501) 185; Natalie Fuchs, 'Iran Space Agency Provides Update on Status of Satellites at World Space Week Event' (*SpaceWatch Middle East*, 26 October 2017) <https://spacewatchme.com/2017/10/iran-space-agency-provides-update-status-satellites-world-space-week-event/> accessed 15 February 2018.

584 Based on information in: Tarikhi (n 501) 187; Fuchs (n 583).

585 Based on information in: Tarikhi (n 501) 185; 'Vaezi Announces Launch of Three Iranian Satellites by 2018' (*SpaceWatch Middle East*, 26 December 2016) <https://spacewatchme.com/2016/12/vaezi-announces-launch-three-iranian-satellites-2018/> accessed 15 February 2018; Fuchs (n 583).

improvement compared to previous Iranian remote sensing satellites that had resolutions in the hundreds of metres.'[586]

Fifth, this study has found that *Tadbir* (Wisdom), a follow-up satellite project to the previously launched microsatellite *Navid* and developed by the same institutions but with a more advanced imaging capability, awaits its launch.[587]

Sixth, a consortium of Iranian universities reportedly works on a no further specified remote sensing satellite called *Pars-1* and potentially a later *Pars-2* mission.[588]

Previous to them, the specific major government-promoted domestic remote sensing measures seem to have encompassed at least the following four satellite projects:

The first one was microsatellite *Rasad* (Observation). Developed by MCIT together with the Malek Ashtar Technical University, which is apparently affiliated with MODAFL, *Rasad* was put into space on 15.06.2011 onboard a domestic *Safir* launcher. Its 21 day-mission included technology testing and Earth imaging for disaster management, water border demarcation, river topography and meteorology. Despite the link to MODAFL, the satellite likely had no particular military use due to its low 150m imaging resolution.[589]

The second one was microsatellite *Navid-e Elm-o Sanat* (often just: *Navid;* Promise of Science and Industry), jointly developed by ISA and the Iran University of Science and Technology within a $10 million budget. It was launched on 03.02.2012 via a domestic *Safir* launcher. Its two months-mission involved testing of EO equipment and a

586 Based on information in: 'Iran Adds Soha Remote Sensing Satellite to List of Imminent Launches' (*SpaceWatch Middle East*, 31 May 2017) <https://spacewatchme.com/2017/05/iran-adds-soha-remote-sensing-satellite-list-imminent-launches/> accessed 15 February 2018; 'Iran to Launch Communications Satellite by 2021' (*Mehr News Agency*, 9 October 2017) <https://en.mehrnews.com/news/128459/Iran-to-launch-communications-satellite-by-2021> accessed 15 February 2018. Citation based on the first link.

587 Based on information in: 'Iran's Tadbir Imaging Satellite Ready for Launch' (*SpaceWatch Middle East*, 23 November 2016) <https://spacewatchme.com/2016/11/irans-tadbir-imaging-satellite-ready-launch/> accessed 15 February 2018; 'Iran to Launch New Satellite into Space Soon' (*Fars News Agency*, 7 January 2014) <http://english.farsnews.com/newstext.aspx?nn=13921017000229> accessed 22 July 2015. More information on Navid is presented further below.

588 Based on information in: Tarikhi (n 501) 189; Fuchs (n 583).

589 Based on information in: 'Iran Unveils New Satellites and Rocket' (n 535); 'Iran Shows Off Space Hardware [Tehran Times]' (n 535); Tarikhi (n 501) 183–184.

telecommunication link, collecting weather data and contributing to Iran's disaster management.[590]

The third domestic remote sensing satellite launched was microsatellite *Fajr* (Dawn). Developed by SAIran and Aerospace Industries Organisation, both of which are entities affiliated to Iran's military complex, and put successfully into orbit on 02.02.2015 onboard a domestic *Safir* launcher, *Fajr* was supposed to function for about 1.5 years.[591] However, it presumably lasted only about a month.[592] Despite the involvement of military-related entities in its development, its low 500-1000m resolution image quality makes it unlikely that it would have contributed much to Iran's military capabilities.[593] Mehdi Sarvi from SAIran even claimed officially that the satellite served no military purpose. Instead, he pointed out *Fajr*'s application in such areas like agriculture, meteorology, roads, sea monitoring and shipping.[594]

On 27.07.2017, Iran attempted but failed[595] to put its fourth remote sensing satellite called *Tolou* (Sunrise) into orbit onboard a domestic *Simorgh* launcher.[596] Developed by military-related SAIran for an 18-months mission, the available information indicates that this microsatellite's 'imagery products [… should have been] used for synoptic land mapping, monitoring of water bodies and environmental disasters, agricultural areas and forests, urban distribution, and cloud coverage.' On the national security front, the plan might have been to apply it for signal intelligence gathering.[597] Iran's previous Defence

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590 Based on information in: 'Report: Iran Unveils Self-Made Satellite Navigation System' (*Haaretz*, 31 May 2012) <http://www.haaretz.com/news/middle-east/report-iran-unveils-self-made-satellite-navigation-system-1.433673> accessed 13 August 2015; Tarikhi (n 501) 184–185.

591 Based on information in: 'Iran Launches Fourth Satellite into Orbit' (n 536); 'Iran's National Fajr Satellite Transmits Data to Stations on Earth' (*PressTV*, 2 February 2015) <http://www.presstv.ir/Detail/2015/02/02/395835/Iran-satellite-transmits-data-to-earth> accessed 22 July 2015; Tarikhi (n 501) 186–187. For the military connection of the Aerospace Industries Organisation, see: 'Aerospace Industries Organization (AIO)' (*Iran Watch*, 17 March 2010) <http://www.iranwatch.org/iranian-entities/aerospace-industries-organization-aio> accessed 15 February 2018.

592 Norbert Brügge, 'Safir-1A/B IRILV' (*www.b14643.de*) <http://www.b14643.de/Spacerockets_1/Rest_World/Safir-1B-IRILV/Description/Text.htm> accessed 13 August 2015.

593 Tarikhi (n 501) 186.

594 'Fajr Satellite Serves No Military Purpose' (*SpaceDaily*, 5 February 2015) <http://www.spacedaily.com/reports/Fajr_satellite_serves_no_military_purpose_999.html> accessed 12 August 2015.

595 Nadimi (n 546).

596 'Iran Launches Simorgh Satellite Carrier from Imam Khomeini Space Center' (*Mehr News Agency*, 28 July 2017) <https://en.mehrnews.com/news/126769/Iran-launches-Simorgh-satellite-carrier-from-Imam-Khomeini-Space> accessed 15 February 2018.

597 Tarikhi (n 501) 185–186.

Minister Ahmad Vahidi referring to *Tolou* as a reconnaissance satellite strengthens the argument that it might have had some planned national security purpose.[598]

Altogether, the combination of information presented in the context of these previous and upcoming remote sensing satellite missions, on the INSA webpage and by Tarikhi allows arguing that major government-promoted domestic space-related remote sensing measures are somewhat aimed at aiding the pursuit of the government's current space-related socioeconomic state preference of advancing Iran's socioeconomic development, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Iran. For example, the government has apparently used or wants to use its domestic remote sensing capabilities and capacities to address issues in such socioeconomically relevant areas like agriculture, archaeology, atmospheric studies, biotechnology, cadaster and real estate registry, civil engineering, coastal zone management, disaster management, energy and natural resources, environmental monitoring and studies, forestry, geographic information systems, geology, greenhouse gas emission and air pollution monitoring, land use and surveying, meteorology, oceanography, roads and transportation, shipping, water border demarcation, water studies, wildlife monitoring and urban development.[599]

Even though there is no hard evidence for the pursuit of the government's current space-related national security state preference through the various measures above, it is reasonable to take such a direction into account here as well. The connection of some major government-promoted domestic remote sensing satellite projects with Iranian military-related entities cannot be denied. Moreover, it is common to many governments, including such other preeminent Asian governments in the space sector like China, India, Japan and South Korea, to develop and apply domestic remote sensing satellites for national security purposes. In particular, such satellites can serve the pursuit of the Iranian government's space-related national security-oriented target area of enhancing the Iranian military's strategic support system.

598 'Iran and Israel Plan New Satellites' (*UPI*, 2 February 2010) <http://www.upi.com/Business_News/Security-Industry/2010/02/02/Iran-and-Israel-plan-new-satellites/30381265135400/> accessed 24 July 2015.

599 Based on information presented in the context of the various domestic space-related remote sensing satellite measures above and in: Tarikhi (n 501) 87,160; 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (n 525); 'Some Massive Projects in Space Field to Be Executed through Creating a Network of Knowledge-Based Companies' (*INSA*, 22 November 2016) <http://en.insa.ir/news/news/19560/Some+Massive+Projects+in+Space+Field+to+Be+Executed+through+Creating+a+Network+of+Knowledge-Based+Companies> accessed 16 February 2018.

6.6.2.2 Major cooperative measures

Excluding the already discussed Iranian participation in APSCO, this study has, without claiming completeness, only found a few measures that somewhat fit the status of a current major government-promoted cooperative space-related remote sensing measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

More specifically, Iranian government-related entities apparently engage in GEO alongside China, India, Japan and South Korea,[600] UN-SPIDER alongside China, India and South Korea,[601] and WMO alongside China, India, Japan, North Korea and South Korea.[602]

In terms of state preferences, these measures are likely for the most part oriented towards serving the pursuit of the government's space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Iran.

Also, it cannot be ruled out that the Iranian government might believe that such cooperative measures support, e.g. by others profiting from Iranian contributions, the pursuit of its current space-related political state preference of advancing Iran's international prestige and influence with its respective partners.

6.6.3 Communications and broadcasting

6.6.3.1 Major domestic measures

There are various national satellite communication ground stations in Iran and there is a nationwide network of ground hubs and terminals connected to these stations. Currently, Iranian entities use a mix of foreign and Iranian-owned satellites to provide communications and broadcasting services to the Iranian people and across the world, whereby the Iranian dependence on international satellite networks remains high. Prominent Iranian providers of internal and external communication services are the

600 'Member List' (n 238).
601 'Islamic Republic of Iran Regional Support Office' (*UN-SPIDER*) <http://www.un-spider.org/network/regional-support-offices/islamic-republic-iran-regional-support-office> accessed 18 August 2015.
602 'Members' (n 240).

Telecommunication Company of Iran, a subordinate to MCIT and tasked to develop and manage Iran's communication infrastructure, as well as IRIB.[603]

Based on this background, the Iranian government's current major domestic space-related communications and broadcasting measure apparently is the development and application of more and better domestic telecommunications satellite capabilities and capacities.[604]

By 2017, more specific measures in this regard are, for example, the development and application of the – presumably geostationary – communications satellites *Iransat-1/-2/-3*. Reportedly, their launch shall take in the 2020s. The decision to opt for the *Iransats* instead a continuation of the previously promoted *Zohreh* communications and broadcasting satellite system[605] might be the *Iransats* comparably lower price tag and shorter development time.[606] It is likely of the essence for the Iranian government to become less dependent from foreign providers as quickly as possible considering that IRIB experienced a loss of access to several international satellites between 2012 and 2014 due to decisions of the USA and the EU to punish Iran for alleged satellite jamming activities and an alleged broadcast content that violated human rights.[607]

603 Tarikhi (n 501) 101–104.

604 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).

605 For more information on the by now cancelled Zohreh system, see: Tarikhi (n 501) 104–106; Harvey, Smid and Pirard (n 500) 256–257; 'Regime Gives up on Russia for Zohreh Satellite' (*Iran Times*, 14 October 2010) <http://iran-times.com/regime-gives-up-on-russia-for-zohreh-satellite/> accessed 20 July 2015.

606 Combined information in: Mryam Mousavi Moayed, 'NAHID-1 Satellite' (Presentation, 55th UNCOPUOS STSC, Vienna, 7 February 2018) <http://www.unoosa.org/documents/pdf/copuos/stsc/2018/tech-32E.pdf> accessed 13 April 2018; Tarikhi (n 501) 189; 'Iran Plans to Launch 3 Telecom Satellites in 5 Years: ISA' (*Press TV*, 19 February 2013) <http://www.presstv.ir/detail/2013/02/19/289770/iran-to-launch-3-telecom-satellites/> accessed 19 August 2015; S Isayev and T Jafarov, 'Iran to Launch Own Communications Satellite into Space' (*Trend News Agency*, 8 April 2013) <http://en.trend.az/iran/2136853.html> accessed 22 July 2015.

607 For the full story, see: Peter B de Selding, 'Broadcasters Call for ITU Action on Satellite Jamming' (*SpaceNews*, 9 December 2011) <http://spacenews.com/broadcasters-call-itu-action-satellite-jamming/> accessed 8 August 2015; Paul Sonne and Farnaz Fassihi, 'In Skies Over Iran, a Battle for Control of Satellite TV' (*WSJ*, 27 December 2011) <http://www.wsj.com/articles/SB10001424052970203501304577088380199787036> accessed 9 August 2015; Golnaz Esfandiari, 'Who Is Behind Iran's "Dangerous" Satellite Jamming?' (*Radio Free Europe / Radio Liberty*, 23 August 2012) <http://www.rferl.org/content/satellite-jamming-dangerous-health-iran/24686214.html> accessed 8 August 2015; Peter B de Selding, 'Sanctions Prompt Eutelsat To Drop Iranian TV Channels' (*SpaceNews*, 23 October 2012) <http://spacenews.com/sanctions-prompt-eutelsat-drop-iranian-tv-channels/> accessed 8 August 2015; Golnaz Esfandiari, 'Denying Involvement, Iran Vows to Investigate Jamming of Foreign Media' (*VOA*, 5 April 2014) <http://www.voanews.com/content/denying-involvement-iran-vows-to-investigate-jamming-of-foreign-media/1893676.html> accessed 8 August 2015.

Other specific major government-promoted domestic space-related communications and broadcasting measures are the domestic development and application of the *Nahid-1* and *-2* satellites. Both shall be completed by the early 2020s and be put into LEO. *Nahid-1* shall be an experimental telecommunication microsatellite that includes folding solar panels. *Nahid-2* is so far only referred to as a telecommunications microsatellite.[608]

Adding to that, there is the indigenous development of *Mesbah-2*, a data storage and forward communications satellite with a potential reach from Iran to the European and American region, as well as potentially involving some added navigation-related technology.[609] It appears to be a successor mission to the by now scrapped *Mesbah* project that was based on a collaboration between Iranian entities and an Italian enterprise. Without going into much detail here, the cooperation fell victim to the UNSC sanctions against Iran.[610]

This study was unable to determine whether the government's current space programme still includes the development of the domestic communications satellite *Sina-2*.[611] Presumably, it would be the successor mission to previous Iranian communications satellite *Sina*-1 that was the first Iran-owned satellite in orbit. With an overall price tag of around $15 million, the Iranian government procured microsatellite *Sina*-1 from a Russian company to bridge the delay – at that time due to technical problems – in the development of the *Mesbah* communications satellite. Launched by Russia on 27.10.2005, *Sina*-1 has contributed to Iran's communications capabilities, helped to improve the Iranian expertise in tracking and telemetry, as well as included some additional remote sensing capabilities potentially – and supporting the argument in the 'remote sensing' section above – serving Iran in such areas like agriculture, disaster

608 Combined information in: Moayed (n 606); Tarikhi (n 501) 189; 'Iran Position Nine on World Satellite Record Launch: Space Official' (*Islamic Republic News Agency*, 7 February 2018) <http://www.irna.ir/en/News/82823862/> accessed 16 February 2018; 'Iran Space Agency to Build Communication Satellite' (*Financial Tribune*, 30 January 2017) <https://financialtribune.com/articles/sci-tech/58471/iran-space-agency-to-build-communication-satellite> accessed 16 February 2018.

609 Tarikhi (n 501) 187; 'Iran Negotiating with Italy for the Return of Mesbah Satellite' (*SpaceWatch Middle East*, 7 June 2016) <https://spacewatchme.com/2016/06/iran-negotiating-italy-return-mesbah-satellite/> accessed 16 February 2018.

610 For this and further background information, see: 'Iran Negotiating with Italy for the Return of Mesbah Satellite' (n 609); 'Mesbah Satellite to Go to Space Museum' (*Mehr News Agency*, 2 July 2017) <https://en.mehrnews.com/news/126269/Mesbah-satellite-to-go-to-space-museum> accessed 16 February 2018.

611 Tarikhi (n 501) 190.

management and natural resources.[612] National security applications of the remote sensing element were unlikely because the satellite's reported 250m multispectral scanning mode resolution and 50m panchromatic mode resolution are of little military use.[613]

Besides *Sina-1*, the other previous Iranian satellite project in this field was *Omid* (Hope). Put into orbit on 02.02.2009 onboard a domestic *Safir-2* launcher, this experimental data storage and forward communications satellite with a price tag of around $0.5 million constituted Iran's first domestically manufactured – by military-related SAIran – and launched satellite. It has further made Iran the ninth member of the elite group of states, and the first new one in the 21st century, with the domestic capability to manufacture and launch its own satellites.[614]

Arguably, the pursuit of the three state preferences is at the centre of its present (specific) major domestic space-related communications and broadcasting measures.

This study finds that the available information points towards the government's development and use of communications and broadcasting satellite capabilities and capacities in such socioeconomically relevant areas like domestic communication and broadcasting services, internet connectivity, connectivity of remote areas to the rest of the country, disaster management, tele-education and telemedicine.[615] It fits the pursuit of the government's space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Iran.

The government has never highlighted that its current space-related national security state preference is an important driver of the satellite projects outlined above. However, considering that other preeminent Asian governments in the space sector like China, India, Japan and South Korea use domestic communications and broadcasting satellites regarding their respective national security state preference-related target area of enhancing the domestic military's strategic support system, it makes it very likely that Iran will want to do the same.

612 ibid 108–109; 'First Iranian Satellite Launched' (*BBC*, 27 October 2005) <http://news.bbc.co.uk/1/hi/world/middle_east/4381436.stm> accessed 20 July 2015.
613 Harvey, Smid and Pirard (n 500) 272–273; Sheldon (n 500) 232.
614 Tarikhi (n 501) 175–180.
615 ibid 101–104.

Besides that, the argument can be made that more and improved domestic communications and broadcasting satellite capabilities and capacities put the Iranian government in a better position in its soft power conflict with the Western and Gulf Arab states.[616] The government can use such domestic capabilities and capacities to distribute its worldview on the international level more sustainably, without the fear of being shut out by foreign providers. This is coherent with the government's current space-related political state preference of advancing Iran's international prestige and influence.

6.6.3.2 Major cooperative measures

Excluding the already introduced APSCO-related measures, the Iranian government appears to promote only two measures that can be somewhat considered a major cooperative space-related communications and broadcasting measure (with a high potential for) involving other preeminent Asian governments in the space sector.

More specifically, the Iranian government reportedly wants to commercially procure a special geostationary communications satellite called *National Communications Satellite* from a foreign company. While writing, it seems to deliberate on contract proposals from entities from China, France, Russia, and South Korea.[617] The underlying space-related state preferences are unknown.

Besides that, Iran is, alongside all the other preeminent Asian governments in the space sector, a member state of ITU. This shall presumably aid the pursuit of all space-related state preferences underlying the Iranian government's space-related communications and broadcasting measures.[618]

616 'Iran Space Agency Applies for Five Geostationary Orbital Slots for Ka- and Ku-Band Communications Satellites' (*SpaceWatch Middle East*, 14 March 2017) <https://spacewatchme.com/2017/03/iran-space-agency-applies-five-geostationary-orbital-slots-ka-ku-band-communications-satellites/> accessed 16 February 2018.

617 ibid.

618 For more information, see this study's Section 4.6.3.3.

6.6.4 Navigation

6.6.4.1 Major domestic measures

Even though INSA head Manteghi mentioned in 2016 that the government's current space programme includes the design and development of Iranian positioning satellites,[619] this study has found no evidence that such a major domestic measure has commenced.

6.6.4.2 Major cooperative measures

The accessible information allows arguing that the major government-promoted – apparently cooperative – space-related navigation measure is to improve the accuracy of satellite navigation in Iran through application of globally and regionally available navigation satellite systems.[620] In this regard, the Iranian government seems to prefer China's BDS. Reportedly, SAIran has already entered into an MoU in October 2015 with the Chinese side in which they agreed to develop the use of BDS in Iran and to establish BDS ground stations and a BDS data centre in the country. Iran's focus on the Chinese system is reasonable. Not only has Iran already a working space-related relationship with China through APSCO but China has apparently also agreed to provide Iran even with access to the high-precision BDS services, which the USA has denied Iran regarding the use of GPS. Moreover, BDS covers the blind spots of the American GPS in Iran.[621]

In terms of state preferences, this study concludes that Iran's collaboration regarding the use of BDS might be, on the one hand, aimed at serving the government's current space-related national security state preference, with a focus on the target areas of enhancing the Iranian military's strategic support system. Stable access to – especially high precision – navigation services can make the use of, e.g., Iranian missiles and uncrewed aerial vehicles more effective.[622]

On the other hand, the Iranian government presumably wants to also have access to a stable and precise satellite navigation services for the pursuit of its current space-related socioeconomic state preference, probably especially regarding the target area of developing and applying space-related capabilities and capacities to deal with a broad set

619 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).

620 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (n 525).

621 'Chinese BeiDou BDS to Transfer Satellite Tech. to Iran' (n 277).

622 'Iran and China Defence and Intelligence Cooperation: The Space Dimension' (*SpaceWatch Middle East*, 28 November 2016) <https://spacewatchme.com/2016/11/irans-growing-dependency-on-chinas-beidou-satellite-navigation/> accessed 14 October 2017.

of socioeconomically relevant issue-areas for Iran. After all, the current space programme reportedly considers the use of space achievements in different economic sections a central objective.[623] Moreover, other preeminent Asian governments in the space sector arguably see navigation satellites contributing to their socioeconomic development.

6.6.5 Science and technology research

This study was unable to identify any current measure that deserves to be referred to as a dedicated major government-promoted space-related domestic or cooperative space-related science and technology research measure.

At most, the past years seem to have seen some government-promoted sounding rocket missions to study the ionosphere, the atmosphere and microgravity effects,[624] as well as some government-promoted astronomical research.[625] Other government-promoted science and technology research appears to have been so far strongly linked to other major government-promoted measures.

6.6.6 Human spaceflight

6.6.6.1 Major domestic measures

Not least due to a reference of INSA head Manteghi in 2016 that Iran's space programme involves 'sending living creatures to space',[626] this study holds that the Iranian government's current space programme for 2016-2025 includes the major domestic space-related measure of developing Iranian human spaceflight capabilities and conducting a first Iranian human spaceflight.

After all, ISA announced in 2005 that Iran will develop its own crewed spacecraft and space laboratory.[627] In 2008, then-ISA President Reza Taghipour Anvari added that Iran has a ten-year programme for a first Iranian human spaceflight.[628] According to then-Iranian President Mahmoud Ahmadinejad in 2010, the feat of putting the first Iranian into

623 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).
624 Tarikhi (n 501) 148–150; Harvey, Smid and Pirard (n 500) 277.
625 Tarikhi (n 501) 148–150.
626 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).
627 Tarikhi (n 501) 205.
628 Dudi Cohen, '"First Iranian in Space within Decade"' (*Ynetnews*, 20 August 2008) <http://www.ynetnews.com/articles/0,7340,L-3585540,00.html> accessed 23 July 2015.

space should be accomplished by 2019,[629] while then-ISA President Hamid Fazeli explained a year later that the relevant development steps commenced having an Iranian enter outer space by around 2021.[630] Other statements between 2013 and 2015 further suggested that Iran wanted to conduct the first manned sub-orbital flight around 2016-2018.[631] Notably, ISA's deputy head announced in June 2017, while referring to the high estimated programme costs ranging around $15-20 billion over 15 years, that the government cancelled Iran's human spaceflight programme.[632] However, the head of the country's Astronautics Research Institute declared only a few months later that the Iranian government continues with its human spaceflight endeavour.

Ultimately, as far as this study was able to ascertain, the current space programme still encompasses a suborbital and an orbital phase, but the feat shall now be achieved as late as 2025. Related test missions might involve the launch of robots and other living creatures.[633] Previous prominent development steps in this context seem to have been the launch of an empty bio-capsule up to an altitude of 135km in March 2011 and a suborbital flight of a monkey in January 2013.[634] Also, Iran presented a mock-up of a self-engineered one-person spacecraft in February 2015.[635]

Considering that the pursuit of current space-related political state preferences is an aspect of, e.g., the Chinese government's space programme, this study assumes that the pursuit of the Iranian government's two political space-related state preferences is the most likely motivational factor behind all the above. One needs to just take into account that no Muslim nation and only a few states overall have ever successfully conducted domestic human spaceflight. As such, the government can be quite hopeful that its human spaceflight feat will increase the Iranian people's national pride and support for the

629 'Iran Aims to Send Man into Space by 2019' (*BBC*, 23 July 2010) <http://www.bbc.co.uk/news/world-middle-east-10747390> accessed 23 July 2015.

630 Tarikhi (n 501) 205.

631 'Iran to Conduct Manned Space Mission by 2018, Official Says' (*NTI*, 5 February 2013) <http://www.nti.org/gsn/article/iran-conduct-manned-space-mission-2018-official/> accessed 21 July 2015; 'Too Ambitious to Be True? Iran Plans to Send Humans to Space by 2016' (*SpaceDaily*, 2 March 2015) <http://www.spacedaily.com/reports/Too_Ambitious_to_be_True_Iran_Plans_to_Send_Humans_to_Space_by_2016_999.html> accessed 21 July 2015.

632 'Iran Abandons Its Human Spaceflight Ambitions' (n 319).

633 Natalie Fuchs, 'Iran Reconsiders Human Spaceflight Policy, Seeks to Send Humans to Space by 2025' (*SpaceWatch Middle East*, 20 September 2017) <https://spacewatchme.com/2017/09/iran-reconsiders-human-spaceflight-policy-seeks-send-humans-space-2025/> accessed 16 February 2018.

634 Tarikhi (n 501) 142–143.

635 'Iran Unveils Mock-Up of Manned Spacecraft' (*Tasnim News Agency*, 17 February 2015) <http://www.tasnimnews.com/English/Home/Single/657512> accessed 14 August 2015.

authoritarian political system, as well as advance Iran's international prestige and influence. Fitting its related target areas, the government will also be in a strong position to claim to have attained the regional (Muslim/Middle Eastern) first place in the conquest of space and to be a top ten spacefaring state worldwide.

6.6.6.2 Major cooperative measures

There appears to be no current major government-promoted cooperative human spaceflight measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

Nonetheless, it seems open to some collaboration in this regard. The 2013 Aerospace Document includes a reference to an Iranian engagement in human spaceflight, potentially based on cooperation with the Islamic world and other international cooperation.[636] Also, Iran has reportedly entered preliminary talks for collaboration with a Russian space company to support its human spaceflight programme's progress.[637] Moreover, Iran has apparently begun preliminary discussions with China regarding the potential to have Iranian astronauts sent to the upcoming Chinese space station.[638]

Overall, it is reasonable to assume that the Iranian government expects such collaboration to aid the pursuit of is current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in (human spaceflight and) the (related) pursuit of other space-related state preferences.

Moreover, an Iranian astronaut onboard a Chinese space station might somewhat add to the pursuit of government's current space-related political state preferences since there has never been a purely Iranian astronaut before[639] and only a limited number of people fulfil the requirements for astronaut training in general.

636 Information provided by Mr Hosseini in 2015.
637 Fuchs (n 633).
638 'Iran Abandons Its Human Spaceflight Ambitions' (n 319).
639 Previously, there only was a US-Iranian citizen residing and working in the USA who went to space. Her name is Anousheh Ansari: (*Iran Chamber Society*) <http://www.iranchamber.com/personalities/aansari/anousheh_ansari.php> accessed 3 September 2018.

6.6.7 Exploration of celestial bodies, including the Moon

There is no robust indicator that the government currently promotes a major domestic or cooperative measure regarding the exploration of celestial bodies, including the Moon.

6.6.8 Stable use of outer space

6.6.8.1 Major domestic measures

A current major government-promoted domestic measure that appears to be linked to the pursuit of the government's current space-related autonomy-oriented state preference of ensuring a stable use of outer space for Iran is the development and application of the *Nasir-1* satellite. The project reportedly commenced around 2012. Once up, the satellite shall help to establish an independent Iranian capability for locating satellites and satellite carriers in orbit. Notably, according to INSA, *Nasir-1* might be additionally employed to achieve more precise positioning of aircraft, ships and missiles.[640]

The second major government-promoted domestic measure related to ensuring the stable use of outer space for Iran is the setup of an orbital debris team in ISA's Astronautics Research Institute (previously: Aerospace Research Institute). It apparently addresses issues like categorisation and regulative aspects.[641]

6.6.8.2 Major cooperative measures

Outside of the already introduced APSCO-related measures, this study was unable to find any current major government-promoted cooperative measure regarding the pursuit of the government's space-related autonomy-oriented state preference of ensuring a stable use of outer space for Iran (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

640 Combined information in: Tarikhi (n 501) 187; 'Report: Iran Unveils Self-Made Satellite Navigation System' (n 590); 'The Software Simulation of Star Finder System of Nasir 1 Was Designed' (*INSA*, 20 June 2016) <http://en.insa.ir/news/news/15847/The+Software+Simulation+of+Star+Finder+System+of+Nasir+1+Was+Designed> accessed 16 February 2018.

641 Harvey, Smid and Pirard (n 500) 268–269; Tarikhi (n 501) 140–141.

6.6.9 Launchers

6.6.9.1 Major domestic measures

Without a doubt, access to various domestic space launcher capabilities and capacities is a long-standing major government-promoted domestic space-related measure. Statements by INSA head Manteghi in 2016 underline this.[642]

In short, Iran's launcher workhorse is the *Safir* (Envoy) launcher family. It presumably has somewhat evolved from Iran's *Shahab* ballistic missile family, which, in turn, might have links to North Korean[643] or Pakistani[644] ballistic missile technology. The *Safir-1* series can put a payload of 100kg into an orbit with a perigee of 250km and an apogee of around 500km. It was a *Safir-1* that sent *Omid*, the first domestically developed satellite, into orbit in 2009. The upgraded *Safir-1B* series has a capability of putting a 60kg payload into an elliptical orbit of 300-450km. A newly added and more powerful domestic space launcher is the *Simorgh* (Phoenix) series. Reportedly, it can lift a 250kg satellite into an orbit of 500km. Its first, but reportedly failed satellite mission took place in July 2017 with the launch of domestically developed remote sensing satellite *Tolou*.

Tarikhi further mentions two more Iranian launcher series, namely *Ghoghnoos* and *Sarir,* that seem to be under development but this study was unable to ascertain more detailed information about them. Considering the various Iranian geostationary satellite projects, one of them might ultimately be a geostationary launcher series.[645]

Iran's main space launch facility is the Imam Khomeini Space Center, which opened in 2017. It appears to be the renamed but extended version of the Semnan Space Center that initially opened in 2008.[646]

Regarding underlying state preferences, Section 6.4.3 indicates that enhancing the domestic launcher development capability might contribute to the target area of establishing efficient domestic long-range (nuclear-armed) ballistic missile strike capabilities under the government's current space-related national security state

642 'The Second Ten-Year Space Program of the Country Was Compiled' (n 527).
643 Harvey, Smid and Pirard (n 500) 286, 294; Harding (n 534) 130.
644 Sheldon (n 500) 237.
645 Tarikhi (n 501) 191–197; 'Iran Launches Simorgh Satellite Carrier from Imam Khomeini Space Center' (n 596); Nadimi (n 546).
646 'Imam Khomeini Space Center' (*NTI*, 2 November 2017) <http://www.nti.org/learn/facilities/313/> accessed 14 April 2018.

preference. However, the exact degree of this interlinkage, if any, is unknown at this point in time.

Since only a small elite group of states has domestic satellite launch capabilities, especially in the direct Iranian neighbourhood, it is reasonable to assume that the government sees access to and thus the enhancement of domestic launcher capabilities and capacities additionally contributing to the pursuit of its current two space-related political state preferences. Without robust launching capabilities and capacities, the Iranian government would have trouble to address its related target areas of attaining the regional first place in the conquest of space and, by 2025, becoming a top ten space-faring state in the world.

Access to and the enhancement of domestic launcher capabilities and capacities are, of course, further necessary for the implementation of many of the aforementioned major government-promoted measures in the field of remote sensing, communications and broadcasting, human spaceflight and the stable use of outer space. As such, the domestic launcher-related measures above are a considerable segment in the pursuit of the government's current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage primarily autonomously in the pursuit of the other space-related state preferences.

6.6.9.2 Major cooperative measures

This study has found no clear evidence for a current major government-promoted cooperative space launcher measure.

However, the Iranian government seems open to engaging in cooperation in this field. For example, in 2008, then-ISA President Reza Taghipour promised that Iran 'is ready to launch satellites of friendly Islamic countries into space[...]'.[647] Also, as mentioned above, Iran has presumably previously cooperated with states like North Korea and Pakistan in the development of its launchers. It might have even received foreign support, e.g. from

647 Parisa Hafezi, 'Iran Ready to Put Muslim Countries' Satellite in Orbit' (*Reuters*, 18 August 2008) <http://www.reuters.com/article/2008/08/18/us-iran-satellite-muslims-idUSLI72158420080818> accessed 15 August 2015.

North Korea, in the setting up a domestic space launch centre.[648] Finally, the government is reportedly ready to enter into international cooperation with developed countries concerning the launch of Iranian satellites for various functions, including specialised geostationary (communication) satellites.[649]

6.6.10 Human resources

6.6.10.1 Major domestic measures

It is hard to pinpoint major domestic space-related human resources measures promoted by the Iranian government within the available English literature.

However, as outlined in the previous sections, there has been progress in developing and applying various domestic space launcher and satellite capabilities and capacities as well as making first successful steps towards developing a domestic spacecraft for human spaceflight in the past decade despite UNSC sanctions being in place. This showcases that the government regards domestic space-related education and training in these fields and the pursuit of any of the related space-related state preferences significant. Due to their involvement in the implementation of various domestic satellite projects, Iranian universities and research centres seem to play a particular role for the domestic space-related human capacity building.[650] Tarikhi introduces a smorgasbord of domestic entities and activities related to domestic space-related capacity building, even in, as this study argues, such less essential fields in the government's current space programme like astronomy.[651]

6.6.10.2 Major cooperative measures

Excluding the already introduced APSCO-related measures, the major government-promoted human resources-specific measure (with a high potential for) involving other

648 Nadimi (n 546).
649 Combined information in: 'Transfer of Necessary Technologies Will Be Carried out to Manufacture Domestic Satellites.' (*INSA*, 2 June 2017) <http://en.insa.ir/news/news/21394/Transfer+of+necessary+technologies+will+be+carried+out+to+manufacture+domestic+satellites.+> accessed 16 February 2018; 'Systematic Satellite Launching Will Be Implemented in the Country Starting 2016' (n 525).
650 See especially this study's Sections 6.6.2-3.
651 Tarikhi (n 501) 45–76.

preeminent Asian governments in the space sector is the Iranian participation in space-related education and training offered by CSSTEAP.[652]

The Iranian government likely considers this participation primarily as a temporarily useful tool in the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

6.6.11 Unspecified satellite projects

For the sake of completion, it shall be stated here that Tarikhi's book refers to three unspecified Iranian satellite projects, namely *ZS4, Saar* (Starling) and *Muhammad-1.* The latter might be a joint project between Muslim states.[653] This study found no information on their status within the government's current space programme.

652 'Governing Board' (*CSSTEAP*) <http://www.cssteap.org/governing-board> accessed 27 September 2018; Tarikhi states: 'To extend existing knowledge, Iranian space specialists regularly participate in courses [...] offered by other regional or international bodies such as the United Nations regional Centre for Space Science and Technology Education in Asia and the Pacific (CSSTE-AP)[...].' Tarikhi (n 501) 51–53.

653 Tarikhi (n 501) 189–190.

7 Japan

7.1 Analytical considerations

At first glance, this study's key challenge in its particular analysis of the Japanese government's current space programme is that several of the present main domestic space-specific legal documents and all of the present main domestic space-specific political documents are not publicly accessible in full (unofficial) English translations. However, because there is a smorgasbord of other English material addressing aspects of the government's current space programme available, it is nonetheless very much possible to arrive at adequate findings regarding this study's primary research interest. Notably, this study's search for and interpretation of such material has greatly benefited from the input of various renowned experts in the Japanese space sector during the author's three-weeks-long research stay in Japan in 2016.[654]

7.2 Main domestic political and legal documents

Without claiming completeness, this study ascertains based on the available material that at least the following domestic political and legal documents significantly guide the Japanese government's space programme as of 2017. Their known content merits special attention throughout this chapter.

At the centre is the 'Basic Space Law'[655] (BSL) from 2008, which constitutes Japan's principal national space law. BSL stipulates that the government shall formulate a 'Basic Space Plan' (BSP) that, while remaining in line with BSL provisions, outlines the government's main policy regarding the development and use of outer space, as well as related adequate implementation measures. By 2017, the government has adopted three consecutive BSPs. The 1st BSP[656] dates back to 2009 and the 2nd BSP[657] to 2013. On

654 See also this study's 'Acknowledgements' chapter. Any mistakes in this study are its author's alone.

655 For an unofficial English translation, see: 'Basic Space Law (Law No.43 of 2008)' (*JAXA*) <http://stage.tksc.jaxa.jp/spacelaw/country/japan/27A-1.E.pdf> accessed 10 July 2016. If not specified otherwise, future references to BSL are to this translation.

656 For an unofficial English translation, see: SHSD, 'Basic Plan for Space Policy – Wisdom of Japan Moves Space – June 2, 2009' (*Cabinet Public Relations Office, Cabinet Secretariat, Government of Japan*) <http://www.kantei.go.jp/jp/singi/utyuu/basic_plan.pdf> accessed 8 May 2017.

657 For an unofficial English translation, see: SHSD, 'Basic Plan on Space Policy January 25, 2013' (*Cabinet Office, Government Of Japan*) <http://www8.cao.go.jp/space/plan/plan-eng.pdf> accessed 13 August 2014.

09.01.2015, the government under Prime Minister Shinzo Abe, who came into office in December 2012,[658] adopted the currently active 3rd BSP.[659]

The government's decision to create a new BSP only two years after the adoption of the 2nd BSP followed, on the one hand, from the necessity to address perceived changes in Japan's security environment and to factor in the increasing relevance of space for national security. Connected with that, the government also wanted to interlock its space programme with the country's first[660] 'National Security Strategy'[661] (NSS).[662] Adopted on 17.12.2013, NSS shall steer Japan's security sector for the next ten years. It acknowledges an important role of outer space.[663] On the other hand, the government set up the 3rd BSP specifically to recover and bolster Japan's space-related industrial base. The government determined that the previous two BSPs' respective timeframes of five years with a ten-year outlook were too short for the domestic space industry to develop properly.[664] Apparently, the 3rd BSP now 'sufficiently reflects the new national security policy shown in the National Security Strategy (NSS) and is a long-term and concrete public investment plan for [the] next 10 years foreseeing [the] coming 20 years, thereby maintaining and strengthening Japan's industrial basis through improvement of foreseeability of industrial investment.'[665]

Supposedly in support of this development of the domestic space-related industrial base, the government additionally published the 'Space Industry Vision 2030' in 2017. Reportedly, this vision fits Prime Minister Abe's 'Japan Revitalisation Strategy 2016'.[666]

658 Nancy Gibbs and Hannah Beech, 'The Patriot: Shinzo Abe Speaks to TIME' (*Time*, 17 April 2014) <http://time.com/65673/shinzo-abe-japan-interview/> accessed 8 May 2017.

659 This study was unable to obtain an English translation of the 3rd BSP. However, it can draw on a government representative's detailed English presentation of this plan's content and related first revised implementation schedule as of 08.12.2015: Yoshinori Komiya, 'Basic Plan on Space Policy Implementation Schedule (Revised FY2015)' (Presentation, ONSP, Cabinet Office, Government of Japan, 3 March 2016) <http://www.jsforum.or.jp/stableuse/pdf/6.%20DG_Komiya.pdf> accessed 23 May 2016.

660 'Statement by Minister for Foreign Affairs of Japan on Adoption of the "National Security Strategy (NSS)"' (*Ministry of Foreign Affairs of Japan*, 17 December 2013) <http://www.mofa.go.jp/press/release/press4e_000141.html> accessed 25 May 2017.

661 For an unofficial English translation, see: 'National Security Strategy December 17, 2013 (Provisional Translation)' (*Cabinet Secretariat, Government of Japan*) <http://www.cas.go.jp/jp/siryou/131217anzenhoshou/nss-e.pdf> accessed 23 May 2016.

662 Komiya (n 659) 4.

663 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 1–2.

664 Komiya (n 659) 4–5; concerning the previous two BSPs' respective timeframes, see: SHSD (n 656) 4; and the 'Outline of Basic Plan on Space Policy' attached to: SHSD (n 657).

665 Komiya (n 659) 5.

666 Kazuto Suzuki, 'Japanese Space Industrial Policy in Transition' (2017) 3(13) ROOM 42, 44. This study was unable to obtain an English translation of this vision.

In addition to BSL, other highly relevant domestic space-related legal documents currently are the ‘Act concerning Ensuring Adequate Handling of Satellite Remote Sensing Data’ (Remote Sensing Data Act) and the ‘Act concerning launch and control of satellites’ (Space Activities Act), which were both promulgated in November 2016.[667] They are, to a large part, also directed towards strengthening the development of the Japanese space industry.[668] Moreover, there is the ‘Law Concerning Japan Aerospace Exploration Agency’[669] (JAXA Law), first enacted in 2002 and revised in 2012. It establishes and regulates the Japan Aerospace Exploration Agency[670] (JAXA), which constitutes Japan’s national space agency.

Ultimately, other – but here not further discussed – domestic space-related political and legal documents presumably connect to and specify certain aspects of the key domestic space-related political and legal documents identified above.[671]

7.3 Basic domestic decision-making system

There is much English material discussing aspects of the basic domestic decision-making system behind the formulation and implementation of the Japanese government’s current space programme. In sum, knowledge of the following context sufficiently serves this study’s particular assessment of the said programme.

The highest decision-making body is the Strategic Headquarters for Space Development[672] (SHSD). In short, SHSD, established within the Cabinet of Japan under

667 This study was unable to obtain English translations of these acts, but information about their content is presented in some other available English material. There are different translations for these two acts’ titles. This study uses the English titles provided by a government representative in: Koji Hara, ‘Current Status of Japan’s Space Policy and Development of Legal Frameworks’ (Presentation, 56th UNCOPUOS LSC, Vienna, 6 April 2017) <http://www.unoosa.org/documents/pdf/copuos/lsc/2017/tech-09.pdf> accessed 21 March 2018; for the promulgation dates and a different translation of these acts’ titles, see: Sayuri Umeda, ‘Japan: Two Outer Space-Related Laws Enacted’ (*The Library of Congress*, 19 December 2016) <//www.loc.gov/law/foreign-news/article/japan-two-outer-space-related-laws-enacted/> accessed 21 March 2018.

668 Based on information in: Hara (n 667); Setsuko Aoki, ‘New Law Aims to Expand Japan’s Space Business’ (*Nippon*, 3 March 2017) <https://www.nippon.com/en/currents/d00294/> accessed 27 March 2018.

669 For an unofficial translation, see: ‘[Unofficial Provisional Translation] Law Concerning Japan Aerospace Exploration Agency (Law Number 161 of 13th December 2002) Revised: June 27, 2012, Law Number 35’ (*JAXA*) <http://stage.tksc.jaxa.jp/spacelaw/country/japan/27A-5.E.pdf> accessed 10 July 2016. If not specified otherwise, future references to the JAXA Law are to this translation.

670 Section 7.3 provides some more information on JAXA.

671 As indicated by, for example, JAXA Law art 19.

672 This entity is often referred to as ‘Strategic Headquarters for Space Policy’ in other studies. However, based on the information provided by Japanese space experts in 2016, the term ‘Strategic Headquarters

the chairmanship of the Prime Minister and encompassing a membership mirroring the Cabinet, is responsible for BSP's formulation and the promotion of its implementation.[673]

SHSD receives assistance in its tasks from the National Space Policy Secretariat (NSPS; previously known as Office of National Space Policy (ONSP)).[674] Pursuant to Anan's account, ONSP's – and thus now supposedly NSPS's – positions are usually filled by secondments from JAXA and various ministries, primarily Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT), Ministry of Economy, Trade and Industry, Ministry of Internal Affairs and Communications and Ministry of Defence. In particular, ONSP/NSPS apparently 'plans, drafts, and coordinates affairs based on the fundamental policies for the comprehensive and systematic promotion of space development and use.' For example, this involves communicating budget priorities to relevant ministries, coordinating the government's space strategy throughout the ministries and promoting space development and use and related measures not under the jurisdiction of other ministers. ONSP/NSPS can further take part in pertinent negotiations with foreign entities together with relevant ministries and JAXA, whereby the Cabinet Office and Japan's Ministry of Foreign Affairs conduct the diplomacy-related part. Besides that, ONSP/NSPS might also engage in '[m]aintenance and management of satellites, referring satellites, and equipment installed in satellites specified by Cabinet Order to be for public and official use in diversified fields, and facilities or equipment necessary for their operation […].' Lastly, ONSP's/NSPS's responsibilities seemingly allow the Cabinet Office to officially manage Japan's multi-purpose *Quasi-Zenith Satellite System*[675] (QZSS). In practice, however, ONSP/NSPS apparently does not operate QZSS but mainly authorises QZSS-related 'Private Finance Initiative'[676] (PFI) contracts and supervises the contractors.

In addition to that, there is the Committee on National Space Policy (CNSP) that consists of up to nine space experts from, among others, academia and the industry. It functions as an advisory board to SHSD and ONSP/NSPS in their respective tasks. CNSP may, for

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for Space Development' might be more precise.

673 For this and more information on SHSD, see especially BSL arts 24-30.

674 Keiichi Anan, 'Administrative Reform of Japanese Policy Structures in 2012' (2013) 29(3) Space Policy 210, 212. Based on the information provided by Japanese space experts, ONSP was originally established in the Cabinet Office in 2012. By 01.04.2016, the start date of Japan's Fiscal Year 2016, the government has restructured ONSP, without touching its general role and membership, into NSPS.

675 For more information on QZSS, see this study's Section 7.6.4.

676 For more information on PFIs in Japan, see: Jean Heilman Grier, 'PPPs #3: Japan's Private Finance Initiative' (*Djaghe LLC*, 31 August 2015) <http://trade.djaghe.com/?p=1628> accessed 17 June 2017.

example, investigate and consult on the government's space policy and budgetary priorities upon request by the prime minister. It may further formulate recommendations and opinions to the prime minister and his ministers on space matters.[677] Even though SHSD and ONSP/NSPS are not legally bound to follow CNSP's input, they are known to value it.[678]

Administrative matters related to SHSD seem to fall ordinarily under the purview of the Cabinet Secretariat.[679] Also, due to its general function concerning national intelligence matters, the latter is apparently involved in the management of Japan's *Intelligence Gathering Satellite*[680] (IGS) constellation.[681]

Arguably, the National Security Council within the Cabinet has some relevance to the development of the government's current space programme since it is responsible for NSS,[682] which, as explained in Section 7.2, links to the formulation of the 3rd BSP.

The space-related role of government ministries encompasses not only the aforementioned involvement of Cabinet ministers in SHSD and the provision of secondments to ONSP/NSPS, but ministries and their competent ministers also appear to have to plan, draft and implement space-related strategies coherent with the current BSP version within their ministerial responsibilities and allocated budget priorities.[683]

Established pursuant to the 'Incorporated Administrative Agency General Provisions Law' and JAXA Law, JAXA primarily is, despite its secondments to the space policy and strategy-focused ONSP/NSPS, an implementation-oriented national space agency.[684] Initially constituted as an incorporated administrative agency on 01.10.2003 by a merger of the National Space Development Agency, the National Aerospace Laboratory of Japan,

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677 Anan (n 674) 212–213. Based on the information provided by a Japanese space expert, CNSP membership was increased from seven to nine in August 2016.
678 Information provided by Japanese space experts in 2016.
679 BSL art 32.
680 For more information on the IGS constellation, see this study's Section 7.6.2.
681 Anan (n 674) 212.
682 For more information on this council, see: 'Defense of Japan 2014' (*Japan Ministry of Defense*) 125–127 <http://www.mod.go.jp/e/publ/w_paper/pdf/2014/DOJ2014_2-2-1_web_1031.pdf> accessed 22 June 2017.
683 See the provisions in BSL and JAXA Law, as well as the information in: Anan (n 674) 213.
684 Based on information in JAXA Law arts 2,4,18 and: Naoki Okumura, 'To Become a National Research and Development Agency' (*JAXA*, April 2015) <http://global.jaxa.jp/about/president/> accessed 30 May 2016.

and the Institute of Space and Aeronautical Science,[685] it is officially designated as a National Research and Development Agency since 01.04.2015.[686] MEXT is the competent ministry in charge of JAXA. Other ministries, the prime minister and his ministers are involved with JAXA as explicitly prescribed to them.[687]

7.4 Space-related state preferences

7.4.1 Socioeconomic state preferences

This study argues that the government's current space-related socioeconomic state preference is the advancement of Japan's socioeconomic development. Additionally, it concludes that there seem to be four target areas under this state preference. These are the expansion of the domestic (private) space industry, the extension of the domestic space market, the enhancement of the Japanese space industry's role in the international space market, and the development and application of space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan. All this develops from the following narrative.

Overall, the government puts forward three civil goals in its presently active 3rd BSP:

- utilising outer space for realising a safe and affluent society;
- utilising outer space for dealing with global challenges; and
- building new domestic space-related industries.[688]

With no official definition in its accessed material, this study ultimately interprets the first civil goal of utilising outer space for realising a safe and affluent society as to stand for the space-related socioeconomic state preference of advancing Japan's socioeconomic development. This interpretation also holds up to BSL's partial stipulation that the government shall engage in space development and use 'in order to improve the lives of the citizenry', 'to ensure a safe and secure society' and 'to mitigate […] poverty'.[689]

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685 Based on information in JAXA Law art 3 and supplemental provisions, as well as in: 'Introduction of JAXA' (*JAXA*) <http://global.jaxa.jp/about/jaxa/> accessed 30 May 2016; 'New JAXA Philosophy and Corporate Slogan' (*JAXA*, 9 October 2013) <http://global.jaxa.jp/press/2013/10/20131009_jaxa_e.html> accessed 1 August 2016.

686 Based on information in: Okumura (n 684); 'JAXA History' (*JAXA*) <http://global.jaxa.jp/about/history/> accessed 30 May 2016.

687 Based on information in JAXA Law art 26 and: Anan (n 674) 213.

688 Komiya (n 659) 5; JAXA's English homepage also introduces JAXA's management philosophy as to incorporate: 'To realize a safe and affluent society using space and the sky.' See: 'JAXA Philosophy / Code of Conduct' (*JAXA*) <http://global.jaxa.jp/about/philosophy/> accessed 13 June 2017.

689 BSL art 3.

The second civil goal of utilising outer space for dealing with global challenges seems to be a segment of the government's space-related socioeconomic state preference. After all, global challenges that the government apparently deems currently highly prevalent and threatening to the country, as well as to the international community as a whole, are those related to the socioeconomically relevant areas of 'energy, environment, food and natural disasters'.[690] The utilisation of outer space to increase Japan's capabilities for disaster management and for tackling environmental issues makes especially sense. Japan is prone to natural disasters like earthquakes. The great earthquake in 2011 negatively affected the country's economy, energy security and human safety. It left thousands dead, destroyed domestic infrastructure and buildings and led to a nuclear catastrophe.[691] A government plan from 2015 also shows that the government is aware that climate change negatively affects Japan's socioeconomic status on a broad level.[692] Combining this second civil goal under the 3rd BSP with BSL's stipulation that the government shall engage in space development and use 'to mitigate disasters, poverty and various other threats to the survival and lives of humankind[…]',[693] as well as with this study's findings on the socioeconomic orientation of various current major government-promoted space-related measures,[694] it is ultimately reasonable to conclude the following here: the government's current space-related socioeconomic state preference includes the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan.

The other three – and somewhat interlinked – target areas of expanding the domestic (private) space industry, extending the domestic space market, and enhancing the Japanese industry's role in the international space market finally emerge from the existence of the government's third present BSP-specific civil goal of building new domestic space-related industries and the following narrative regarding its (planned) space-related industry and market engagement.

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690 Komiya (n 659) 5.

691 Based on information in: 'Information on Disaster Risk Reduction of the Member Countries' (*Asian Disaster Reduction Center*) <http://www.adrc.asia/nationinformation.php?NationCode=392> accessed 25 April 2017; Will Ripley, Junko Ogura and James Griffiths, 'Fukushima: Five Years after Japan's Worst Nuclear Disaster' (*CNN*, 11 March 2016) <http://www.cnn.com/2016/03/08/asia/fukushima-five-year-anniversary/index.html> accessed 9 May 2017.

692 'National Plan for Adaptation to the Impacts of Climate Change' (*Ministry of Environment, Government of Japan*, 27 November 2015) <https://www.env.go.jp/en/earth/cc/nationalplan151127-2.pdf> accessed 12 May 2017.

693 BSL art 3.

694 See especially this study's Sections 7.6.1-4. For example, there appear to be measures focussing on issues in such areas like agriculture, climate change, disaster management, construction, the environment, energy, fishery, forestry, infrastructure, meteorology and transportation.

In short, the government appears to be aware that the expansion of the domestic (private) space industry, including through the building of new domestic space-related industries, offers a potential to reinvigorate Japan's since the 1990s stagnating and sometimes even shrinking economy.[695] Reportedly, the government even set out in the course of the 3rd BSP 'to boost the value of Japan's space industry to ¥5 trillion [$42 billion] over the next decade.'[696] In the context of its Space Industry Vision 2030 from 2017, which originated in a CNSP subcommittee, the government seems to have dialled back a bit but still aims at 'doubling its space market to about 2.4 trillion yen ($21.1 billion) by the early 2030s.'[697] Towards that end, the government apparently gives particular importance to the reduction of the domestic space industry's extreme dependency from government demand (reportedly standing at over 90% around 2017). It further wants to support a shift – but of course not a full departure – from the domestic space industry's previous focus on space hardware research and development to this industry's emphasis on establishing (domestically and internationally) marketable space hardware and software capacities. Based on the available information, the hardware component might presumably involve the (future) development and marketisation of internationally competitive launcher, debris removal, space solar power and satellite remote sensing, communications and positioning technologies. The software component might involve the creation and domestic and international commercialisation of space-based data, as well as the development and marketisation of domestically and internationally competitive user-oriented products and services using – among others, certain government-provided – space-based data.[698]

A look into BSL also supports the space industry and market-specific conclusions above. This law wants the government to undertake space development and use 'to strengthen the technical capabilities and international competitiveness of the space industry and

695 Based on information in: Deyana Goh, 'Japan Looks to Space Industry to Stimulate Stagnant Economy' (*SpaceTech Asia*, 1 February 2018) <http://www.spacetechasia.com/japan-looks-to-space-industry-to-stimulate-stagnant-economy/> accessed 24 March 2018; Keith Breene, 'Why Is Japan's Economy Shrinking?' (*World Economic Forum*, 16 February 2016) <https://www.weforum.org/agenda/2016/02/why-is-japans-economy-shrinking/> accessed 25 April 2017.

696 'Abe Approves New Space Policy with Profit, Security in Mind' (*The Japan Times*, 9 January 2015) <http://www.japantimes.co.jp/news/2015/01/09/national/new-space-policy-focuses-security-science> accessed 20 July 2017.

697 Based on information in: 'Japan Aims to Double Its Space Market to $21bn by 2030s' (*Nikkei Asian Review*, 12 May 2017) <http://asia.nikkei.com/Business/Trends/Japan-aims-to-double-its-space-market-to-21bn-by-2030s> accessed 14 June 2017; Suzuki (n 666) 44–45. Citation based on first link.

698 Based on information in: Goh (n 695); 'Japan Aims to Double Its Space Market to $21bn by 2030s' (n 697); Suzuki (n 666); Komiya (n 659) 65–70.

other industries of Japan, thereby contributing to the advancement of the industries of Japan, by the positive and systematic promotion of Space Development and Use as well as smooth privatization of the results of the research and development with regard to Space Development and Use.'[699]

7.4.2 Political state preferences

This study contends that one of the government's currently pursued space-related political state preferences is the advancement of Japan's international prestige and influence.

It surfaces from BSL's general stipulation that the government shall engage in space development and use 'to play a positive role and contribute to advancing national interests in international society, through positively promoting international cooperation and diplomacy with regard to Space Development and Use.'[700] Moreover, the presently active 3rd BSP, which bases on BSL provisions, reportedly publicly incorporates the position that 'we will engage in space development to directly utilize it for our nation's diplomatic and security policies[...].'[701] Since this study has found no hard evidence to the contrary, this position presumably includes the previously outlined international prestige and influence-oriented stance in the 1st BSP that Japanese space-related (cooperative) contributions to the international community, e.g. in disaster management and space science, 'are diplomatic assets which enhance Japan's international leverage and presence, as well as a source of its soft power. It is important for Japan to utilize this kind of power as a tool for diplomacy to assert itself in the international society.'[702] Lastly, this study wants to point out that the striving to advance Japan's international prestige and influence provides a plausible (partial) explanation for the existence of various current major government-promoted space-related measures.[703]

Similar to the Indian case and also lacking clear-cut evidence, a second current space-related political state preference that this study has decided to take into account at least tentatively is the increase of public support for the democratically elected Japanese government.

699 BSL art 4.
700 BSL art 6.
701 'Abe Approves New Space Policy with Profit, Security in Mind' (n 696).
702 SHSD (n 656) 8–10. Citation on 9.
703 See especially this study's Sections 7.6.6-7.

It is not farfetched to assume that any democratically elected Japanese government is aware that successfully implemented space undertakings, especially technologically complex ones (e.g. an asteroid mission), allow presenting itself to its people as the driver of national progress. This might translate into higher support for the government among the Japanese people.

7.4.3 National security state preferences

Safeguarding Japan's national security is the national security state preference underlying the government's current space programme.

This is apparent by, as introduced in Section 7.2, the government's adoption of the 3rd BSP to address, *inter alia*, its perceived changes in Japan's security environment and to factor in the increasing relevance of space for national security. In particular, the 3rd BSP shall interlock with the government's NSS. Notably, all this is also in line with BSL's call upon the government to undertake space development and use, among others, 'to ensure international peace and security; and to increase the national security of Japan'.[704]

This state preference includes at least two – interconnected – target areas. Two more can be taken into account tentatively.

The first evident target area is the enhancement of the Japanese military's strategic support system. It emerges from the 3rd BSP's directly mentioned space security goal of utilising outer space to strengthen Japan's security capabilities.[705] Moreover, a look into NSS suggests that the government presently aims, with a special view on supporting the operation of Japanese armed forces, at advancing Japan's space-related capabilities for information gathering, surveillance, maritime domain awareness, military communications and security-relevant navigation, positioning and timing services.[706]

The second definite target area is the improvement of the US-Japanese alliance, with a focus on furthering their military deterrence and response capabilities. This surfaces similarly from a space security goal under the 3rd BSP, namely the goal of strengthening the US-Japanese alliance through space cooperation.[707] Japan's fixation on amplifying

704 BSL art 3.
705 Komiya (n 659) 5.
706 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 9,19-20.
707 Komiya (n 659) 5.

this alliance is highly reasonable. As laid out in the NSS, the two parties are already allies for over 60 years, and the Japanese government perceives their alliance generally as a cornerstone of Japan's security and a positive influence on regional peace, stability and prosperity.[708] Concerning the alliance's space element, it appears from the deliberations of Kallender and Hughes that the Japanese government currently sees an increased development of domestic space-related military support capabilities, which links to the first target area, and their collaborative integration with respective US capabilities within the US-Japanese alliance as important steps to mitigate a potential abandonment of Japan by the USA in the security sector, as well as to increase their alliance's military strength.[709] According to the NSS, the Japanese government has a particular interest in engaging with the USA regarding the latter aspect in such a way that it bolsters their military deterrence and response capabilities.[710]

This study's evaluation of current major government-promoted space-related measures introduces various examples, especially in the form of satellite projects, that display and consequently foster the above conclusions about the existence of these two target areas.[711]

Notably, a look into NSS indicates that the Japanese government has in all of that especially the activities of three of the other preeminent Asian governments in the space sector, namely China, Iran and North Korea, on its national security radar.[712]

The third and fourth target area under the Japanese government's national security state preference that this study has decided to take into account at least tentatively are the prevention of the weaponisation of and an arms race in outer space, as well as the hedging against potential enemies' use of their space capabilities during armed conflict with Japan. After all, the available information offers some pointers for the existence of such target areas, but it is not clear enough to draw a definite conclusion about them yet. For example, Nobushige Takamizawa, the Japanese ambassador to the Conference on

708 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 20–23.

709 Paul Kallender and Christopher W Hughes, 'Hiding in Plain Sight? Japan's Militarization of Space and Challenges to the Yoshida Doctrine' [2018] Asian Security 1, 4,8-9,12-14.

710 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 22.

711 See especially Sections 7.6.2-4; the overall argument is supported by the findings in: Kallender and Hughes (n 709) 5-12,19(Endnote 1).

712 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 6-8,11-13; regarding the concerns about China see also: Paul Kallender-Umezu, 'Japan Boosts Space Spending In Support of Security Focus' (*SpaceNews*, 2 February 2015) <http://spacenews.com/japan-boosts-space-spending-in-support-of-security-focus/> accessed 20 July 2017; the effect of North Korean and Chinese activities is also referred to in: Kallender and Hughes (n 709) 8–9.

Disarmament stated in 2017: ‘Japan reaffirms the importance of enhancing the rule of law in outer space and will continue working with other nations to that end. In this connection, we reiterate the need to implement principles of responsible behavior for outer space activities, which could be an important step for international rule-making. In particular, we encourage all states to refrain from any action which brings about, directly or indirectly, damage or destruction of space objects. We thus continue to express our concerns about the development of anti-satellite weapons (ASAT) capability. With regard to the idea of preventing an arms race in outer space, which we support in principle, Japan’s outer space activities have always been peaceful in nature and this will continue. We have participated in substantive discussions on the Prevention of an Arms Race in Outer Space (PAROS) within the CD, including the Way Ahead Working Group that was established this year.’[713] Additionally, Nakasuka has, within the context of Japan’s 3rd BSP, concluded that, ‘[b]y working for the resilience of [its] space systems and promoting the creation of international rules concerning the utilization of space, Japan will prevent any abnormal change in outer space from adversely affecting Japan’s security and civilian use of outer space and secure the stable utilization of outer space.’[714] Future research might have access to better information and be able to clarify the existence of these two target areas beyond reproach.

7.4.4 Science and technology state preferences

This study holds on the basis of various indicators that the government’s current space-related science and technology state preference is the advancement of Japan’s scientific and technological level per se; whereby the reference to ‘per se’ indicates here more of a basic research and knowledge gathering orientation.

First, BSL stipulates that the government shall engage in space development and use ‘to contribute to the realization of the aspirations of humankind and the development of human society, by promoting state-of-the-art Space Development and Use as well as

713 ‘Statement by Nobushige Takamizawa, Ambassador of Japan to the Conference on Disarmament, at the First Committee of the 72nd Session of the General Assembly - Thematic Debate: Outer Space - October 17, 2017, New York’ (21 October 2017) 2 <http://www.disarm.emb-japan.go.jp/files/000300878.pdf> accessed 29 August 2018.

714 Shinichi Nakasuka, ‘The Current Status and Review of Japan’s Space Security Policy Seen in the Basic Plan on Space Policy and Subsequent Discussions’ (National Institute for Defense Studies International Symposium on Security Affairs ‘Space Security: Trends and Challenges’, Hotel Chinzanso Tokyo, Japan, 30 November 2015) 4–5 <http://www.nids.mod.go.jp/english/event/symposium/pdf/2015/E-10.pdf> accessed 2 April 2018. Citation on 4.

advancing space science in consideration of the fact that the aggregate knowledge of space is an intellectual asset of humankind.'[715] Second, and somewhat coherent with that, the 3rd BSP's implementation schedule as of 08.12.2015 promotes measures related to space science and exploration to enhance humankind's intellectual property.[716] Third, this study identifies several current major government-promoted space-related measures that (partially) fit the pursuit of such a state preference.[717]

7.4.5 Autonomy-oriented state preferences

The government currently appears to pursue two space-related autonomy-oriented state preferences.

The first one is to ensure the stable use of outer space for Japan. The government's 3rd BSP directly states it as a policy goal.[718] Also, Section 7.6.8 shows that the government currently engages in some major space-related measures that apparently are directed towards serving the pursuit of such a state preference. The relevance that the government gives to the latter is obvious by a look into NSS. The document presents the stable use of outer space to be pertinent to Japan's national security and economy, as well as its people's lives.[719] Particular factors that the government seems to worried about are the congestion of space by space assets of a growing number of actors, the increasing amount of space debris, as well as the threat to Japanese space assets and the space environment stemming from other states' development of counterspace weapons.[720]

The second space-related autonomy-oriented state preference is the development and maintenance of the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. The argumentative starting point is BSL stipulating that 'it is important for the State to have the capability to independently develop, launch, track, and operate artificial satellites, etc.'[721] Moreover, the 3rd BSP sets out to maintain and strengthen Japan's space-related industrial, scientific and

715 BSL art 5.
716 Komiya (n 659) 59–60.
717 See especially this study's Sections 7.6.5-7.
718 Komiya (n 659) 5.
719 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 19.
720 Based on information in: Komiya (n 659) 5; 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 9.
721 BSL art 15.

technological basis. Statements in the context of the 3rd BSP read that Japan's '[i]ndustrial basis is essential for conducting space activities autonomously' and that there previously were '[i]nsufficient [Japanese] efforts of R&D in use of space for security purpose and of making the most of outcomes of R&D in civil space areas for industrial vitalization.'[722] NSS further notes that technological development is vital for Japan's national security, economic strength and capability to deal with global issues.[723] Lastly, this state preference is somewhat palpable by this study determining that the government presently puts in most activity fields more emphasis on promoting major domestic than major cooperative space-related measures.[724]

7.5 Basic pol. & leg. framework concerning IGO-based regional space cooperation

This study has found no evidence that the Japanese government has taken any steps under its current space programme to establish or enter an IGO-based regional space cooperation mechanism involving other preeminent Asian governments in the space sector. Yet, such a collaboration potential is not excluded either. For example, the BSL provisions apparently allow for IGO-based space cooperation in general.[725] Moreover, the participation of Japanese government-related (as well as non-governmental) entities in APRSAF,[726] which has also seen an involvement of, among others, Chinese, Indian and South Korean government-related entities,[727] suggests a willingness on the Japanese side to engage within regional institutions with other preeminent Asian governments in the space sector. Notably, a Japanese membership in APSCO presumably failed so far not least due to strained Sino-Japanese political relations and a Japanese perception that APSCO is too dominated by and dependent on China.[728]

In terms of principles guiding Japan's current intergovernmental space cooperation, BSL appears to provide the most explicit input. It stipulates that Japanese space undertakings need to be coherent with international space-related agreements ratified by Japan, as well as the principle of pacifism enshrined in the Constitution of Japan.[729] Similar to the other

722 Komiya (n 659) 5.
723 'National Security Strategy December 17, 2013 (Provisional Translation)' (n 661) 19–20.
724 See the findings throughout this study's Section 7.6.
725 BSL arts 6,19.
726 'JAPAN' (*APRSAF*) <https://www.aprsaf.org/participants/countries/japan.php> accessed 13 October 2018.
727 'Countries and Regions' (n 405).
728 Author's discussions with Japanese space experts in 2016.
729 BSL art 2.

preeminent Asian governments in the space sector, Japan is party to four of the five main international space agreements. It signed and ratified the Outer Space Treaty in 1967.[730] In 1983, it further acceded to the Rescue Agreement, the Liability Convention, and the Registration Convention.[731] Japan has not entered the Moon Agreement. Regarding the pacifism prerequisite, the Japanese government nowadays subscribes to the non-aggressive interpretation of peaceful purposes in the case of outer space.[732]

Finally, it shall not be forgotten here that Japan, alongside such states like India and South Korea, is an MTCR partner.[733] As such, the Japanese government, if it takes its MTCR participation seriously, presumably has only a limited current potential to engage cooperatively with non-partners of MTCR like China, Iran and North Korea in the field of space launcher development.

7.6 Major domestic and cooperative space-related measures

7.6.1 APRSAF

The Japanese government's current main institutionalised regional cooperative space-related measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector is APRSAF.

Established in 1993 and led by Japan, APRSAF is no IGO. Instead, its overall framework allows arguing that it somewhat crosses the line towards 'an open and flexible'[734] regional space cooperation regime. Its current central features are its executive committee, its

730 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies' (*U.S. Department of State*) <http://www.state.gov/t/isn/5181.htm> accessed 20 July 2017.

731 'UK Depositary Status List: Agreement on the Return of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space' (n 563); 'UK Depositary Status List: Convention on International Liability for Damage Caused by Space Objects' (n 563); 'Depositary: Convention on Registration of Objects Launched into Outer Space' (*UN*, 20 July 2017) <https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXIV-1&chapter=24> accessed 20 July 2017.

732 Setsuko Aoki, 'National Space Laws of Japan: Today and Tomorrow' (Presentation, United Nations/China/APSCO Workshop on Space Law 'The Role of National Space Legislation in Strengthening the Rule of Law', Beijing, 18 November 2014) slides 21,23,26 <http://www.unoosa.org/documents/pdf/spacelaw/activities/2014/pres10E.pdf> accessed 18 February 2018; Yasuaki Hashimoto, 'Japanese Space Security Policy and Utilization' (National Institute for Defense Studies International Symposium on Security Affairs 'Space Security: Trends and Challenges', Hotel Chinzanso, Tokyo, 30 November 2015) 1–4 <http://www.nids.mod.go.jp/english/event/symposium/pdf/2015/E-05.pdf> accessed 2 April 2018.

733 'MTCR Partners' (n 407). For more information on MTCR, see this study's Section 5.5.

734 'Principles of APRSAF' (*APRSAF*) <http://www.aprsaf.org/about/pdf/Principles.pdf> accessed 19 August 2014.

annual conference-like plenary meeting, which is by now the largest annual space-related event in the Asia-Pacific region, its working groups (on space application, space technology, space environment utilisation and space education) and its initiatives.[735] Participation, which is on a strictly voluntary basis, is open to governmental and non-governmental entities. More precisely, APRSAF allows for the participation of 'agencies involved in space science, technology and its applications and governmental bodies, as well as companies, universities and research institutes in the region of Asia and the Pacific and international organizations.' Furthermore, '[a]gencies involved in space science, technology and its applications and organizations based outside the region that support the objectives of APRSAF may also participate in APRSAF meetings and activities.' In the context of its study, it is important to note that APRSAF has seen participation by, among others, Chinese, Indian, Japanese and South Korean government-related (and non-governmental) entities.

Purpose and activity-wise, APRSAF promotes the exchange of information and opinions on space programmes, space resources as well as applications of space science and technology among space-related agencies and international organisations in the region. Moreover, it supports the identification of common interests among regional space actors and the establishment of mutually beneficial cooperative measures in the pursuit of such interests. The most emphasised purpose and related activity field are the endorsement of joint measures in space technology and its application for sustainable socioeconomic development in the Asia-Pacific region, apparently including environmental protection.[736]

While these do not represent all APRSAF-linked measures involving Japan, this study has found that *Sentinel Asia*, *Space Applications for Environment* (SAFE), *Asian Beneficial Collaboration through "Kibo" Utilisation* (Kibo-ABC) and Climate R³ have constituted the most important specific major Japanese government-promoted cooperative measures under APRSAF in recent years:

Sentinel Asia, initially set up in 2005 and continuously managed by the Japanese side, is directed towards advancing disaster management, especially for the mitigation of the

735 Based on information in: 'About APRSAF' (n 412); APRSAF Task Force, 'Asia-Pacific Regional Space Agency Forum (APRSAF) Task Force Final Report' (Final Report, APRSAF 2013) <http://www.aprsaf.org/about/pdf/TF_Report_(Final-13Dec12).pdf> accessed 25 July 2016. The plenary meeting did not take place in 1995, 2002 and 2009, but was organised twice in 2004 and 2010.

736 Based on information in: 'Principles of APRSAF' (n 734); 'Countries and Regions' (n 405). Citations in first link.

number of human casualties and social and economic losses, in the Asia-Pacific region through application of space technology, e.g. remote sensing satellites.[737] *Sentinel Asia*'s currently over 100 governmental, non-governmental and international institution-based joint project team members include, among others, government-related entities from China, India, Japan and South Korea.[738]

SAFE, initially established in 2008 by a proposal from the Japanese side, focuses on the study of environmental changes and the development of practical solutions through space technology and data application. Notably, there seems to have been no particular involvement of government-related entities from any of the other preeminent Asian governments in the space sector.[739]

Kibo-ABC, formally proposed in 2011 with the blessing of the Japanese government as the owner of the ISS's *Japanese Experiment Module "Kibo"*, fosters the utilisation of the said module in the Asia-Pacific region. The utilisation for educational and scientific endeavours appears to have dominated so far. Kibo-ABC members are, among others, the national space agencies of Japan and South Korea.[740]

Climate R³, adopted in 2011, has been already completed by 2017. Its primary purpose was 'to determine the ability of APRSAF countries and institutions to benefit from the data and information which will be provided by selected climate-related satellite missions in coming years.' Among the many participants were – considering the topic presumably somewhat government-approved – entities from, e.g., India, Japan and South Korea.[741]

737 Based on information in: 'About Sentinel Asia' (*Sentinel Asia*) <https://sentinel.tksc.jaxa.jp/sentinel2/MB_HTML/About/About.htm> accessed 29 July 2016; 'Sentinel-Asia: Disaster Management Support System In The Asia-Pacific Region' (*APRSAF*) <http://aprsaf.org/initiatives/sentinel_asia/> accessed 29 July 2016.

738 'JPT Members' (n 410).

739 Based on information in: 'SAFE: Space Applications For Environment' (*APRSAF*) <http://aprsaf.org/initiatives/safe/> accessed 29 July 2016; 'About SAFE' (*Earth Observation Research Center, JAXA*, March 2016) <http://www.eorc.jaxa.jp/SAFE/about/> accessed 30 July 2016; 'History' (*Earth Observation Research Center, JAXA*, March 2016) <http://www.eorc.jaxa.jp/SAFE/about/history/> accessed 26 March 2018.

740 Based on information in: 'Kibo-ABC (Asian Beneficial Collaboration through "Kibo" Utilization)' (*APRSAF*) <http://aprsaf.org/initiatives/kibo_abc/> accessed 26 March 2018; 'Terms of Reference for the Initiative of Asian Beneficial Collaboration through "Kibo" Utilization (Kibo-ABC)' (*APRSAF*) 1 <http://aprsaf.org/initiatives/kibo_abc/pdf/Kibo-ABC_TOR.pdf> accessed 30 July 2016.

741 'Twentieth Session of the Asia-Pacific Regional Space Agency Forum (APRSAF-20) Climate R³ (Regional Readiness Review for Key Climate Missions) Proposed Outline' (n 411). Citation on 1.

Overall, this study derives from all that information that the Japanese government's engagement within APRSAF is arguably primarily directed towards supporting the pursuit of the following space-related state preferences:

First, and quite obviously, the Japanese government seems to employ APRSAF to foster the pursuit of its current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan.

Second, the proposed exchange of information and opinions on, among others, applications of space science and technology among APRSAF participants as well as the inclusion of scientific endeavours within Kibo-ABC suggests that the Japanese government considers APRSAF an option to add to the pursuit of its current space-related science and technology state preference.

Third, Japan's leadership role in APRSAF and Japanese entities' strong involvement in various APRSAF-specific undertakings allow concluding that the Japanese government sees this regime as a valuable instrument to increase its space-related linkage with other APRSAF participants, believing that it might help to advance Japan's international prestige among and influence over them in general. This suits one of the government's current space-related political state preferences.

Fourth, the Japanese government likely considers APRSAF as a mechanism that can temporarily support the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining Japan's domestic human, industrial, scientific and technological capacities and capabilities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. The combination of Japan's continued leadership role in APRSAF, the latter's openness to the participation of governmental and non-governmental entities, including regional companies, universities and research institutes, as well as the proposed exchange of information and opinions on space programmes within this regime at least indicates such a direction.

7.6.2 Remote sensing

7.6.2.1 Major domestic measures

Currently, the overarching major Japanese government-promoted domestic space-related remote sensing measure arguably is the continuous development and application of various domestic(ally controlled) remote sensing satellite series.

Besides the satellites belonging to the IGS constellation that is introduced in more detail further below, the specific major government-promoted domestic remote sensing satellite series in the 21st century seemingly have been the *Advanced Land Observing Satellite* (ALOS) series,[742] the *Global Change Observation Mission* (commonly known as GCOM) series,[743] the *Greenhouse Gases Observing Satellite* (commonly known as GOSAT) series[744] and the *Himawari* series.[745]

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742 Based on information in: 'Advanced Land Observing Satellite-2 (ALOS-2) DAICHI-2' (*JAXA*, April 2014) <http://global.jaxa.jp/projects/sat/alos2/pdf/daichi2_e.pdf> accessed 1 May 2017; Komiya (n 659) 6,9,23-24; 'Advanced Land Observing Satellite-2 "DAICHI-2" (ALOS-2)' (*JAXA*) <http://global.jaxa.jp/projects/sat/alos2/> accessed 1 May 2017; 'About Advanced Optical Satellite' (*JAXA*) <http://global.jaxa.jp/projects/sat/alos3/> accessed 25 March 2018; 'Japan Aerospace Exploration Agency (JAXA)' (*International Charter Space & Major Disasters*) <https://disasterscharter.org/web/guest/charter-members/jaxa> accessed 30 March 2018; 'Satellite Programs Observation Satellites' (*Mitsubishi Electric Corporation*) <http://www.mitsubishielectric.com/bu/space/satellite/observation/> accessed 16 May 2017.

743 Based on information in: Komiya (n 659) 6,9,31-32; 'GCOM-W: Global Change Observation Mission - Water "SHIZUKU"' (*JAXA*) <http://global.jaxa.jp/activity/pr/brochure/files/sat25.pdf> accessed 2 May 2017; 'Global Change Observation Mission - Water "SHIZUKU" (GCOM-W)' (*JAXA*) <http://global.jaxa.jp/projects/sat/gcom_w/> accessed 2 May 2017; 'GCOM-C: Global Change Observation Mission-Climate' (*JAXA*) <http://global.jaxa.jp/activity/pr/brochure/files/sat30.pdf> accessed 2 May 2017; 'Global Change Observation Mission - Climate (GCOM-C)' (*JAXA*) <http://global.jaxa.jp/projects/sat/gcom_c/> accessed 2 May 2017.

744 Based on information in: Akimasa Sumi, 'President's Greeting The Past, Present and Future of the GOSAT Mission' (*National Institute for Environmental Studies*, Summer 2015) <http://www.gosat.nies.go.jp/en/about.html> accessed 28 April 2017; 'Global Greenhouse Gas Observation by Satellite GOSAT Project' (Pamphlet (7th edn), Satellite Observation Center, National Institute for Environmental Studies July 2016) <http://www.gosat.nies.go.jp/eng/GOSAT_pamphlet_en.pdf> accessed 28 April 2017; 'GOSAT-2 Project at the National Institute for Environmental Studies' (Pamphlet, Satellite Observation Center, National Institute for Environmental Studies September 2016) <http://www.gosat-2.nies.go.jp/uploads//GOSAT-2_en_v2.3.pdf> accessed 28 April 2017; 'The Global Observing System for Climate: Implementation Needs' (Implementation Plan GCOS-200 (GOOS-214), GCOS Secretariat, World Meteorological Organization 2016) 95 <https://library.wmo.int/opac/doc_num.php?explnum_id=3417> accessed 28 April 2017; Komiya (n 659) 6,9,29-30; 'Satellite Programs Observation Satellites' (n 742).

745 Based on information in: Kotaro Bessho and others, 'An Introduction to Himawari-8/9 — Japan's New-Generation Geostationary Meteorological Satellites' (2016) 94(2) Journal of the Meteorological Society of Japan 151; Caleb Henry, 'Japan Launches Himawari-9 Weather Satellite Into Orbit' (*Space.com*, 3 November 2016) <http://www.space.com/34603-japan-launches-himawari-9-weather-satellite.html> accessed 27 April 2017; Komiya (n 659) 6,9,27-28; 'About Us' (*Japan Meteorological Agency*) <http://www.jma-net.go.jp/msc/en/remark/greeting.html> accessed 26 April 2017; 'JMA Geostationary Meteorological Satellite System for Himawari-8/9' (*Japan Meteorological Agency*) <http://www.jma-net.go.jp/msc/en/general/system/system89/index.html> accessed 26 April 2017; 'Products and Library' (*Japan Meteorological Agency*) <http://www.data.jma.go.jp/mscweb/en/product/index.html> accessed 27 April 2017. The series is a continuation of Japan's GMS and MTSA series.

Based on the information presented in the footnotes of the respective satellite series above, these series appear to be primarily aimed at serving the government's current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan. For example, these series shall assist in dealing with issues related to such socioeconomically relevant areas like agriculture, climate change, disaster management, the environment, energy, fishery, forestry, industry, infrastructure, meteorology (including weather analysis, forecasting and monitoring), shipping, solar power, transport, wildfires and yellow dust.

A different story is the IGS constellation, supposedly implemented under the responsibility of the Cabinet Secretariat. In short, this specific major government-promoted domestic space-related remote sensing measure encompasses the creation of a – not yet completed – operational ten satellite constellation, consisting of two optical, two radar, four surveillance capability augmentation and two data relay satellites. Also, and presumably in an attempt to strengthen such a constellation's resiliency, it is notable here that the government's current space programme apparently includes the development of small satellites that can be put into orbit within a short launch window.

Overall, the IGS constellation is beyond doubt primarily oriented towards fostering the pursuit of the government's current space-related national security state preference, including the target areas of enhancing the Japanese military's strategic support system (especially against such states like China and North Korea), as well as of improving the US-Japanese alliance, with a focus on furthering their deterrence and response capabilities (especially against such states like China and North Korea).

For one, its development was a reaction to the DPRK's alleged satellite launch in 1998 that took many in Japan by surprise, flew over Japanese territory and was broadly perceived as a North Korean long-range ballistic missile test. Moreover, the reported main reconnaissance targets of the IGS constellation are China and North Korea. Also, observers reasonably argue that the Japanese government sees such a domestically controlled constellation benefiting Japan's security status by lowering its dependency from US satellite reconnaissance and commercial remote sensing satellite data. At the same time, the IGS constellation allows Japan to increase its space-related contribution to the US-Japanese alliance. Notably, while not constituting a priority, the constellation might in certain situations additionally serve Japan's disaster management activities.[746]

For the sake of completion, this study wants to point out here that the government's deliberation of the future development of satellite-based early-warning technology, e.g. infrared sensors, fits into the IGS constellation's narrative, and thus might warrant some more analytical attention soon as well.[747]

7.6.2.2 Major cooperative measures

In terms of major government-promoted cooperative space-related remote sensing measures, the 3rd BSP indicates that the government currently considers especially collaborations encompassing 'joint development of satellites, piggybacking of mission equipment and materials, and earth observation based on the joint use of satellite data.'[748]

Excluding APRSAF-related measures, and without claiming completeness, the (more) specific current major government-promoted cooperative space-related remote sensing measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector seem to encompass the following:

Japan through JAXA contributes, alongside the space agencies of, among others, China, India and South Korea, remote sensing data from domestic satellites to the International Disaster Charter. In particular, Japan shares data derived from ALOS-2 (and before that the first ALOS), as well as cameras attached to the ISS.[749]

Japanese government-related entities engage in GEO alongside China, India, Iran and South Korea,[750] and WMO alongside China, India Iran, North Korea and South Korea.[751]

746 Based on information in: Joan Johnson-Freese, 'Japan Joins the Exclusive Space Spy Club' (*YaleGlobal Online*, 31 March 2003) <http://yaleglobal.yale.edu/content/japan-joins-exclusive-space-spy-club> accessed 1 May 2017; Paul Kallender-Umezu, 'What's Behind Japan's Sudden Thirst for More Spy Satellites' (*SpaceNews*, 13 November 2015) <http://spacenews.com/whats-behind-japan-sudden-thirst-for-more-spy-satellites/> accessed 1 May 2017; Mike Wall, 'Japanese Spy Satellite Launches to Watch North Korea' (*Space.com*, 16 March 2017) <http://www.space.com/36099-japan-launches-spy-satellite-igs-radar-5.html> accessed 30 April 2017; Komiya (n 659) 6,17-22; 'Information Gathering Satellites' (*Spaceflight101.com*) <http://spaceflight101.com/spacecraft/information-gathering-satellites/> accessed 1 May 2017.

747 Komiya (n 659) 55–56.

748 ibid 106.

749 'The International Charter Space and Major Disasters' (n 236) 23.

750 'Member List' (n 238); Komiya (n 659) 103.

751 'Members' (n 240).

The Indian-Japanese MoU 2016 promotes, among others, (further) collaboration in EO applications, presumably especially to reap socioeconomic benefits.[752]

In sum, the information presented in the context of these cooperative measures allows arguing that their primary orientation is towards serving the pursuit of the government's current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan.

Besides that, the Japanese government is surely aware that such cooperative measures can, e.g. through its contributions to others' disaster management, add to the pursuit of its space-related political state preference of advancing Japan's international prestige and influence with its respective partners.

7.6.3 Communications and broadcasting

7.6.3.1 Major domestic measures

One of the current major government-promoted domestic space-related communications and broadcasting measures is the utilisation of domestic(ally controlled) satellite-based communications and broadcasting capabilities, presumably in the pursuit of the government's current space-related socioeconomic state preference.[753]

Besides that, the government currently invests into the development and launch of a domestic optical data-relay communications satellite by around FY2019, presumably to assist Japan's civil and security-related remote sensing undertakings.[754] As such, the satellite shall apparently aid the pursuit of all space-related state preferences underlying the aforementioned major government-promoted space-related remote sensing measures.

Finally, the government presently promotes the development of the domestic(ally controlled) *X-Band Satellite-based Defence Communication Network* under the purview of its Ministry of Defence. Potentially fully established by FY2020, this network shall

752 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

753 Komiya (n 659) 115–116.

754 ibid 37–38.

consist of three government-owned satellites and supersede the Japanese military's commercial use of secure X-band communications links aboard the *Superbird-B2*, *Superbird-C2* and *Superbird-D* communications satellites that are privately owned by the domestic Sky Perfect JSAT Corporation. The task of implementing and operating the new network's first two satellites called DSN-1 and DSN-2 lies with DSN Corporation, a joint venture of Japanese enterprises SKY Perfect JSAT Corporation (majority owner), NEC Corporation and NTT Communications Corporation based on a PFI contract with the Ministry of Defence running from 15.01.2013 to 31.03.2031. Reports indicate that the purchase of the third satellite is underway.

Undoubtedly, this new network shall primarily support the pursuit of the government's space-related national security state preference, especially the target area of enhancing the Japanese military's strategic support system. After all, the network shall reportedly strengthen the Japanese military's command and control, as well as information and communications capabilities. The trigger for investing in this network was the government's realisation of the fractured and overburdened status quo of the Japanese military's communications capabilities. The fear has been that this situation causes problems in addressing the growing regional assertiveness of states like China efficiently.[755]

7.6.3.2 Major cooperative measures

Excluding APRSAF-related measures, and without claiming completeness, this study has only found these two current major government-promoted space-related cooperative communications and broadcasting measures:

755 Combined information in: ibid 39–40; SKY Perfect JSAT Holdings Inc., 'Execution of a Program to Upgrade and Operate X-Band Satellite Communications Functions by the Subsidiary' (News Release, SKY Perfect JSAT Corporation 15 January 2013) <http://www.sptvjsat.com/wp-content/uploads/130115_hd_DSNPFIEN.pdf> accessed 4 May 2017; Peter B de Selding, 'Japan Selects Military Satellite Telecom Provider' (*SpaceNews*, 28 November 2012) <http://spacenews.com/japan-selects-military-satellite-telecom-provider/> accessed 4 May 2017; Nobuhiro Kubo, 'Sources: Tarpaulin Delays Japanese Military Communications Satellite by Two Years' (*SpaceNews*, 19 July 2016) <http://spacenews.com/sources-tarpaulin-delays-japanese-military-communications-satellite-by-two-years/> accessed 4 May 2017; Peter B de Selding, 'Japan's DSN-1 Military Communications Satellite Damaged during Transport to Launch Base' (*SpaceNews*, 20 June 2016) <http://spacenews.com/japans-dsn-1-military-communications-satellite-damaged-during-transport-to-launch-base/> accessed 4 May 2017; Stephen Clark, 'Japan Puts Its First Military Communications Satellite into Orbit' (*Spaceflight Now*, 24 January 2017) <https://spaceflightnow.com/2017/01/24/japan-puts-its-first-military-communications-satellite-into-orbit/> accessed 4 May 2017.

The Indian-Japanese MoU 2016 promotes cooperation in the application of satellite-based communications, presumably especially to reap socioeconomic benefits.[756] As such, the Japanese government likely engages in this measure primarily in the pursuit of its space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan.

Additionally, Japan is, alongside all the other preeminent Asian governments in the space sector, a member state of ITU. This shall presumably aid the pursuit of all space-related state preferences underlying the Japanese government's major space-related communications and broadcasting measures.[757]

Last but not least, it is not unreasonable to assume at this point that the Japanese government also engages in all these cooperative measures in the hope that they assist in the pursuit of its space-related political state preference of advancing Japan's international prestige and influence with its respective partners.

7.6.4 Navigation

7.6.4.1 Major domestic measures

With the Cabinet Office apparently taking on the general management responsibility for this system, the Japanese government's current main domestic space-related navigation project is the development and application of QZSS.

In short, QZSS is a government-owned GPS-compatible regional satellite navigation system offering publicly available but also special government-regulated navigation, positioning and timing signals. Ultimately, it shall consist of seven satellites, including an integrated SBAS for aircraft, and relevant ground infrastructure to improve navigation, positioning and timing services in Japan and the surrounding region. The first satellite was launched in 2010. The system, with satellites purchased from the domestic private industry, may be completed by around FY2023, whereas SBAS shall already be operational around FY2020. Quasi-Zenith Satellite System Services Inc. (QSS), a special-

756 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

757 For more information, see this study's Section 4.6.3.3.

purpose company established under a PFI between a domestic private industry actor and the government, functions as the ground system operator, including with regard to the daily command and control of the satellites. The SBAS project falls under the responsibility of the Ministry of Land, Infrastructure, Transport and Tourism.[758]

Overall, QZSS appears to be primarily aimed at fostering the pursuit of these two space-related state preferences:

First, there is the pursuit of the government's current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan. After all, the available information points out QZSS's potential use in such socioeconomically relevant areas like agriculture, construction, disaster management, people's personal lives and transport.

Second, there is the pursuit of the government's current national security state preference, in particular the target areas of enhancing the Japanese military's strategic support system, as well as of improving the US-Japanese alliance. For example, the information in the context of the 3rd BSP refers to QZSS's potential contribution to improving national security capabilities and strengthening the US-Japanese alliance.[759]

7.6.4.2 Major cooperative measures

Currently, the general major government-promoted cooperative space-related navigation measures (with a presumed high potential for) involving other preeminent Asian government's in the space sector seem to be the Japanese government's active promotion of the application of GNSS, including QZSS, for socioeconomic development in Japan and the Asia-Pacific region, as well as the creation of the overseas infrastructure relevant to Japanese and regional users of QZSS.[760]

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758 Komiya (n 659) 6,9,11-14; Yoshiyuki Murai, 'Project Overview of The Quasi-Zenith Satellite System' (Presentation, 56th CGSIC, Portland, 12 September 2016) <http://www.gps.gov/cgsic/meetings/2016/murai.pdf> accessed 29 April 2017; Souichirou Kozuka and Ingo Baumann, 'The Emerging Legal Debate Around Japan's QZSS' (2016) 11(4) InsideGNSS 39; 'What Is the Quasi-Zenith Satellite System (QZSS)?' (*Cabinet Office, Government Of Japan*) <http://qzss.go.jp/en/overview/services/sv02_why.html> accessed 29 April 2017.

759 Based on information in: Komiya (n 659) 11–14; Murai (n 758); 'User Guide' (*Cabinet Office, Government Of Japan*) <http://qzss.go.jp/en/usage/useimage/index.html> accessed 29 April 2017.

760 Komiya (n 659) 81-82,109.

A more specific measure in this regard appears to be the involvement of Japanese government-related (and non-governmental) entities in *Multi-GNSS Asia* (MGA). In short, MGA, which shows some similarities with APRSAF regarding its internal structure, was established on 04.09.2011 and has its roots in the *Multi-GNSS Demonstration Campaign in the Asia-Oceania region*, which was originally proposed by JAXA in 2009. Overall, MGA aims at 'promot[ing] social progress and better standards of life in the Asia Oceania region through the application of "Multi-GNSS" technologies for such purposes as, for example, the mitigation of environmental and natural hazard impacts so as to ensure a safe and secure society, and the encouragement of economic growth by peaceful utilization of "Multi-GNSS" products and services.' The related approach 'is to encourage GNSS signal and service providers and user communities in the Asia Oceania region to develop new applications, and to carry out experiments or demonstrations by using all available "Multi-GNSS" systems whose interface control documents are public, on a best efforts basis in the spirit of international cooperation.'[761] MGA has governmental and non-governmental participants from the Asian and some other world regions. Notable Japanese participants comprise, among others, JAXA and NEC Corporation, which is a private industry actor connected to QZSS. Except for the participation of the South Korean government-affiliated National Geographic Information Institute, all other South Korean and all Indian members are currently non-governmental. There are no Iranian or North Korean participants, and the sole Chinese member is presently a China-based campus of a UK university.[762]

Besides that, the Indian-Japanese MoU 2016 also promotes cooperation in the application of satellite-based navigation, presumably especially to reap socioeconomic benefits.[763]

From all that, it is a reasonable conclusion that these cooperative measures are primarily directed towards serving the pursuit of the government's current socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for Japan.

761 Multi-GNSS Asia (MGA) TERMS OF REFERENCE (adopted October 2014, effective from 11 October 2014, latest revision on 15 November 2016).

762 'Members' (*Multi-GNSS Asia*) <http://www.multignss.asia/members.html> accessed 30 April 2017.

763 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

Yet, this study contends that the Japanese government might also hope that these measures additionally aid the pursuit of its current space-related political state preference of advancing its international prestige and influence with its respective partners.

7.6.5 Science and technology research

7.6.5.1 Major domestic measures

Without claiming completeness, this study has identified various specific current major Japanese government-promoted domestic space-related science and technology measures outside of lunar, planetary and asteroid exploration missions. In short, the more science-oriented measures comprise *EQUilibriUm Lunar-Earth point 6U Spacecraft* (EQUULEUS),[764] *Exploration of energization and Radiation in Geospace' spacecraft* (ERG; dubbed: ARASE),[765] *Solar Physics Satellite* (SOLAR-B; nicknamed: HINODE)[766] and *X-ray Astronomy Satellite* (ASTRO-H).[767] The more technology-oriented measures are the *Super Low Altitude Test Satellite* (SLATS) series,[768] the *Advanced Satellite with New system ARchitecture for Observation* (ASNARO) series, which saw its first launch in 2014,[769] and the long-standing Japanese *Engineering Test Satellite* (ETS) series.[770]

764 'International Partners Provide Science Satellites for First SLS Mission' (*SpaceDaily*, 30 May 2016) <http://www.spacedaily.com/reports/International_Partners_Provide_Science_Satellites_for_Americas_Space_Launch_System_Maiden_Flight_999.html> accessed 5 May 2017.

765 Based on information in: Komiya (n 659) 59; 'Exploration of Energization and Radiation in Geospace "ARASE" (ERG)' (*JAXA*) <http://global.jaxa.jp/projects/sat/erg/> accessed 5 May 2017; 'ERG: Exploration of Energization and Radiation in Geospace' (Pamphlet, JAXA) <http://global.jaxa.jp/activity/pr/brochure/files/sat36.pdf> accessed 5 May 2017.

766 'Solar Physics Satellite "HINODE" (SOLAR-B)' (*JAXA*) <http://global.jaxa.jp/projects/sat/solar_b/> accessed 5 May 2017.

767 Based on information in: Komiya (n 659) 59; '"Hitomi" (ASTRO-H) Science Goals' (*JAXA*) <http://global.jaxa.jp/projects/sat/astro_h/goals.html> accessed 5 May 2017; Jeff Foust, 'JAXA Abandons Efforts to Recover Hitomi Satellite' (*SpaceNews*, 28 April 2016) <http://spacenews.com/jaxa-abandons-efforts-to-recover-hitomi-satellite/> accessed 5 May 2017; 'International Collaboration' (*JAXA*) <http://global.jaxa.jp/projects/sat/astro_h/collaboration.html> accessed 5 May 2017.

768 Based on information in: Komiya (n 659) 31; 'SLATS : Super Low Altitude Test Satellite' <http://global.jaxa.jp/activity/pr/brochure/files/sat37.pdf> accessed 2 May 2017; Maciej Heyman, 'Super Low Altitude Test Satellite Planned for Fiscal Year 2017 – SatNEWSwire' (*satNEWSwire*, 3 May 2017) <http://satnewswire.com/super-low-altitude-test-satellite-planned-for-fiscal-year-2017/> accessed 18 May 2017.

769 Based on information in: Komiya (n 659) 33–34; Stephen Clark, 'Japanese Satellites Launched on Soviet-Era Missile' (*Spaceflight Now*, 6 November 2014) <https://spaceflightnow.com/2014/11/06/japanese-satellites-launched-on-sovietera-missile/> accessed 3 May 2017; 'Technology Demonstration Satellite ASNARO-1 Was Successfully Launched' (*Ministry of Economic, Trade and Industry of Japan*) <http://www.meti.go.jp/english/press/2014/1106_02.html> accessed 3 May 2017; 'ASNARO : Advanced Satellite with New System Architecture for Observation' (*Japan Space Systems*) <http://www.jspacesystems.or.jp/en_project_asnaro/> accessed 3 May 2017.

770 Based on information in: Komiya (n 659) 35–36; 'Mitsubishi Electric Chosen as Prime Contractor of Japanese Government's Engineering Test Satellite 9' (*Mitsubishi Electric Corporation*, 7 April 2017) <http://nl.mitsubishielectric.com/en/news-events/releases/global/2017/0407-a/index.page> accessed 3 May 2017.

Despite sometimes involving international collaboration, all can be considered domestic measures due to Japan's apparent domestic control over them.

SOLAR-B, launched in 2006, is a Japanese-US-UK mission to study solar explosions and predict solar events relevant for Earth. ERG, launched in 2016, aids the study of high-energy electrons in geospace, e.g. to advance weather research and mitigate satellite malfunctions, equipment damage and radiation threats to astronauts. EQUULEUS, developed between JAXA and the University of Tokyo, is a cubesat mission scheduled for 2019 to study Earth's plasmasphere and the plasma distribution around Earth, e.g. to improve measures protecting humans and electronics from radiation damage in outer space. Moreover, it shall demonstrate low-energy trajectory control techniques within the Earth-Moon region. ASTRO-H, which included contributions from Canada, ESA and the USA but failed soon after its launch in 2016, was supposed to strengthen humanity's understanding of the structure and evolution of the universe, e.g. by studying black holes, galaxy clusters, heavy elements and physics in extreme conditions.

SLATS, scheduled for launch in FY2018, will test Japanese EO satellite technology at super low altitudes to reduce future EO satellite manufacturing and launch costs and to enhance domestic EO resolution capabilities. ASNARO-2, launched in January 2018, is a technology test mission that serves the domestic development of small-sized, high-performance and low-cost satellite series that can be launched within a short time-frame. ETS-9, scheduled for launch around FY2021, shall test domestic satellite technology to enhance Japan's national research and development infrastructure and space industry capability. Also, the government apparently hopes that these activities ultimately improve Japan's international commercial competitiveness in the satellite market.[771]

For the sake of completion, this study wants to add here that the Japanese government apparent promotion of domestic research and development into space solar power system technology fits into this technology development narrative, and thus might warrant some more analytical attention soon as well.[772]

771 These findings are based on the information presented in the footnotes regarding the specific missions.
772 Komiya (n 659) 81–82.

Arguably, these measures are mainly directed towards fostering the pursuit of the government's current science and technology state preference of developing Japan's space science and technology per se.

However, the government presumably promotes such measures further with an eye to their potential future contribution to the pursuit of other space-related state preferences. For example, as indicated above, the government apparently hopes that its satellite technology development activities also enhance domestic EO resolution capabilities, allow cutting costs, and improve Japan's international commercial competitiveness in the satellite market. Moreover, the science-oriented measures that shall improve the understanding of dangers in the space environment additionally suit the pursuit of the government's current space-related autonomy-oriented state preferences of ensuring the stable use of outer space for Japan.

7.6.5.2 Major cooperative measures

Excluding APRSAF-related measures, and without claiming completeness, the major government-promoted cooperative space-related science and technology research measure (with a presumed high potential for) involving preeminent Asian governments in the space sector seems to encompass only the following:

The Indian-Japanese MoU 2016 promotes cooperation on space exploration and science, as well as research and development regarding space systems and technology.[773] Before that, the Indian and Japanese space agencies apparently entered an agreement for cooperation on space x-ray observations in 2007.[774]

In short, it is reasonable to assume that these measures are directed towards serving the pursuit of the Japanese government's space-related science and technology state preference, and, to some degree, its space-related political state preference of advancing Japan's international prestige and influence (with India).

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773 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

774 'Joint Statement On the Roadmap for New Dimensions to the Strategic and Global Partnership between India and Japan' (n 465).

7.6.6 Human spaceflight

7.6.6.1 Major domestic measures

This study has found no serious intention by the Japanese government to establish an independent human spaceflight project under its current space programme.

7.6.6.2 Major cooperative measures

The Japanese government's primary cooperative human spaceflight measure remains its participation in the ISS alongside the USA, Russia, ESA and Canada.[775]

Concerning specific major government-promoted cooperative human spaceflight measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector, the closest measures are the already introduced Kibo-ABC within APRSAF, as well as the three-year-long *United Nations/Japan Cooperation Programme on CubeSat Deployment from the International Space Station (ISS) Japanese Experiment Module (Kibo) "KiboCUBE"* set up by JAXA and UNOOSA in September 2015. The latter programme supports developing countries in conducting space activities and developing their spacecraft capabilities by offering to deploy cubesats linked to developing countries' educational or research institutions from the Kibo module.[776]

Overall, the Japanese government likely conducts these two specific cooperative measures in the context of its participation in the ISS mainly in the pursuit of its current space-related political state preference of advancing its international prestige and influence with its respective partners (developing countries), as well as to add to the pursuit of its current space-related science and technology state preference.

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775 Komiya (n 659) 61–62.

776 'Collaboration between JAXA and UNOOSA to Offer Small Satellite Deployment Opportunity from Kibo to Contribute to Developing Countries to Improve Space Technology' (*JAXA*, 9 August 2015) <http://global.jaxa.jp/press/2015/09/20150908_unoosa.html> accessed 19 June 2017; 'The United Nations/Japan Cooperation Programme on CubeSat Deployment from the International Space Station (ISS) Japanese Experiment Module (Kibo) "KiboCUBE"' (*UNOOSA*) <http://www.unoosa.org/oosa/en/ourwork/psa/hsti/kibocube.html> accessed 19 June 2017.

7.6.7 Exploration of celestial bodies, including the Moon

7.6.7.1 Major cooperative measures

Within the 3rd BSP's timeframe, the Japanese government continues with some previously commenced as well as promotes several new specific major domestic lunar, planetary and asteroid exploration measures.

Without claiming completeness, the most prominent missions as of 2017, several of which involve international but no notable regional intergovernmental cooperation, appear to be *Hayabusa-2*,[777] *Martian Moons eXploration* (MMX),[778] *Outstanding MOon exploration Technologies demonstrated by NAno Semi-Hard Impactor* (OMOTENASHI),[779] *Smart Lander for Investigating Moon* (SLIM),[780] *Spectroscopic Planet Observatory for Recognition of Interaction of Atmosphere* (SPRINT-A; dubbed: HISAKI),[781] and *Venus Climate Orbiter* (Planet-C; dubbed: AKATSUKI).[782]

In terms of lunar exploration, the SLIM mission, scheduled for around FY2019, is a Japanese lunar lander project to enhance domestic landing technology and techniques for future space exploration activities. OMOTENASHI, developed between JAXA and the University of Tokyo, is a cubesat mission scheduled for 2019 to test domestic technology

777 Based on information in: 'HAYABUSA A Technology Demonstrator for Sample and Return' (Pamphlet, JAXA) <http://global.jaxa.jp/projects/sat/muses_c/files/hayabusa_return.pdf> accessed 5 May 2017; For Hayabusa see: 'HAYABUSA Return to the Earth' (Press Kit, JAXA) <http://global.jaxa.jp/projects/sat/muses_c/files/presskit_hayabusa_e.pdf> accessed 5 May 2017; For Hayabusa-2 see: 'Astroid Explorer Hayabusa2' (Pamphlet, JAXA) <http://global.jaxa.jp/activity/pr/brochure/files/sat33.pdf> accessed 5 May 2017.

778 Based on information in: Komiya (n 659) 59–60; 'Martian Moons EXploration (MXX) Mission Overview' (Presentation, Signing Ceremony for the Implementation Arrangement with CNES on Cooperative Activities in MMX (Martian Moons eXploration), Tokyo, 10 April 2017) <http://www.isas.jaxa.jp/en/topics/files/MMX170412_EN.pdf> accessed 5 May 2017; 'MMX - Martian Moons EXploration' (*Institute of Space and Astronautical Science, JAXA*) <http://mmx.isas.jaxa.jp/> accessed 5 May 2017; 'JAXA and CNES Make and Sign Implementing Arrangement on Martian Moons Exploration (MMX)' (*Institute of Space and Astronautical Science, JAXA*, 10 April 2017) <http://www.isas.jaxa.jp/en/topics/000950.html> accessed 5 May 2017.

779 Based on information in: 'International Partners Provide Science Satellites for First SLS Mission' (n 764); Stephen Clark, 'NASA Confirms First Flight of Space Launch System Will Slip to 2019' (*Spaceflight Now*, 28 April 2017) <https://spaceflightnow.com/2017/04/28/nasa-confirms-first-flight-of-space-launch-system-will-slip-to-2019/> accessed 7 August 2017.

780 Based on information in: Komiya (n 659) 59; 'Japanese Lunar Lander to Be Built by Mitsubishi Electric' (*Nikkei Asian Review*, 18 May 2016) <http://asia.nikkei.com/Tech-Science/Tech/Japanese-lunar-lander-to-be-built-by-Mitsubishi-Electric> accessed 24 May 2017; 'SLIM' (*Institute of Space and Astronautical Science, JAXA*) <http://www.isas.jaxa.jp/en/missions/spacecraft/developing/slim.html> accessed 5 May 2017.

781 'Spectroscopic Planet Observatory for Recognition of Interaction of Atmosphere "HISAKI" (SPRINT-A)' (*JAXA*) <http://global.jaxa.jp/projects/sat/sprint_a/> accessed 5 May 2017.

782 'Venus Climate Orbiter "AKATSUKI" (PLANET-C)' (*JAXA*) <http://global.jaxa.jp/projects/sat/planet_c/> accessed 5 May 2017.

in the development of low-cost and very small spacecraft for lunar surface exploration. It shall further measure the lunar radiation environment.

Regarding planetary exploration, SPRINT-A, launched in 2013, has been the world's first space telescope for remote observation of planets from Earth orbit. Japan's Planet-C, launched in 2010, continues to deliver data on Venus' climate and atmosphere. MMX, scheduled to launch around 2024, shall be a sample return mission from Mars' two Moons, Phobos and Deimos, to bolster knowledge of, e.g., their origin and the formation of planetary systems. While presumably remaining a primarily Japanese controlled mission, JAXA and the French space agency already signed an implementation agreement for MMX's research and development stage.

Finally, *Hayabusa-2*, launched in 2014, is an ongoing Japanese-controlled asteroid sample return mission to demonstrate space exploration technology and to foster the study of asteroids and the universe. However, it also involves a German-French lander and received some technical support from the USA.[783]

Altogether, these measures seem to mainly fit the pursuit of the government's current space-related science and technology state preference, but might, considering the still limited scope of such missions worldwide, also be considered useful by the government concerning the pursuit of its two current political state preferences.

7.6.7.2 Major cooperative measures

Presently, the government's specific major cooperative space-related measure (with a presumed high potential for) involving preeminent Asian governments in the space sector regarding the exploration of celestial bodies, including the Moon, seems to be following:

The Indian-Japanese MoU promotes cooperation on space exploration and science, as well as research and development regarding space systems and technology for presumably scientific purposes and to better the understanding of outer space.[784] This can likely cover cooperation in the exploration of celestial bodies, including the Moon.

783 Based on information provided in the footnotes regarding the specific missions.

784 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

Regarding lunar exploration, the Japanese and Indian space agencies have already announced that they commenced discussions on a joint mission to explore the lunar polar regions for water. Mission results might be important for the development of future human lunar habitations. Their mission proposal may be finalised around early 2019.[785]

In short, it is reasonable to assume that the Japanese government hopes that such collaboration serves the pursuit of its current science and technology state preference, as well as its two current space-related political state preferences.

7.6.8 Stable use of outer space

7.6.8.1 Major domestic measures

With a view to its current autonomy-oriented state preference of ensuring the stable use of outer space for Japan, the Japanese government presently especially promotes setting up an operational domestic Space Situation Awareness framework, e.g. for debris and satellite orbit monitoring. By FY2022, it shall encompass an optical telescope, radar and analysis system, capable of observing the low-earth orbit (objects as small as 10 cm) and the geostationary orbit.[786] Also, JAXA engages in the development of domestic space debris removal technology.[787] This includes support for Japanese industry actors in their attempts to create such technology.[788]

7.6.8.2 Major cooperative measures

Regarding major government-promoted cooperative space-related measures (with a presumed high potential for) involving preeminent Asian governments in the space sector to address the stable use of outer space for Japan, the government currently sees an importance in the formulation of suitable international regulations. e.g. in the form of a code of conduct, and the advancement of the rule of law in outer space.[789]

785 Harding and Kazmin (n 477).

786 Based on information in: 'Space Situational Awareness (SSA) System' (*JAXA*) <http://global.jaxa.jp/projects/ssa/> accessed 27 March 2018; Komiya (n 659) 51–52.

787 'On-Orbit Demonstration of Electrodynamic Tether on the H-II Transfer Vehicle (HTV) (Kounotori Integrated Tether Experiments (KITE))' (*JAXA*) <http://www.kenkai.jaxa.jp/eng/research/kite/kite.html> accessed 25 March 2018.

788 'ASTROSCALE and JAXA Conclude Joint Agreement to Counteract Space Debris' (*JAXA*, 12 September 2017) <http://global.jaxa.jp/press/2017/09/20170912_elsa-d.html> accessed 25 March 2018.

789 Komiya (n 659) 101–102.

Moreover, the Japanese space agency participates in IADC, which also involves, *inter alia*, the space agencies of China, India and South Korea.[790]

7.6.9 Launchers

7.6.9.1 Major domestic measures

The development and maintenance of domestic space launcher capabilities and capacities are a central element in the government's current space programme.

The particular focus is on the further development and maintenance of the two domestic space launching sites (Tanegashima Space Center; Uchinoura Space Center) and related facilities,[791] as well as Japan's three current main government-promoted launcher series, namely the H-IIA series, H-IIB series and *Epsilon* rocket series. Altogether, they allow for domestic launches of near-Earth to deep space missions, including for uncrewed services to the ISS. Notably, the production of all three launcher series involves private sector contractors. H-IIA and H-IIB launch services have already been privatised, and the current launcher under development, named H3, shall be privatised in the future. In the end, H3 shall supersede the H-IIA series and improve Japan's competitiveness in the international launch market.[792]

Table 4: Overview of main launcher series currently promoted by the Japanese government

Launcher	Maiden flight	Project responsibility	Primary contractor for launchers	Launch service provider	Launching site
H-IIA	2001	MEXT through JAXA	Since 2002: Mitsubishi Heavy Industries, LTD	Privatised 2007: Mitsubishi Heavy Industries, LTD	Tanegashima Space Center, JAXA
H-IIB	2009	MEXT through JAXA	Since 2003: Mitsubishi Heavy Industries, LTD	Privatised 2013: Mitsubishi Heavy Industries, LTD	Tanegashima Space Center, JAXA
H3	(FY2020)	MEXT through JAXA	Since 2014: Mitsubishi Heavy Industries, LTD	To be privatised: Mitsubishi Heavy Industries, LTD	Tanegashima Space Center, JAXA
Epsilon	2013	MEXT through JAXA	IHI Aerospace Co.	JAXA	Uchinoura Space Center, JAXA

The *Epsilon* launcher series, constituting a next-generation solid propellant rocket series, shall allow for simpler, more frequent and cheaper launches from Japanese soil, reducing

790 'Inter-Agency Space Debris Coordination Committee' (n 343).

791 'Field Centers' (*JAXA*) <http://global.jaxa.jp/about/centers/> accessed 30 May 2017; 'Tanegashima Space Center' (*JAXA*) <http://global.jaxa.jp/about/centers/tnsc/> accessed 30 May 2017; 'Uchinoura Space Center' (*JAXA*) <http://global.jaxa.jp/about/centers/usc/> accessed 30 May 2017.

792 Based on information in: Komiya (n 659) 41–44; 'Company History' (*MHI*) <http://h2a.mhi.co.jp/en/launch/history/index.html#anc01> accessed 30 May 2017; 'H-IIA Launch Vehicle' (*JAXA*) <http://global.jaxa.jp/projects/rockets/h2a/> accessed 30 May 2017; 'H-IIB Launch Vehicle' (*JAXA*) <http://global.jaxa.jp/projects/rockets/h2b/> accessed 30 May 2017; 'H3 Launch Vehicle' (*JAXA*) <http://global.jaxa.jp/projects/rockets/h3/> accessed 30 May 2017; 'Tanegashima Space Center' (n 791).

the price tag by – depending on the report – from a third to a half of that of its predecessor, the M-V rocket.[793]

Adding to all that, Japan also takes steps towards improving domestic launcher services by promoting research and development of reusable space transportation systems and creating the world's best performing, cheapest and lightest Liquefied Natural Gas propulsion system.[794]

Overall, three space-related state preferences arguably underlie these measures:

First, there is little doubt that these measures fit the pursuit of the government's space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. The autonomous implementation of the government's other domestic space undertakings rests on domestic launch capabilities and capacities.

Second, these measures are clearly oriented towards supporting the pursuit of the government's space-related socioeconomic state preference, especially the space industry and market-related target areas.

Third, it is likely that these measures shall contribute to the pursuit of the government's two space-related political state preferences. After all, there is still only a limited number of states, especially in the Asian region, with a broad range of domestic launching capabilities and capacities. Japan's impressive capabilities and capacities can foster the domestic standing of the democratically elected Japanese government, as well as showcase Japan's technological sophistication to the international community.

793 Based on information in: Komiya (n 659) 41,45-46; 'Epsilon Launch Vehicle' (*JAXA*) <http://global.jaxa.jp/projects/rockets/epsilon/> accessed 30 May 2017; Stephen Clark, 'Japan's "affordable" Epsilon Rocket Triumphs on First Flight' (*Spaceflight Now*, 14 September 2013) <https://spaceflightnow.com/epsilon/sprinta/130914launch/#.UjSh0cbkt8E> accessed 30 May 2017; Stephen Clark, 'Japan Schedules Launch of Innovative Epsilon Rocket' (*Spaceflight Now*, 5 November 2012) <https://spaceflightnow.com/news/n1211/05epsilon/> accessed 30 May 2017; 'Uchinoura Space Center' (n 791).

794 Komiya (n 659) 77–80.

7.6.9.2 Major cooperative measures

This study has found no major government-promoted cooperative launcher measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

7.6.10 Human resources

7.6.10.1 Major domestic measures

It is well-known that the Japanese government promotes a variety of domestic measures to foster Japan's space-related human resource development. Thus, this topic does not need to be discussed in detail here. For example, JAXA has a Space Education Center.[795] Also, various Japanese universities offer space-related education.[796]

Overall, these measures mostly fit the pursuit of the government's space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. After all, the successful implementation of domestic space undertakings depends on access to the relevant experts within the country.

7.6.10.2 Major cooperative measures

Excluding APRSAF-related measures, there appear to be not many major government-promoted cooperative space-related human resources-specific measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

The most prominent attempt in this regard seems to be the Indian-Japanese MoU 2016 addressing the exchange of personnel, joint organisation of workshops and training programmes regarding their cooperative undertakings.[797]

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795 'Space Education Center' (*JAXA*) <http://edu.jaxa.jp/en/> accessed 14 October 2018.

796 Eg: 'Best Global Universities for Space Science in Japan' (*U.S. News*) <https://www.usnews.com/education/best-global-universities/japan/space-science> accessed 14 October 2018; 'Institute of Space Law' (*Keio University*) <http://space-law.keio.ac.jp/> accessed 14 October 2018.

797 'Memorandum of Understanding between the Indian Space Research Organisation (ISRO) and the Japan Aerospace Exploration Agency (JAXA) Concerning Cooperation in the Field of Outer Space' (n 424).

State preference-wise, this study finds it reasonable to argue that the Japanese government presumably considers the engagement with India, at a minimum, as a temporarily useful tool for the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

Also, the Japanese government might hope that such cooperation benefits the pursuit of its space-related political state preference of advancing Japan's international prestige and influence (with India).

8 <u>Democratic People’s Republic of Korea (DPRK / North Korea)</u>

8.1 Analytical considerations

One of this study’s main challenges in its particular assessment of the DPRK government’s current space programme is that public access to (translated) domestic space-related political and legal documents is sparse.[798] In addition, all government policies and strategies are subject to, and all domestic legislation ranks below the – easily shiftable and not necessarily always publicly distributed – words and directives of the national leader.[799] Also, there is the great challenge that foreign media articles about the country are prone to engaging in wild speculations and spreading rumours.[800] Altogether, the limited public access to such documents and the national leader’s words and directives, as well as the emergence of speculations and rumours, presumably result from the North Korean government’s strict control over the flow of information on domestic matters and the well-known infusion of its officially distributed information with state propaganda. According to Green, Kim Jong-il (KJI), North Korea’s previous national leader, held the position ‘that it is to North Korea’s advantage for the international community to be unable to understand, preferably not even to know, what is going on inside the country and by what principles it is being run.’[801]

This study tackles these issues by carefully considering and interpreting a wide array of English material addressing aspects of the DPRK government’s current space programme, with special attention given to the national leader’s positions. Ultimately, this produces relatively robust findings regarding this study’s primary research interest.

8.2 Main domestic political and legal documents

Without claiming completeness and while acknowledging that they are subordinate to and easily modified or overturned by the national leader’s words and directives, this study’s

798 This is coherent with Goedde’s statement that ‘[l]egal materials on North Korea in the English language are not readily available to the general public, with the exception of a few law journal articles.’ Patricia Goedde, ‘UPDATE: Overview of the North Korean Legal System and Legal Research’ (*Hauser Global Law School Program, New York University School of Law*, March 2011) <http://www.nyulawglobal.org/globalex/North_Korea1.html> accessed 27 February 2018.

799 For more information on the national leader’s authority, see this study’s Section 8.3.

800 Anna Broinowski, ‘True or False: The “kooky” North Korea Stories They Couldn’t Make up – but Did’ (*The Guardian*, 1 June 2015) <https://www.theguardian.com/books/2015/jun/01/true-or-false-kooky-north-korea-stories> accessed 13 March 2017.

801 Christopher Green, ‘Wrapped in a Fog: On the North Korean Constitution and the Ten Principles’ (*Sino-NK*, 5 June 2012) <http://sinonk.com/2012/06/05/chris-green-on-10-principles/> accessed 18 April 2016.

accessed material suggests that at least the following few domestic political and legal documents play an important role in guiding the government's current space programme. Their known substance receives special scrutiny throughout this chapter.

Even though not much information about its particular provisions is publicly available, the central piece of domestic legislation affecting the government's current space programme seems to be the country's national space law called 'DPRK Law on Developing Space'. Reportedly, the Supreme People's Assembly (SPA), constituting North Korea's unicameral national legislature, adopted it in 2013.[802] Also, there is the 'Bylaw of the National Aerospace Development Administration of the Democratic People's Republic of Korea'[803] (NADA Bylaw). Apparently, it primarily regulates the National Aerospace Development Administration (NADA) that serves as the DPRK's national space agency.

Based on the known content of the NADA Bylaw, the national space law steers the government's space policy.[804] Document-wise, the latter appears to encompass, at a minimum, '5-year plan[s] for national aerospace development.'[805] The first such plan supposedly run from 2012-2016 and the second and presumably currently active one commenced in 2017. Their specific content remains obscure.[806]

8.3 Basic domestic decision-making system

Coherent with the aforementioned opaqueness of domestic matters, the basic domestic decision-making system behind the formulation and implementation of the government's

802 '7th Session of the 12th SPA Held (Updated)' (*North Korea Leadership Watch*, 1 April 2013) <https://nkleadershipwatch.wordpress.com/2013/04/01/7th-session-of-the-12th-spa-held/> accessed 22 April 2016. This study was unable to obtain an English translation of this law.

803 For an unofficial English translation of the NADA Bylaw, see: UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (27 February 2016) UN Doc S/2016/157 112–113. Further references to the NADA Bylaw are to this translation.

804 This is particularly indicated in NADA Bylaw arts 2,5. Since there is no evidence for two national space laws in the DPRK, the 'Law of the DPRK on the Space Exploration' referred to in NADA Bylaw art 2 can be considered to be identical with the aforementioned 'Law on Space Development'. For more information on NADA, see this study's Section 8.3.

805 For example, the Korean Central News Agency (KCNA) reported that the DPRK 'launched a sci-tech satellite Kwangmyongsong 3-2 in December 2012 and an earth observation satellite Kwangmyongsong-4 in February 2016 under the 2016 plan of the 5-year plan for national aerospace development.' 'DPRK, Full-Fledged Space Power' (*KCNA*, 31 August 2016) <http://www.kcna.kp> accessed 6 February 2017.

806 'DPRK Launch Plans' (*GlobalSecurity.org*) <http://www.globalsecurity.org/space/world/dprk/launch.htm> accessed 11 April 2017. This study was unable to obtain English copies of these plans.

current space programme is not known in detail. In the end, this study deems it sufficient for its particular assessment of the said programme to be aware of the following context, which also showcases the already stressed domestic political and legal dominance of the national leader.

Proclaimed by Kim Il-sung (KIS) under the prospect of Socialism in 1948, the DPRK has, *de facto*, developed into a totalitarian dictatorship. It is politically organised through a 'monolithic leadership system'[807] that is enshrined in the quasi-supra-constitutional document titled 'Ten Principles for the Establishment of the One-Ideology System' (10 Principles).[808] The 10 Principles in their current version determine, *inter alia*, that a single political party, namely the Workers' Party of Korea[809] (WPK), governs the DPRK. The party has absolute authority over the state and the military.[810] However, what is more, the 10 Principles and the 'Charter of the Workers' Party of Korea' (WPK Charter) together stipulate that the WPK is ultimately under the absolute authority of a sole leader. It makes the latter, nowadays usually addressed as 'Supreme Leader' in English (or '*Suryeong'* in a transliteration from the Korean language), consequently the highest military authority and effectively – but not nominally –[811] the head of the North Korean state and government.[812] Observers agree that SPA merely acts as a rubber-stamp institution

807 'Kim Jong Un Elected Chairman of WPK' (*KCNA*, 10 May 2016) <http://www.kcna.kp> accessed 16 May 2016.

808 Based on information in: 'Ten Principles for the Establishment of the One-Ideology System' (*Columbia Law School*, 8 April 2003) <http://www2.law.columbia.edu/course_00S_L9436_001/North%20Korea%20materials/10%20principles%20of%20juche.html> accessed 18 April 2016; Green (n 801); Fyodor Tertitskiy, 'The Party's 10 Principles, Then and Now' (*NK News*, 11 December 2014) <https://www.nknews.org/2014/12/the-partys-10-principles-then-and-now/> accessed 16 April 2016; Robert Collins, 'Marked for Life: Songbun North Korea's Social Classification System' (Report, The Committee for Human Rights in North Korea 2012) 15 <https://www.hrnk.org/uploads/pdfs/HRNK_Songbun_Web.pdf> accessed 11 April 2017. The 10 Principles' title here follows the translation offered by the Columbia Law School. For slight variations of their English title, see Tertitskiy's and Collins' texts.

809 'Workers' Party of Korea' (*Naenara*) <http://www.naenara.com.kp/en/politics/?organization> accessed 20 March 2017.

810 Tertitskiy (n 808). Since their first publication in 1974, the 10 Principles have been merely revised once in 2013. Tertitskiy's article includes an unofficial English translation of the basic content of the updated 10 Principles.

811 The DPRK's current nominal head of state is Kim Yong-nam, President of the Presidium of SPA: Sang-Hun Choe, 'Sister of North Korean Leader Arrives in South Korea for Highly Symbolic Trip' (*The New York Times*, 8 February 2018) <https://www.nytimes.com/2018/02/08/world/asia/north-korea-kim-sister-olympics.html> accessed 30 August 2018; the DPRK's current Premier is Pak Pong-ju: 'Pak Pong Ju' (*North Korea Leadership Watch*) <http://www.nkleadershipwatch.org/pak-pong-ju/> accessed 30 August 2018.

812 For information on the WPK Charter as of 2010, see: Jin Ha Kim, 'The North Korean Workers' Party Charter Revisions and Their Political Dynamics' (2011) CO 11-08 Online Series 1, 1–2; and as of 2016, see: 'Fourth and Final Day of the 7th Party Congress' (*North Korea Leadership Watch*, 10 May 2016) <https://nkleadershipwatch.wordpress.com/2016/05/10/fourth-and-final-day-of-the-7th-party-congress/> accessed 13 March 2017; for information on the 10 Principles, see: Tertitskiy (n 808); see also the argument in: Collins (n 808) 15–16. For the English and Korean title of the national leader, see,

publicly approving the Supreme Leader's and his WPK's decisions.[813] Similarly, '[t]he courts and procuracies are dependent on the KWP[814][...]',[815] and thus ultimately the Supreme Leader.

It is from this context that the Supreme Leader's decisions and positions need to be treated as politically and legally dominant in the formulation and implementation of the government's space programme. Overall, by putting Collins' findings for the time of previous Supreme Leader KJI into a more general layout, '[t]he specific hierarchy of authority in North Korea is the words or personal directives of [... the Supreme Leader]; followed by the [… 10 Principles], KWP directives—particularly the policy guidance of the KWP Secretariat's Organization and Guidance Department; the KWP Charter and domestic civil laws; and finally the [...] North Korean Constitution[, titled 'Socialist Constitution of the Democratic People's Republic of Korea' (DPRK Constitution)][816].'[817]

Kim Jong-un (KJU) - son of previous Supreme Leader KJI and grandson of state founder and the DPRK's first national leader KIS – has assumed the (apparently hereditary) position as Supreme Leader since the death of KJI in December 2011.[818] His control over the WPK, the state, including the government, and the military is fully formalised by granting him the officially most influential party, state and military offices and some particular titles established in the WPK Charter and the DPRK Constitution. In short, KJU currently leads the party as Chairman of the WPK (previously: First Secretary of the WPK). He guides the state, and thus effectively the DPRK Cabinet, SPA and other state

for example, Kim's paper and Collins' report.

813 Maria Rosaria Coduti, 'The State Affairs Commission and the Consolidation of Kim Jong Un's Power' (*NK News*, 13 July 2016) <https://www.nknews.org/2016/07/the-state-affairs-commission-and-the-consolidation-of-kim-jong-uns-power/> accessed 29 January 2017; Seol Song Ah, 'Inside North Korea's Supreme People's Assembly' (*The Guardian*, 22 April 2014) <http://www.theguardian.com/world/2014/apr/22/inside-north-koreas-supreme-peoples-assembly> accessed 21 April 2016; Dae-Kyu Yoon, 'The Constitution of North Korea: Its Changes and Implications' (2003) 27(4) Fordham International Law Journal 1289, 1292–1294.

814 KWP stands for Korean Workers' Party. It is another translation and abbreviation for the WPK.

815 Goedde (n 798).

816 For an English translation of the DPRK Constitution (as last amended 2016), see: 'Socialist Constitution' (*Naenara*) <http://www.naenara.com.kp/en/politics/?rule> accessed 27 January 2017. If not mentioned otherwise, future references to the DPRK Constitution are to this English version.

817 Collins (n 808) 15.

818 Based on information in: 'North Korean Leader Kim Jong-Il Dies "of Heart Attack"' (*BBC*, 19 December 2011) <http://www.bbc.co.uk/news/world-asia-16239693> accessed 18 January 2018; Ken E Gause, *North Korean Leadership Dynamics and Decision-Making under Kim Jong-Un. A Second Year Assessment* (COP-2014-U-006988-Final, CNA 2014) <https://www.cna.org/CNA_files/PDF/COP-2014-U-006988-Final.pdf> accessed 14 April 2016; Chad O'Carroll, 'Kim Jong Un yet to Consolidate Power: Expert' (*NK News*, 2 November 2015) <https://www.nknews.org/2015/11/kim-jong-un-yet-to-consolidate-power-expert/> accessed 14 April 2016.

institutions, as Chairman of the State Affairs Commission of the DPRK[819] (previously: First Chairman of the National Defence Commission of the DPRK).[820] Furthermore, the DPRK Constitution officially links this chairman position to the title of 'supreme leader'.[821] On the military side, KJU is Chairman of the Central Military Commission of the WPK,[822] while the DPRK Constitution declares that as Chairman of the State Affairs Commission he also controls all the state's armed forces and receives the additional title of 'supreme commander'.[823]

The domestic actors under KJU with the most influence on – the Supreme Leader's decisions and positions regarding – the government's current space programme are likely high-ranking members in the WPK, the state and the military, as well as loyalists in other positions close to the Supreme Leader, e.g. certain family members[824] and personal political staff.[825]

While the provisions in the NADA Bylaw allow for it being considered the government's national space agency on paper,[826] the actual role of NADA, presumably replacing the Korean Committee of Space Technology[827] (KCST) that was established in the 1980s under the rule of KIS,[828] in the formulation and implementation of the government's

819 See especially DPRK Constitution arts 103,106,109,123-126.

820 Combination of information in: Coduti (n 813); Gause (n 818) 1, 9; 'Seventh Congress of WPK Closes' (*KCNA*, 5 October 2016) <http://www.kcna.kp> accessed 12 May 2016.

821 DPRK Constitution art 100.

822 'Fourth and Final Day of the 7th Party Congress' (n 812).

823 DPRK Constitution art 102.

824 For example, his sister Kim Yo-jong: Choe (n 811).

825 See the State Affair Commission members chosen during the 4th Session of the 13th SPA in 2016: Coduti (n 813); Pinkston holds that the main domestic actors for space policy-making under KJI were the national leader and his senior advisors, whereas the latter are made up by loyalists connected to the WPK, the National Defence Commission, and the military: Daniel A Pinkston, 'North and South Korean Space Development: Prospects for Cooperation and Conflict' (2006) 4(2) Astropolitics 217–218 <207-227>.

826 According to NADA Bylaw art 3, the administration belongs to the DPRK Cabinet and is led by an administrator in the rank of a minister. Pursuant to NADA Bylaw art 4, its tasks involve drawing up comprehensive plans for the state's space undertakings, whereas these plans have to be approved by SPA through the DPRK Cabinet; offering unified guidance for the implementation of those plans; monitoring and controlling all elements related to national space undertakings; guiding production, assembly and launch of necessary space equipment and launchers; processing and disseminating space-derived data; being responsible for the safety of space activities and authentication of space exploration technology; and engaging in cooperation and exchanges with foreign and international space organisations.

827 Sometimes: Korean Committee for Space Technology.

828 UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (23 February 2015) UN Doc S/2015/131 22; Moltz (n 32) 170.

present space programme since its creation in 2013[829] remains speculative.[830] The same is true for less prominent domestic institutions thought or claiming to contribute to national space undertakings.[831]

8.4 Space-related state preferences

The evaluation of the state preferences underlying the government's current space programme profits considerably from certain knowledge of the domestic satellite launches as of 2017 and a basic understanding of the present main pillars of the North Korean state ideology.

8.4.1 Domestic satellite launches as of 2017

In short, the government has promoted the domestic launches of five domestically manufactured satellites christened *Kwangmyongsong* (KMS) between 1998 and 2016. The satellites' designations were KMS-1/-2/-3/-3-2/-4, respectively. The domestic launcher series used were *Paektusan-1*, *Unha-2*, *Unha-3* and (apparently with an identical name to the satellite series) *Kwangmyongsong*. The government's official position is that all these satellite missions except for KMS-3 were successful. However, reliable foreign observers argue that the KMS-1, KMS-2 and KMS-3 missions failed entirely. Also, they consider the KMS-3-2 and KMS-4 missions as to have been (at most) partially successful because these two satellites seem to have reached outer space but to have never been (fully) operational. Table 5 provides a quick overview of these and some additional fundamental facts and assumptions surrounding the five KMS missions:[832]

829 SPA initially decided on 01.04.2013 to set up a DPRK State Space Development Bureau: '7th Session of the 12th SPA Held (Updated)' (n 802); this bureau was later rebranded into NADA. See: 'National Aerospace Development Administration of DPRK' (*KCNA*, 31 March 2014) <http://www.kcna.kp> accessed 1 April 2016; 'For North Korea, New Space Agency Name and Logo Are Anything but "Nothing"' (*collectSPACE*, 2 April 2014) <http://www.collectspace.com/news/news-040214a-north-korea-nada-space-agency.html> accessed 1 April 2016.

830 This study's Section 8.4.5 addresses one particular issue in this regard.

831 For example, there is a Korea Space Association with the official 'mission [...] to promote the peaceful development and utilization of space, a wealth common to mankind, through brisk academic exchanges at home and abroad.' 'Korea Space Association Organized in DPRK' (*KCNA*, 27 June 2016) <http://www.kcna.kp> accessed 11 April 2017; and a potential contribution of the State Academy of Science: Harvey, Smid and Pirard (n 500) 449.

832 Overview in Table 5 based on information in: Harvey, Smid and Pirard (n 500) 441–485; Moltz (n 32) 170–171; Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 70-72,130-132; Harding (n 534) 175–177; 'DPRK to Launch Application Satellite' (*NCNK*, 16 March 2012) <http://www.ncnk.org/resources/publications/DPRK%20March%2016%20Satellite %20Announcement.pdf> accessed 5 March 2017; Nick Macfie, 'North Korea Gives Details of "Weather" Satellite Launch' (*Reuters*, 27 March 2012) <https://www.reuters.com/article/us-nuclear-summit-satellite/north-korea-gives-details-of-weather-satellite-launch-idUSBRE82Q01S20120327> accessed 5 March 2018; 'North Korea Rocket Launch Fails' (*BBC*, 13 April 2012)

Table 5: Overview of North Korean satellite launch attempts between 1998-2016

Launch date	Launcher	Payload	Official mission	Additional information
31.08.1998 (KJI)	*Paektusan-1*	KMS-1	Laying the foundation for development and launch of practical satellites	• On 04.09.1998, the DPRK announced that it put a satellite into orbit successfully; • Independent sources failed to confirm this claim. Foreign observers mostly treat the mission either as a failed satellite launch attempt or argue that it was a concealed long-range ballistic missile test; • Launcher may have been a variation of the *Taepodong-1* long-range ballistic missile.
05.04.2009 (KJI)	*Unha-2*	KMS-2	Experimental communications satellite to foster development and launch of practical satellites	• The DPRK claims that the mission was successful; • Foreign observers determined that the launcher and its potential payload fell into the Pacific ocean. Foreign researchers either treat the mission as a failed launch attempt or argue that it was again a concealed long-range ballistic missile test; • Launcher may have been a variation of the *Taepodong-2* long-range ballistic missile.
13.04.2012 (KJU)	*Unha-3*	KMS-3	EO for weather forecasting to foster agriculture and other economic fields	• The DPRK acknowledged that the mission failed; • The launcher and potential payload fell into the ocean; • Some foreign observers consider the launch a concealed long-range ballistic missile test; • Launcher presumably was an upgraded *Unha-2* launcher.
12.12.2012 (KJU)	*Unha-3*	KMS-3-2	EO for crops surveying, forest resources and natural disasters	• The DPRK claims that the mission was successful; • Payload presumably was a replacement for KMS-3; • Foreign observers confirmed that the satellite reached orbit, but their further observations indicate that it was tumbling and never operational.
07.02.2016 (KJU)	*Kwangmyongsong*	KMS-4	EO	• The DPRK claims that the mission was successful; • Foreign observers confirmed that KMS-4 reached orbit. However, first observations indicated that it was tumbling and missed its intended orbit slightly. Later observations suggest that the DPRK has been able to communicate with the satellite and to stabilise it. So far, foreign observers have been unable to detect any data transmission from the satellite. Consequently, they consider the satellite not (fully) operational; • Launcher may have been a renamed (and upgraded) *Unha-3* launcher.

Notably, the designations *Paektusan-1*, referring to Mount Paektu, and *Kwangmyongsong*, meaning 'Lodestar' or 'Bright Star', are homages to Supreme Leader KJI.[833] According to the official KJI biography, the soldiers who first congratulated on his birth in Paektusan Secret Camp were '[w]ishing him to become the lodestar that would brighten the future of Korea, [… and] hailed him as the Bright Star of Mt. Paektu.'[834]

<http://www.bbc.co.uk/news/world-asia-17698438> accessed 6 April 2017; 'DPRK National Aerospace Development Administration Releases Report on Satellite Launch' (*KCNA*, 7 February 2016) <http://www.kcna.kp> accessed 1 April 2016; John Schilling, 'North Korea's Space Launch: An Initial Assessment' (*38 North*, 9 February 2016) <http://38north.org/2016/02/jschilling020816/> accessed 8 April 2016; Andrea Shalal and David Brunnstrom, 'North Korea Satellite in Stable Orbit but Not Seen Transmitting: U.S. Sources' (*Reuters*, 9 February 2016) <https://www.reuters.com/article/us-northkorea-satellite-orbit/north-korea-satellite-achieves-stable-orbit-u-s-official-idUSKCN0VI1XN> accessed 8 March 2018; Michael Ellemann, 'North Korea Launches Another Large Rocket: Consequences and Options' (10 February 2016) <http://38north.org/2016/02/melleman021016/> accessed 5 April 2017; UN Secretariat 'Information furnished in conformity with the Convention on Registration of Objects Launched into Outer Space Note verbale dated 22 January 2013 from the Permanent Mission of the Democratic People's Republic of Korea to the United Nations (Vienna) addressed to the Secretary-General' (24 January 2013) UN Doc ST/SG/SER.E/662; UN Secretariat 'Information furnished in conformity with the Convention on Registration of Objects Launched into Outer Space Note verbale dated 25 April 2016 from the Permanent Mission of the Democratic People's Republic of Korea to the United Nations (Vienna) addressed to the Secretary-General' (9 May 2016) UN Doc ST/SG/SER.E/768.

833 Based on information in: 'Kwangmyongsong No. 1 "Satellite" Compendium' (*North Korean Economy Watch*) <http://www.nkeconwatch.com/category/military/rocket-tests/paektusan-1/> accessed 11 March 2017; Harvey, Smid and Pirard (n 500) 445–446.

834 *Kim Jong Il Biography 1* (Foreign Languages Publishing House 2005) 3 <www.naenara.com.kp/en/book/download.php?4+4013> accessed 4 April 2017.

8.4.2 Main pillars of North Korean state ideology

The North Korean state ideology usually endorses the national leader's primary political agenda.[835] As such, a basic understanding of the present main pillars of the state ideology can assist in the correct identification of the (leader-subservient) government's current space-related state preferences. As of 2017, this study holds that the main pillars are the *Byungjin* line, *Juche* philosophy, *Songun* politics and *Kimilsungism-Kimjongilism*.

8.4.2.1 *Byungjin* line

On 31.03.2013, the WPK under KJU adopted 'a new strategic line on carrying out economic construction[, which is often connected with a call to improve the North Korean people's living standard,][836] and building nuclear armed forces simultaneously under the prevailing situation and to meet the legitimate requirement of the developing revolution.' Through its implementation, the country is thought to 'emerge as a great political, military and socialist economic power and a highly-civilized country which steers the era of independence.'[837] This line is nowadays commonly known as *Byungjin* line, meaning to 'move two things forward simultaneously'.[838]

8.4.2.2 *Juche* philosophy

Juche, commonly referred to as meaning 'self-reliance', is a political philosophy first introduced in the 1950s and attributed to the political thought of KIS. It is currently promoted through, e.g., the 10 Principles and Art. 3 DPRK Constitution. For this study, it is enough to understand that *Juche* advocates three principles of self-reliance. More precisely, the principles are 'the line of [a)] independence, [b)] self-sustenance, and [c)] self-defense to [a)] consolidate the political independence of the country (*chaju*), [b)]

835 This argument rests upon the discussions of key ideological phrases in: Rüdiger Frank, 'Can North Korea Prioritize Nukes and the Economy At the Same Time?' (2014) 9(1) Global Asia 38, 39; Grace Lee, 'The Political Philosophy of Juche' (2003) 3(1) Stanford Journal of East Asian Affairs 105, 112; 'Juche [Self-Reliance or Self-Dependence]' (*Globalsecurity.org*) <http://www.globalsecurity.org/military/world/dprk/juche.htm> accessed 5 May 2016; 'Songun Chongch'i [Army First]' (*Globalsecurity.org*) <http://www.globalsecurity.org/military/world/dprk/songun-chongchi.htm> accessed 5 May 2016.

836 For example: 'Kim Jong Un Reviews Successes Made by WPK in Period under Review' (*KCNA*, 7 May 2016) <http://www.kcna.kp> accessed 12 May 2016; 'Spokesman for DPRK Foreign Ministry Urges U.S. to Choose between Two Options' (*NCNK*, 12 February 2013) <http://www.ncnk.org/resources/publications/DPRK_FM_3rd_Nuke_Test.pdf> accessed 5 March 2017.

837 As cited in: '2013 Plenary Meeting of WPK Central Committee and 7th Session of Supreme People's Assembly' (*North Korean Economy Watch*, 1 April 2013) <http://www.nkeconwatch.com/2013/04/01/2013-plenary-meeting-of-wpk-central-committee-and-supreme-peoples-assembly/> accessed 11 May 2016 (first citation originally in bold).

838 Frank (n 835) 38.

build up more solidly the foundations of an independent national economy capable of insuring the complete unification, independence, and prosperity of our nation (*charip*) and [c)] increasing the country's defense capabilities, so as to safeguard the security of the fatherland reliably by our own force (*chawi*), by splendidly embodying our Party's idea of *juche* in all fields.'[839] The *Byungjin* line appears to accentuate *Juche*'s self-sustenance and self-defence principles politically.

8.4.2.3 *Songun* politics

Presumably first put in place around 1995, the emergence of *Songun* politics, often referred to as 'military-first' politics,[840] is generally attributed to KJI.[841] In sum, it seems to give domestic prevalence to military affairs and the advancement of the DPRK's military power (especially in the form of nuclear weapons), all with a particular view on guaranteeing regime survival and upholding *Juche*'s self-defence principle.[842] On paper, it is still promoted through the DPRK Constitution (especially in its preamble and Art. 3), the WPK Charter[843] and the 10 Principles.[844] In practice, the newly embraced, two-pronged *Byungjin* line appears to have replaced *Songun* politics' relevance for the government.

8.4.2.4 Kimilsungism-Kimjongilism

In 2012, the WPK adopted *Kimilsungism-Kimjongilism* as the WPK's guiding ideological compass. A closer look indicates that this has brought little new to the table in terms of domestic politics. The phrase seems to mainly sum up the already officially promoted political thought of KIS and KJI, of which *Juche* philosophy and *Songun* politics are core elements, under a single ideological term.[845]

839 Lee, 'The Political Philosophy of Juche' (n 835) 105–107. As cited on 105-106 (numbering added); see also: 'Juche [Self-Reliance or Self-Dependence]' (n 835).

840 Subin Kim, '"Songun" Now Fading Away in North Korea: Expert' (*NK News*, 9 April 2015) <https://www.nknews.org/2015/04/songun-now-fading-away-in-north-korea-expert/> accessed 7 April 2016.

841 'Songun Chongch'i [Army First]' (n 835).

842 This argument rests upon the information and discussions in: 'Songun Politics' (*Naenara*) <http://www.naenara.com.kp/en/politics/?songun> accessed 27 September 2018; Han S Park, 'Military-First Politics (Songun): Understanding Kim Jong-Il's North Korea' (2007) 2(7) On Korea: Academic Paper Series 1; Patrick DeRochie, 'THE DRIVING FACTOR: Songun's Impact on North Korean Foreign Policy' (2011) XX(1) International Affairs Review 1; 'Songun Chongch'i [Army First]' (n 835).

843 Kim, 'The North Korean Workers' Party Charter Revisions and Their Political Dynamics' (n 812) 1–2.

844 Tertitskiy (n 808).

845 Based on information and statements in: Kim, '"Songun" Now Fading Away in North Korea: Expert' (n 840); 'KIMILSUNGISM-KIMJONGILISM-AN INTRODUCTION' (*Association for the Study of Songun Politics UK*) <http://www.uk-songun.com/index.php?p=1_351_KIMILSUNGISM-

8.4.3 Socioeconomic state preferences

The government's current space-related socioeconomic state preference appears, at least publicly, to be the advancement of North Korea's socioeconomic development.

In 2013, KJU prominently linked domestic space-related undertakings to the implementation of the new party line. As introduced in Section 8.4.2.1, this (*Byungjin*) line calls, among others, for economic construction and improvement of the North Korean people's living standard. Coherently, NADA was established as a government-related institution '[t]o step up economic construction and improve the people's standard of living by radically developing the space science and technology of the country and manage all the space activities of the DPRK in a uniform way[…].'[846] The NADA Bylaw mirrors this.[847] Also, later North Korean media articles have continuously corroborated the national space programme's socioeconomic orientation.[848]

The publicly available information further allows arguing that the development and application of space-related capabilities and capacities to deal with a few socioeconomically highly relevant issue-areas for North Korea is the primary target area under this space-related socioeconomic state preference. After all, the (ultimately completely failed) KMS-3 mission should have supported weather forecasting to foster North Korean agriculture and other economic fields, whereby the (at least partially failed) KMS-3-2 mission should have served the areas of crop surveying, disaster management and forestry.[849] On paper, these make for very reasonable applications. The DPRK has

KIMJONGILISM-AN-INTRODUCTION> accessed 12 May 2016; 'Kim Jong Un Makes Speech at Military Parade and Public Procession of Pyongyang Citizens' (*NCNK*, 11 October 2015) <http://www.ncnk.org/resources/news-items/kim-jong-uns-speeches-and-public-statements-1/kim-jong-un-makes-speech-at-military-parade-and-public-procession-of-pyongyang-citizens> accessed 7 April 2016.

846 '2013 Plenary Meeting of WPK Central Committee and 7th Session of Supreme People's Assembly' (n 837).

847 NADA Bylaw arts 2,5.

848 For example: 'National Aerospace Development Administration of DPRK' (n 829); 'NADA Director on Successes in Outer Space Development' (*KCNA*, 14 September 2015) <http://www.kcna.kp> accessed 13 April 2016; 'N. Korea Vows to Launch More Satellites' (*Yonhap News Agency*, 30 December 2017) <http://english.yonhapnews.co.kr/news/2017/10/30/0200000000AEN20171030002800315.html> accessed 28 February 2018.

849 Based on information in: Macfie (n 832); and the annex attached to: UN Secretariat 'Information furnished in conformity with the Convention on Registration of Objects Launched into Outer Space Note verbale dated 22 January 2013 from the Permanent Mission of the Democratic People's Republic of Korea to the United Nations (Vienna) addressed to the Secretary-General' (24 January 2013) UN Doc ST/SG/SER.E/662.

only a limited volume of high-quality farmland. It also experienced a horrible famine in 1990, which was partly caused by natural disasters.[850]

The analytical problem at this point is that the government has never provided any tangible proof whether this state preference and its primary target area have ever actually been in place. There is a chance that they are nothing more than empty words. Several previous studies of the DPRK government's space programme have suggested that a mix of political and national security-oriented considerations has dominated this programme so far.[851] Considering that and its further sections' detection of much more signs for the existence of other space-related state preferences, this study has ultimately decided to take this space-related socioeconomic state preference and its related target area only into account tentatively. In the future, more and better information might be available to ascertain the DPRK government's policy position beyond doubt.

8.4.4 Political state preferences

Despite no official emphasis on them, the government currently appears to pursue two space-related political state preferences. These are the securing of the legitimacy of the Supreme Leader's rule over the DPRK, and the advancement of North Korea's international prestige and influence.

The first one develops from the narrative that the domestic satellite launches since 2012 seem, to some extent, to be officially displayed in a way that features North Korea's national progress under KJU's (new) rule and heaps praise on him. For example, the attempted but ultimately failed launch of KMS-3 took place in the wake of state founder KIS's 100th birth anniversary in 2012,[852] which was a high-profile national event, and only a few months after KJU assumed the position as Supreme Leader.[853] Moreover, the North Korean side presented – in contrast to reliable foreign observers that deem them as partially successful at most – the launches of KMS-3-2, which followed only around eight

850 Jordan Weissmann, 'How Kim Jong Il Starved North Korea' (*The Atlantic*, 20 December 2011) <https://www.theatlantic.com/business/archive/2011/12/how-kim-jong-il-starved-north-korea/250244/> accessed 11 April 2017.

851 For example, Harding argues that the DPRK pursues its space programme to uphold its strategic position against South Korea and the USA as well as to foster national pride: Harding (n 534) 176–177; Lele discusses the possibility that the DPRK uses its space programme for political and military power projection: Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 72.

852 'DPRK to Launch Application Satellite' (n 832).

853 As introduced in Section 8.3, KJI died in December 2011.

months after the DPRK officially acknowledged the failure of the KMS-3 mission, and KMS-4 prominently as demonstrations of '[t]he DPRK's tremendous strength as a space power […] under the guidance of supreme leader **Kim Jong Un**.'[854] Additionally, NADA reportedly referred to the KMS-4 launch as 'a gift of most intense loyalty presented by our space scientists and technicians to the great Comrade **Kim Jong Un**, our dignified party, state and people.'[855] Finally, according to a North Korean news report, KJU himself lauded the DPRK's alleged hydrogen bomb test in January 2016 and the KMS-4 mission in February 2016 under his watch together 'as landmarks in the nation's history spanning 5 000 years, thus raising the dignity and might of Juche Korea to the highest level possible[...].'[856]

Notably, the pursuit of this space-related political state preference of securing the legitimacy of the Supreme Leader's rule over the DPRK also offers a reasonable (partial) explanation for the government's public yet inaccurate insistence that all except one of its domestic satellite missions have been successful. An admission of complete or partial failure of more missions might undermine KJU's status as an effective Supreme Leader and thus ultimately his legitimacy to reign.

The second space-related political state preference of advancing North Korea's international prestige and influence materialises, for one, from the state media's linkage of the launches of KMS-1, KMS-2, KMS-3-2 and KMS-4 to the display of the DPRK's national power.[857] Reportedly, KJU further described the KMS-4 mission and the alleged North Korean hydrogen bomb test in 2016 as to raise the might of Korea.[858] Lastly, it should not be forgotten that all DPRK satellite launches since 2009 have taken place in spite of UNSC sanctions that have, *inter alia*, aimed at prohibiting North Korean satellite launches using ballistic missile technology.[859] Similar to the Iranian case, it is not unrealistic to interpret this space-related defiance as a deliberate attempt to create the international perception of an independently powerful North Korean state, eventually

854 'DPRK, Full-Fledged Space Power' (n 805). Citation in this first link (bold words as in source); for the acknowledgement of launch failure, see: 'North Korea Rocket Launch Fails' (n 832).

855 'DPRK National Aerospace Development Administration Releases Report on Satellite Launch' (n 832) (bold words as in source).

856 'Kim Jong Un Makes Opening Address at Seventh Congress of WPK' (*KCNA*, 6 May 2016) <http://www.kcna.kp> accessed 12 May 2016.

857 'DPRK, Full-Fledged Space Power' (n 805).

858 'Kim Jong Un Makes Opening Address at Seventh Congress of WPK' (n 856).

859 For more information on these UNSC sanctions, see this study's Section 8.5.

designed to increase the country's prestige and influence in a challenging international environment.

Based on some further available information, this study concludes that there is at least one particular target area under this second space-related political state preference, namely the advancement of North Korea's international status as a technologically and scientifically powerful independent state vis-à-vis South Korea.

The main indicator is that some North Korean satellite launches so far appear to have been linked to South Korean space launch attempts. For example, Moltz thinks that the attempted but failed launch of KMS-2 in April 2009 might have been a North Korean reaction to the earlier South Korean announcement to conduct the (ultimately failed) maiden flight of the South's first domestically owned satellite launcher around June 2009.[860] The KMS-3 and KMS-3-2 launch attempts in 2012 also took place at a time when the South Korean side was still laboriously trying to achieve the first successful launch of a domestically owned satellite launcher.[861] It is not farfetched to assume that the DPRK government wanted to preempt such a South Korean success to ensure that the first internationally recognised satellite launch from Korean soil is in North Korea's books after most of the international community has come to agree that KMS-1, and later KMS-2 and KMS-3, never reached space. A successful domestic launch of a satellite is commonly recognised as a notable scientific and technological feat and a generator of international prestige. For both Koreas, international prestige can be considered a quite important currency in the context of their inter-Korean competition of (quite different) political visions for the Korean unification.[862] Ultimately, North Korea received the international launching state status and related international prestige ahead of South Korea through the widely recognised launch success of KMS-3-2, even though the satellite was likely never (fully) operational. Notably, this study has found no evidence that the North Korean government has abandoned this exposed policy direction after its launch success over the South. The inter-Korean competition is, after all, still alive and well by 2017. It needs, however, to be taken into account that, while the DPRK

860 Moltz (n 32) 171.
861 For more information on the South Korean launch attempts, see this study's Section 9.6.10.
862 For more information on these visions, see: Young Ho Park, 'South and North Korea's Views on the Unification of the Korean Peninsula and Inter-Korean Relations' (2nd KRIS-Brookings Joint Conference, Seoul, 21 January 2014) <https://www.brookings.edu/wp-content/uploads/2014/04/Park-Young-Ho-paper.pdf> accessed 16 August 2018.

government might see itself in some sort of space race with the South, the latter does not necessarily participate in it.[863]

8.4.5 National security state preferences

The government has usually avoided linking its space programme to national security. Nonetheless, the narrative outlined in this section suggests that the national security state preference of safeguarding North Korea's national security underlies the government's current space programme. Also, this narrative indicates that there are three related target areas, namely the enhancement of the North Korean military's strategic support system, the establishment of efficient domestic nuclear weapon (counter-)strike capabilities, and the prevention of the weaponisation of and an arms race in outer space.

A first indicator for the national security-orientation of the government's current space programme and the related target area of enhancing the North Korean military's strategic support system, presumably especially through remote sensing satellite capabilities and capacities, is NADA's reported reference to the KMS-4 remote sensing mission as 'the proud fruition of the great Workers' Party of Korea's policy on attaching importance to science and technology and an epochal event in developing the country's science, technology, economy and defense capability.'[864] A second indicator is the DPRK government's presentation of satellite-derived images (of unknown origin) that allegedly show the US Terminal High Altitude Area Defence system (THAAD system) deployed in South Korea.[865]

Besides that, a robust sign for the space programme's national security-orientation and the related target area of establishing efficient domestic nuclear weapon (counter-)strike capabilities is the connection that can be drawn between the government-promoted development and use of domestic space launchers and the *Byungjin* line's call to build North Korean nuclear-armed forces. Most relevant here, KJU wants these forces to have nuclear-armed ballistic missile strike capabilities.[866]

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863 One observer at least made this conclusion about the DPRK space programme around a decade ago: Harvey, Smid and Pirard (n 500) 474.

864 'DPRK National Aerospace Development Administration Releases Report on Satellite Launch' (n 832).

865 'N. Korea Unveils "satellite Photos" of THAAD in S. Korea' (*Yonhap News Agency*, 10 May 2017) <http://english.yonhapnews.co.kr/northkorea/2017/05/10/0401000000AEN20170510009000315.html> accessed 8 March 2018.

866 'Statement of DPRK Government on Successful Test-Fire of New-Type ICBM' (*Naenara*, 29 November 2017) <http://www.naenara.com.kp/en/news/?19+8709> accessed 5 March 2018.

To start with, a report of the Panel of Experts set up by UNSC Resolution 1874 (2009)[867] emphasises that high-ranking officials related to the Munitions Industry Department of the WPK Central Committee, which is understood to have a hand in the DPRK's nuclear weapon and ballistic missile programmes, already observed the launch of KMS-2 in 2009 together with KJI. Later, military-related individuals were a part of KJU's selected small delegations that inspected the *Unha-3* satellite launcher prior to its scheduled launch of KMS-3-2, observed this satellite launch, and visited the launching site two days later.[868] This has put officials responsible for domestic space launches, at that time especially KCST members, and officials responsible for the DPRK ballistic missile and nuclear programme in close proximity.[869]

Additionally, the same Panel of Experts concluded in another report that the DPRK's claim in March 2013 to have a nuclear strike capability that can reach the US mainland, despite having never achieved a successful intercontinental ballistic missile test by then, 'only derive[s credibility] from the successful launch of the Unha-3 [carrying KMS-3-2 in December 2012] and, in the Panel's view, shows the substantive overlaps between the country's ballistic missile and space launch programmes.'[870] Harding somewhat similarly surmised that the DPRK's satellite launches serve as measures of psychological warfare against its opponents like Japan, South Korea and the USA.[871] Obviously, the latter cannot rule out that such launches do not translate into a certain North Korean (nuclear-armed) missile strike potential, especially considering the seclusion of the North Korean state, including its military and space-related entities.

The establishment of NADA in 2013, including an assumed transfer of KCST's space-related functions, responsibilities and facilities to this new administration, has also not provided for a clear division between domestic space launcher and ballistic missile development. NADA's creation happened just around three months after UNSC

867 The Panel assists the Security Council Committee established pursuant to resolution 1718 (2006) in its sanction-related tasks. For more information, see: '1718 Sanctions Committee (DPRK)' (*UN*) <https://www.un.org/sc/suborg/en/sanctions/1718> accessed 1 March 2017.

868 UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (11 June 2013) UN Doc S/2013/337 19–20.

869 UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (23 February 2015) UN Doc S/2015/131 21; for KCST's role in the KMS-3-2 launch, see also: 'Kim Jong Un Visits General Satellite Command and Control Center to Order U'nha-3 Launch' (*North Korea Leadership Watch*, 14 December 2012) <https://nkleadershipwatch.wordpress.com/2012/12/14/kim-jong-un-visits-general-satellite-command-and-control-center-to-order-unha-3-launch/> accessed 1 March 2017.

870 UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (6 March 2014) UN Doc S/2014/147 16–17. Citation on 17.

871 Harding (n 534) 176.

sanctioned KCST, as well as some of this committee's personnel, due to KCST's suspected contributions to the country's ballistic missile programme. It allows for the claim that NADA is primarily the new public front of KCST and an attempt to free the latter's involvement in domestic ballistic missile development from UNSC sanctions.[872] Further supporting this claim, NADA has arguably been made an institution responsible for all instead of just for civil space undertakings.[873]

Adding to the above, it should not be forgotten that the *Paektusan-1* launcher allegedly carrying KMS-1 into orbit in 1998 can also already be traced back to the DPRK's *Taepodong* ballistic missile family and a facility with responsibilities for its weapon programme.[874] Various foreign observers even interpreted the launch event as a disguised long-range ballistic missile test.[875] Withal, it is suspicious that the DPRK left the six-party talks with China, Japan, Russia, South Korea and the USA, which aimed at finding a peaceful solution for the denuclearisation of the Korean peninsula, after a UNSC Presidential Statement criticised the KMS-2 launch in 2009.[876] Lastly, it is unlikely a coincidence that the launches of KMS-2, KMS-3-2, and KMS-4 took place within one to two months of the DPRK's second, third and fourth nuclear weapon test, respectively.[877]

In support of its findings regarding the North Korean government's other space-related state preferences, this study further wants, similar to the Iranian case, to add here that, despite the arguments for the existence of this second national security-specific target

872 Based on information in: UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (23 February 2015) UN Doc S/2015/131 21–24; UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (27 February 2016) UN Doc S/2016/157 25; for the sanctions, see: UNSC Res 2087 (22 January 2013) UN Doc S/RES/2087 annexes I,II.

873 Based on information in: Seong-Whun Cheon, 'The Kim Jong-Un Regime's "Byungjin" (Parallel Development) Policy of Economy and Nuclear Weapons and the "April 1st Nuclearization Law"' (2013) CO 13-11 Online Series 1, 3; '2013 Plenary Meeting of WPK Central Committee and 7th Session of Supreme People's Assembly' (n 837); notably, NADA Bylaw art 5 apparently speaks of an undefined 'state interest' in addition to a socioeconomic development purpose: 'NADA [...] is obliged to supervise and control all the space activities for successes achieved from them to be put into peaceful purposes including the state interest, economic development and the improvement of people's living as specified in the [... national space law (that, unhelpfully in terms of confidence building, has still not been made fully available to the international community)].' Governments usually consider national security a primary state interest.

874 Harvey, Smid and Pirard (n 500) 448.

875 Based on information in: ibid 461–465; Lele, *Asian Space Race: Rhetoric or Reality?* (n 32) 71; Harding (n 534) 175.

876 'DPRK Foreign Ministry Vehemently Refutes UNSC's "Presidential Statement"' (*KCNA*, 14 April 2009) <https://web.archive.org/web/20120910123631/http://www.kcna.co.jp/item/2009/200904/news14/20090414-23ee.html> accessed 8 March 2018.

877 Sam Kim, 'A Timeline of North Korea's Missile Launches and Nuclear Detonations' (*Bloomberg*, 6 March 2017) <https://www.bloomberg.com/news/articles/2017-03-06/north-korea-missile-launches-nuclear-detonations-timeline> accessed 11 April 2017.

area, it is short-sighted to try to understand this government's present space programme merely from a ballistic missile development perspective. For example, Ellemann has already found that all five North Korean satellite launch attempts between 1998 and 2006 'were designed to maximize performance as a satellite launcher. In each case, the [...] rockets flew on trajectories fully consistent with a satellite launch.'[878] Moreover, renowned ballistic missile expert Schiller has concluded, especially after analysing salvaged wreckage of the *Unha-3* rocket carrying KMS-3-2, that the *Unha-3* model has technical specifications that point towards its deliberate deployment as a satellite launcher. Such specifications have likely limited its overall contribution to the development of long-range ballistic missile capabilities.[879]

Last but not least, a solid indicator that the North Korean government's space programme has a national security-orientation, as well as the related target area of preventing the weaponisation of and an arms race in outer space, is its opposition to the weaponisation of outer space. Reportedly, the government has a voting pattern regarding related United Nations General Assembly (UNGA) resolutions.[880] Also, the national space law apparently codifies this standpoint.[881] Moreover, it is quite reasonable to argue that the government wants to prevent the weaponisation of and an arms race in outer space considering that the DPRK's national security might be challenged considerably if outer space becomes truly weaponised and such an arms race commences. North Korea's still limited success in operating satellites suggests that the country would have a hard time to keep up with the potential space weapon capabilities and capacities employed by such states like the USA, Russia and China.

All in all, the available material indicates that the North Korean government sees the country's national security mainly endangered by the USA, South Korea and Japan. The

878 Ellemann (n 832).

879 Based on information in: David Wright, 'Markus Schiller's Analysis of North Korea's Unha-3 Launcher' (*All Things Nuclear*, 22 February 2013) <http://allthingsnuclear.org/dwright/markus-schillers-analysis-of-north-koreas-unha-3-launcher> accessed 8 April 2016; 'How Worrisome Is a N. Korean Rocket Launch, Really?' (*CBS News*, 5 February 2016) <http://www.cbsnews.com/news/north-korea-rocket-launch-fueling-experts-not-test-icbm-missile-technology/> accessed 8 April 2016; Schilling comes to a quite similar conclusion: John Schilling, 'Satellites, Warheads and Rockets: Is North Korea's Space Program Really about Missile Development?' (*38 North*, 5 February 2016) <https://www.38north.org/2016/02/schilling092815/> accessed 8 March 2018.

880 Aliaksandr Starun, 'North Korean Space Program Legitimization Efforts: Review and Policy Recommendations' (2017) 15(3) Astropolitics 251, 257–258.

881 'National Aerospace Development Administration of DPRK' (n 829).

government refers to them as hostile nations.[882] It is no surprise considering that the DPRK has never entered a peace treaty with South Korea and the USA since they halted the Korean War with an armistice in 1953.[883] Japan and North Korea also failed to normalise their relationship since the end of Japan's colonial rule over Korea.[884]

8.4.6 Science and technology state preferences

Even though scientific and technological development is undoubtedly necessary for the implementation of the major North Korean government-promoted space-related identified in this study, there is no reliable evidence that the DPRK government currently pursues a dedicated space-related science and technology state preference like any of the other preeminent Asian governments in the space sector. The North Korean government seems to concentrate on the pursuit of other space-related state preferences.

Whether this situation changes in the coming years remains to be seen. Reportedly, North Korea intends to engage in human spaceflight, space exploration and scientific experiments in space in the future.[885] As argued in, for example, the Chinese and Japanese cases, activities in this context might be (partially) directed towards serving the pursuit of a dedicated space-related science and technology state preference.

8.4.7 Autonomy-oriented state preferences

This study contends on the basis of two indicators that the government currently has the space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage primarily independently in the pursuit of other space-related state preferences.

882 Based on information in: 'Launch of Satellite Kwangmyongsong-3 Is Legitimate Right of DPRK: KCNA' (*DPRK Korean Friendship Association Forum*, 18 March 2012) <http://korea-dpr.co/forum/index-p=1117.html> accessed 5 March 2017; 'Japan's Moves for Space Militarization Censured by Rodong Sinmun' (*KCNA*, 20 May 2014) <http://www.kcna.kp> accessed 13 April 2016; 'Rodong Sinmun Accuses Japan of Stretching Its Tentacles of Aggression Even to Space' (*KCNA*, 2 December 2015) <http://www.kcna.kp> accessed 13 April 2016.

883 'The Korean War Armistice' (*BBC*, 5 March 2015) <http://www.bbc.com/news/10165796> accessed 6 March 2018.

884 Rachel Blomquist and Daniel Wertz, 'An Overview of North Korea-Japan Relations' (*NCNK*, June 2015) <https://www.ncnk.org/resources/briefing-papers/all-briefing-papers/overview-north-korea-japan-relations> accessed 17 March 2018.

885 Eric Talmadge, 'AP Exclusive: North Korea Hopes to Plant Flag on the Moon' (*AP*, 4 August 2016) <http://bigstory.ap.org/article/88fa76909dec40b299658a34b489dc1a/ap-exclusive-north-korea-hopes-plant-flag-moon> accessed 11 April 2017.

First, the *Juche* philosophy is a central and longstanding element of North Korea's state ideology. As introduced in Section 8.4.2.2, *Juche* endorses North Korean self-reliance, especially in terms of political independence, economy-directed self-sustenance and military-oriented self-defence. Thus, the government presumably prefers to develop and maintain domestic space-related capabilities and capacities for the independent pursuit of its present space-related political, socioeconomic and national security state preferences. After all, these state preferences link quite well with the three principles of *Juche*.

Second, the current set of UNSC resolutions against the DPRK severely limits the latter's options to partake in international space cooperation.[886] Therefore, the North Korean government has to concentrate on national development and maintenance of domestic space-related capacities and capabilities in the pursuit of its present space-related state preferences.

8.5 Basic pol. & leg. framework concerning IGO-based regional space cooperation

The DPRK government has not entered any regional space-specific IGO so far. Moreover, there is no evidence that it has undertaken any serious steps in this direction in recent years. Yet, there are indicators that it is, at least in theory and based on several principles, presently not opposed to participating in such a cooperation mechanism.

Most prominently, according to a North Korean news report, '[t]he [national space] law [from 2013] calls for cooperation with international agencies and other countries on the principle of ensuring equality and mutual benefits, respecting international law and orders for the space. Clarified in the law is also the DPRK's principled stand to reject the application of selectivity and double-standards in space activities and the weaponization of outer space.'[887] Within the confinements of the national space law and the government's current space plan, the NADA Bylaw further authorises NADA to enter into cooperation with foreign and international institutions, 'to review and approve the space-related agreements and contracts between government organizations or groups and other foreign organizations, and to monitor their successful implementation.' Even more, NADA encourages international space cooperation and seeks to become an active member of, among others, space-related IOs.[888]

886 For more information on the UN resolutions, see this study's Section 8.5.
887 'National Aerospace Development Administration of DPRK' (n 829).
888 NADA Bylaw arts 4-6.

In practice, however, a combination of several UNSC resolutions against North Korea that primarily aim at discouraging the country from continuing its nuclear weapon and ballistic missile programmes firmly curb the DPRK government's current potential to engage in intergovernmental space cooperation, especially in such that supports the development and use of space launchers and satellites.

Overall, the main set of UNSC resolutions against the DPRK in place as of 2017 comprises UNSC Resolution 1695 (2006),[889] UNSC Resolution 1718 (2006),[890] UNSC Resolution 1874 (2009),[891] UNSC Resolution 2087 (2013),[892] UNSC Resolution 2094 (2013),[893] UNSC Resolution 2270 (2016),[894] and UNSC Resolution 2321 (2016).[895]

With regard to outer space, UNSC Resolution 2087 (2013), which is UNSC's response to the launch of KMS-3-2, generally recognises 'the freedom of all States to explore and use outer space in accordance with international law', but adds that international law allows 'including restrictions imposed by relevant Security Council resolutions'.[896] Within this context, UNSC Resolution 2270 (2016), which is UNSC's reaction to the DPRK's proclaimed hydrogen bomb test in January 2016 and its launch of KMS-4 the following month, demands that North Korea does 'not conduct any further launches that use ballistic missile technology[…] and […] suspend[s] all activities related to its ballistic missile program and in this context re-establish[es] its pre-existing commitments to a moratorium on missile launches', as well as 'abandon[s] all other […] ballistic missile programs in a complete, verifiable and irreversible manner'.[897] Additionally, UNSC Resolution 2270 (2016) determines that paragraph 8 (c) of UNSC Resolution 1718 (2006) 'prohibits the DPRK from engaging in any form of technical cooperation with other Member States on launches using ballistic missile technology, even if characterized as a satellite launch or space launch vehicle'. The same resolution further regulates 'that all Member States shall prevent specialized teaching or training of DPRK nationals within their territories or by their nationals of disciplines which could contribute to the DPRK's

889 UNSC Res 1695 (15 July 2006) UN Doc S/RES/1695.
890 UNSC Res 1718 (14 October 2006) UN Doc S/RES/1718.
891 UNSC Res 1874 (12 June 2009) UN Doc S/RES/1874.
892 UNSC 2087.
893 UNSC Res 2094 (7 March 2013) UN Doc S/RES/2094.
894 UNSC Res 2270 (2 March 2016) UN Doc S/RES/2270.
895 UNSC Res 2321 (30 November 2016) UN Doc S/RES/2321.
896 UNSC 2087 preamble. The resolution does not mention the satellite's and the launcher's name, but the launch date put forward in the document makes clear that it refers to the KMS-3-2 mission.
897 UNSC 2270 para 2-3. The resolution does not mention the satellite's and the launcher's name, but the launch date put forward in the document makes clear that it refers to the KMS-4 mission.

[...] development of nuclear weapon delivery systems, including teaching or training in advanced physics, advanced computer simulation and related computer sciences, geospational navigation, nuclear engineering, aerospace engineering, aeronautical engineering and related disciplines'.[898] Besides that, UNSC Resolution 2321 (2016) establishes that '[i]nertial equipment for any application, particularly for civilian aircraft, satellite, geophysical survey applications and their associated test equipment' constitutes 'Nuclear- and/or Missile-usable Items'.[899]

Altogether, this arguably translates into a full prohibition for the DPRK government to engage domestically, and for the DPRK government and other governments to engage cooperatively in the development and use of space launcher and satellite capabilities and capacities. As indicated in Section 8.4.5, North Korean space launcher and ballistic missile development projects presumably are somewhat interlinked to foster the development of domestic nuclear weapon (counter-)strike capabilities. Moreover, there is no guarantee that the DPRK military might not employ satellite technology for the efficient use of ballistic missiles, e.g. regarding target selection and missile guidance. This argument is further supported by UNSC Resolution 2087 (2013) and UNSC Resolution 2270 (2016) putting forward an institutional asset freeze on the DPRK government's official main space-related entities in the past decades, namely KCST and NADA, and a travel ban and an individual asset freeze on some of their personnel.[900] Also, the UNSC sanctions led to the International Astronautical Federation revoking NADA's membership less than one week after the approval of membership in 2015,[901] and India-based CSSTEAP, which the DPRK joined in 1996, cancelling the participation of North Korean citizens from training on sanction-related space-related subjects.[902]

As proven by its four domestic satellite launches between 2009 and 2016, the DPRK government does not accept these sanctions.[903] It argues that it has the right of accessing and using space independently for peaceful purposes as recognised under international

898 ibid para 5,17.
899 UNSC 2321 annex III.
900 UNSC 2087 annex I-II; UNSC 2270 annex I-II.
901 Chad O'Carroll, 'N. Korean Membership of Intl' Astronautical Federation "Revoked"' (*NK News*, 19 October 2015) <https://www.nknews.org/2015/10/n-korean-membership-of-intl-astronautical-federation-revoked/> accessed 22 April 2016. Direct sanctions against NADA were not in place then, but the aforementioned Panel of Experts had already recommended NADA to be included in them.
902 UNSC 'Report of the Panel of Experts established pursuant to resolution 1874 (2009)' (27 February 2016) UN Doc S/2016/157 23-24.
903 'Launch of Satellite Kwangmyongsong-3 Is Legitimate Right of DPRK: KCNA' (n 882).

law, thus disregarding the UNSC's standpoint that its resolutions are a legitimate part of such law.[904] Presumably to underline the legitimacy of its space programme under international law and potentially to present itself as a reliable actor (and partner for cooperation) within the international space sector, the North Korean government has gotten into the habit of informing relevant international institutions about its satellite launches[905] and joined, similar to the other preeminent Asian governments in the space sector, four of the five main international space agreements since 2009.[906] For example, based on two North Korean news reports, the DPRK's accession to these agreements officially aims at fostering international confidence and cooperation regarding North Korea's scientific research of space and its satellite launches for peaceful purposes.[907] It acceded to the Outer Space Treaty on 05.03.2009[908] and the Registration Convention on 10.03.2009.[909] Coherent with the latter, it even established a NADA-administered national registry of objectives launched into outer space in 2015[910] and registered KMS-3-2 and KMS-4 with the UN Register of Objects Launched into Outer Space.[911] In February 2016,

904 'DPRK Foreign Ministry Spokesman on Satellite Launch' (*NCNK*, 12 December 2012) <http://www.ncnk.org/resources/publications/DPRK_FM_on_Dec12_Launch.pdf> accessed 5 March 2017; 'National Aerospace Development Administration Clarifies Its Principled Stand' (*KCNA*, 8 May 2015) <http://www.kcna.kp> accessed 1 April 2016; 'NADA Director on Successes in Outer Space Development' (n 848); 'DPRK National Aerospace Development Administration Releases Report on Satellite Launch' (n 832).

905 'N. Korea Informs of Satellite Launch Plans' (*CNN*, 12 March 2009) <http://edition.cnn.com/2009/WORLD/asiapcf/03/12/nkorea.launch/index.html> accessed 8 March 2018; Martyn Williams, 'Foreigners, Media Invited to Satellite Launch' (*North Korea Tech*, 19 March 2012) <https://www.northkoreatech.org/2012/03/19/foreigners-media-invited-to-satellite-launch/> accessed 8 March 2018; Wright, 'North Korea Gives Location of Splashdown Zones, Begins Assembling Rocket' (*All Things Nuclear*, 4 December 2012) <https://allthingsnuclear.org/dwright/north-korea-gives-location-of-splashdown-zones-begins-assembling-rocket> accessed 8 March 2018; Martyn Williams, 'DPRK Signals February Satellite Launch' (*North Korea Tech*, 2 February 2016) <https://www.northkoreatech.org/2016/02/02/dprk-signals-february-satellite-launch/> accessed 8 March 2018.

906 Moltz (n 32) 170–171; Harding (n 534) 175; Elizabeth Shim, 'North Korea Says It Has Signed International Space Treaties' (*UPI*, 23 February 2016) <http://www.upi.com/Top_News/World-News/2016/02/23/North-Korea-says-it-has-signed-international-space-treaties/4191456237104/> accessed 6 April 2017.

907 'KCNA Report on DPRK's Accession to International Space Treaty and Convention' (*KCNA*, 12 March 2009) <http://www.kcna.co.jp/item/2009/200903/news12/20090312-11ee.html> accessed 6 April 2017; 'DPRK Accedes to Space-Related International Agreements' (*KCNA*, 23 February 2016) <http://www.kcna.kp> accessed 1 April 2016.

908 'Democratic People's Republic of Korea' (*United Nations Regional Centre for Peace and Disarmament in Asia and the Pacific*) <http://unrcpd.org/region/democratic-peoples-republic-korea/> accessed 6 April 2017.

909 Communication from the Secretary-General, 'Convention On Registration of Objects Launched Into Outer Space New York, 12 November 1974 Democratic People's Republic of Korea: Accession' (10 March 2009) C.N.154.2009.TREATIES-1 (Depositary Notification).

910 UN Secretariat 'Information furnished in conformity with the Convention on Registration of Objects Launched into Outer Space Note verbale dated 26 February 2015 from the Permanent Mission of the Democratic People's Republic of Korea to the United Nations (Vienna) addressed to the Secretary-General' (11 March 2015) UN Doc ST/SG/SER.E/INF/31.

911 UN Secretariat 'Information furnished in conformity with the Convention on Registration of Objects Launched into Outer Space Note verbale dated 22 January 2013 from the Permanent Mission of the

shortly after its KMS-4 launch and when a new resolution against the country was already under discussion, the government acceded to the Rescue Agreement and the Liability Convention.[912]

8.6 Major domestic and cooperative space-related measures

8.6.1 Remote sensing

8.6.1.1 Major domestic measures

Based on the statements of Hyon Kwang-il, the Director of NADA's Scientific Research Department, in 2016, the current major government-promoted domestic space-related remote sensing measure is the domestic development and application of more advanced EO satellites by 2020.

Hyon's further comments indicate that these satellites shall help with crop and forestry assessments, and thus are apparently oriented towards serving the pursuit of the government's space-related socioeconomic state preference and related target area of developing and applying space-related capabilities and capacities to deal with a few socioeconomically highly relevant issue-areas for North Korea.[913] This fits neatly with the government's previous claim that, as presented in Table 5 in Section 8.4.1, KMS-3 and KMS-3-2 were EO satellites with a socioeconomic orientation. KMS-3 should have supported weather forecasting to foster North Korean agriculture and other economic fields, whereby the (at least partially failed) KMS-3-2 mission should have served the areas of crop surveying, disaster management and forestry. The North Korean report that a seminar by the Korea Space Association saw papers on computer-aided analysis of satellite images with similar application areas, as well as an application regarding North Korean fishing grounds, additionally supports the government's official position that its upcoming remote sensing satellites have a primarily socioeconomic orientation.[914]

Democratic People's Republic of Korea to the United Nations (Vienna) addressed to the Secretary-General' (24 January 2013) UN Doc ST/SG/SER.E/662; UN Secretariat 'Information furnished in conformity with the Convention on Registration of Objects Launched into Outer Space Note verbale dated 25 April 2016 from the Permanent Mission of the Democratic People's Republic of Korea to the United Nations (Vienna) addressed to the Secretary-General' (9 May 2016) UN Doc ST/SG/SER.E/768.

912 According to KCNA, the DPRK acceded on 22.02.2016: 'DPRK Accedes to Space-Related International Agreements' (n 907); according to a UNCOPUOS Legal Subcommittee report, the DPRK acceded on 24.02.2016: UNGA 'Report of the Legal Subcommittee on its fifty-fifth session, held in Vienna from 4 to 15 April 2016' (27 April 2016) UN Doc A/AC.105/1113 11.

913 Talmadge (n 885).

914 'Korea Space Association Organized in DPRK' (n 831).

However, it shall not be forgotten that Section 8.4.5 has established that the KMS-4 remote sensing satellite shall have presumably also served the development of, among others, the DPRK's defence capability. Moreover, the government published satellite-derived images allegedly showing the THAAD system stationed in South Korea. As such, this study does not want to rule out that the upcoming domestic remote sensing satellite missions might, in practice, be further directed towards strengthening the pursuit of the government's current space-related national security state preference, especially the target area of enhancing the North Korean military's strategic support system.

8.6.1.2 Major cooperative measures

As determined in Section 8.5, the government is hampered by UNSC sanctions in its potential to enter international cooperation in the field of satellite development and application. Consequently, it is no surprise that this study has found little evidence for current major government-promoted cooperative space-related remote sensing measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

The only measure worthwhile to be addressed here is that North Korea apparently engages in the WMO alongside China, India, Iran, Japan and South Korea.[915]

8.6.2 Communications and broadcasting

8.6.2.1 Major domestic measures

According to NADA representative Hyon in 2016, the current major government-promoted domestic space-related communications and broadcasting measure is to put the first North Korean geostationary communications satellite into orbit by 2020. Regarding its specific application area, he merely indicates that the satellite shall enhance the DPRK's communications capabilities.[916]

Previously, the only known attempt by the government to launch a domestic communications satellite was the KMS-2 mission in 2009. As mentioned in Table 5 in Section 8.4.1, sources describe KMS-2 as an experimental communications satellite to foster the development and launch of future practical satellites.

915 'Members' (n 240).
916 Talmadge (n 885).

Considering this study's findings on communications and broadcasting satellites by other preeminent Asian governments in the space sector, it is reasonable to assume that the first domestic geostationary communications satellite shall foster the pursuit of the government's space-related socioeconomic and national security state preferences. The prevalent target areas likely are the development and application of space-related capabilities and capacities to deal with a few socioeconomically highly relevant issue-areas for North Korea, as well as the enhancement of the North Korean military's strategic support system.

8.6.2.2 Major cooperative measures

As determined in Section 8.5, the UNSC sanctions against the DPRK curb its potential to enter international cooperation in the field of satellite development and application. As such, current major government-promoted cooperative space-related communications and broadcasting measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector are nearly non-existent.

At most, North Korea seems, alongside all the other preeminent Asian governments in the space sector, to be a member state of ITU. Similar to the Chinese, Indian, Iranian, Japanese and South Korean cases, this shall presumably foster the pursuit of all space-related state preferences underlying the North Korean government's (rather limited) space-related communications and broadcasting measures.[917]

8.6.3 Navigation

8.6.3.1 Major domestic measures

This study has found no definite information for a current major government-promoted domestic space-related navigation measure.

8.6.3.2 Major cooperative measures

There is no evidence for a current major government-promoted cooperative space-related navigation measure (with a high potential for) involving other preeminent Asian governments in the space sector.

917 For more information on the ITU, see this study's Section 4.6.3.3.

However, based on Brown's account, this study takes into account that the government might seek collaboration in the application of globally and regionally available navigation satellite systems in the pursuit of its current space-related national security state preference. A particular focus might presumably be on the target areas of enhancing the North Korean military's strategic support system, as well as of establishing efficient domestic nuclear weapon (counter-)strike capabilities. After all, satellite navigation can aid troop movements and help with the guidance of nuclear-armed ballistic missiles.

In this regard, the DRPK government's preferred navigation satellite system option is likely the Chinese-controlled BDS. China is not only a long-term military ally but might be even willing to grant North Korea access to BDS's militarily more useful restricted signal capability. As one observer puts it, the DPRK's regional military anti-access/area denial objective, including against US forces, is complementary to China's. The Chinese side has yet to clarify if it already provides such access through or intends to act towards such a collaboration.[918] Overall, it is not out of the question that the DPRK will receive access to high-precision BDS services since China has apparently done so with Iran.[919]

The reported participation of North Korean engineers in a multinational training session on BDS-related technology organised by a Chinese government-related entity in 2014 further supports the argument for a North Korean preference for BDS and a related potential collaboration with China. Also, the DPRK military is unlikely to rely heavily on or enter into serious collaboration in the use of the navigation satellite systems of Japan, South Korea and the USA. As discussed in Section 8.4.5, North Korea considers each of them a major military opponent. Additionally, some states try to deny the North Korean military access to American GPS technology overall.[920]

Notably, this study deems it implausible that the DPRK government seeks to apply globally or regionally available navigation satellite systems in a significant manner in the pursuit of its current other state preferences, e.g. to advance its socioeconomic development. A crucial factor in this regard is likely that the government wants to avoid

918 Peter J Brown, 'Is North Korea Using China's Satellites to Guide Its Missiles?' (*Asia Times*, 24 May 2017) <http://www.atimes.com/article/north-korea-using-chinas-satellites-guide-missiles/> accessed 15 November 2017.

919 For more information, see this study's Section 6.6.4.2.

920 Martyn Williams, 'North Koreans Learn about China's Beidou Satellite Navigation System' (*North Korea Tech*, 31 July 2014) <https://www.northkoreatech.org/2014/07/31/north-koreans-learn-about-chinas-beidou-satellite-navigation-system/>.

the provision of accurate satellite navigation technology to its citizens on a general level because it might challenge the government's control over their lives, and thus the pursuit of its current space-related political state preference of securing the legitimacy of the Supreme Leader's rule.[921]

8.6.4 Science and technology research

This study was unable to identify any dedicated current major government-promoted domestic or cooperative science and technology research measure. Whether this will change in the near future, e.g. regarding lunar and planetary exploration activities or scientific experiments in space indicated by a NADA official, remains to be seen.[922]

8.6.5 Human spaceflight

There is no evidence for a current major government-promoted domestic or cooperative human spaceflight measure. Yet, a NADA representative mentioned in 2016 that the DPRK has, in the long run, an intention to conduct human spaceflight.[923]

It is reasonable to assume that at least the government's political state preferences will underlie such measures. After all, only a few states have so far achieved human spaceflight capabilities, and thus are an excellent feat to improve the Supreme Leader's domestic standing and to generate international prestige for the DPRK.

8.6.6 Exploration of celestial bodies, including the Moon

As of 2017, the government seems to promote no major domestic or cooperative measures related to the exploration of celestial bodies, including the Moon.

However, according to NADA representative Hyon's comments in 2016, the government might engage in – presumably primarily domestic – lunar and planetary exploration in the

921 Conclusion based on the information provided in the following material: ibid; as stated by Bruce, the DPRK government 'limits the flow of information into, out of, and within the country to maintain control over the population.' Official access to, for example, information technology is granted only within a carefully crafted domestic framework and by integration of such technology into the government's system of social controls: Scott Thomas Bruce, 'Information Technology and Social Controls in North Korea' (2014) 8 On Korea: Academic Paper Series 1. Citation on 1.

922 Talmadge (n 885).

923 ibid.

future. This might include the planting of the DPRK's flag on the lunar surface, which Hyon hopes to take place within a decade.[924]

Notably, Schilling points out that a government-promoted domestic lunar undertaking will need, especially if the flag shall be put on the Moon through a soft-landing procedure, huge domestic technical advancements in launcher and spacecraft development, as well as relevant control and communication systems, compared to the capabilities the DPRK has shown so far. This may put a heavy financial burden on an already economically challenged country. Thus, proclaimed North Korean lunar and planetary exploration projects should be treated with some suspicion whether they will be able to come to fruition.[925]

Any initial North Korean lunar and planetary exploration project might be driven mostly by the pursuit of the government's space-related political state preferences. Target area-wise, the government might especially hope to advance North Korea's status as a technologically and scientifically powerful independent state vis-à-vis South Korea, which has already declared to have a lunar mission in the making.[926]

8.6.7 Stable use of outer space

This study has found no hard evidence for a current major government-promoted domestic or cooperative measure addressing issues regarding the stable use of outer space for North Korea.

8.6.8 Launchers

8.6.8.1 Major domestic measures

Access to and enhancement of domestic launcher capabilities and capacities is a long-standing major government-promoted domestic measure.

As introduced in Section 8.4.1, the DPRK has developed and launched various domestic satellite launcher series (*Paektusan-1; Unha-2; Unha-3; Kwangmyongsong*) between

924 ibid.

925 John Schilling, 'North Korea's Man on the Moon?' (*38 North*, 15 August 2016) <http://38north.org/2016/08/jschilling081516/> accessed 11 April 2017.

926 The argument partially follows Schilling in: ibid. For more information on the South Korean lunar programme, see this study's Section 9.6.7.

1998 and 2016 that – presumably – technologically build upon one another. According to one analysis, the available three-stage *Unha-3* series*,* and by extension the *Kwangmyongsong* series,[927] are capable of launching small satellites into an orbit up of at least a few hundred and potentially a few thousand kilometres.[928] Yet, their launch record is still meagre. As further outlined in Section 8.4.1, only the *Unha-3* carrying KMS-3-2 and *Kwangmyongsong* carrying KMS-4 actually delivered their payload into outer space, while reliable observers consider these satellites to have never been fully operational.

Reportedly, KJU directed military and scientific personnel to complete the development of a new launcher by September 2018.[929] This new launcher series shall maybe capable of putting payloads into geostationary orbit. A related successful jet engine test took already place in September 2016.[930] This is reasonable, as explained in Section 8.6.2, it is a current major government-promoted domestic space-related measure to put the first North Korean geostationary communications satellite into orbit by 2020.

Besides that, North Korea recently completed an expansion of its satellite launch pad at the DPRK's Sohae Satellite Launching Station to enable launches of larger rockets than *Unha-3*, which would be needed to successfully implement future domestic geostationary satellite, lunar and human spaceflight projects.[931]

State preference-wise, the findings in Section 8.4.5 allow reasoning that enhancing the domestic launcher capabilities and capacities contributes to some degree to the pursuit of the government's current space-related national security state preference, especially the target area of establishing efficient domestic nuclear weapon (counter-)strike capabilities.

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927 Chandrashekar and others determine similarities between the December 2012 and the 2016 launch vehicles and refer to both as Unha-3 launchers: S Chandrashekar, N Ramani and Arun Vishwanathan, 'Analysis of North Korea's February 2016 Successful Space Launch' (ISSSP Report No 02/2016, International Strategic and Security Studies Programme, National Institute of Advanced Studies April 2016) <http://eprints.nias.res.in/1057/1/2016-North%20Korean%20Feb%202016%20Successful%20Space%20Launch.pdf> accessed 8 March 2018.

928 Schilling, 'North Korea's Man on the Moon?' (n 925).

929 Ankit Panda, 'Why North Korea Is Likely Planning a Satellite Launch in 2018' (*The Diplomat*, 12 January 2018) <https://thediplomat.com/2018/01/why-north-korea-is-likely-planning-a-satellite-launch-in-2018/> accessed 12 January 2018.

930 'Kim Jong Un Guides Ground Jet Test of New-Type High-Power Engine of Carrier Rocket for Geo-Stationary Satellite' (*KCNA*, 20 September 2016) <http://www.kcna.kp> accessed 11 April 2017.

931 Nick Hansen, 'North Korea's Sohae Satellite Launching Station: Major Upgrade Program Completed; Facility Operational Again' (*38 North*, 1 October 2014) <https://www.38north.org/2014/10/sohae100114/> accessed 8 March 2018; Schilling, 'North Korea's Man on the Moon?' (n 925).

At the same time, the same section indicates that it is short-sighted to look at that merely from that perspective.

Following Section 8.4.4, access to and the enhancement of domestic launcher capabilities and capacities presumably further serves the pursuit of the government's current space-related political state preferences. This includes the related target area of advancing North Korea's international status as a technologically and scientifically powerful independent state vis-à-vis South Korea.

Lastly, access to and the enhancement of domestic launcher capabilities and capacities are clearly pertinent to the implementation of the aforementioned (alleged or potential) major government-promoted domestic space-related measures in the fields of remote sensing, communications and broadcasting, exploration of the Moon and other celestial bodies, as well as human spaceflight. They fit the pursuit of the government's space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage primarily autonomously in the pursuit of the other space-related state preferences.

8.6.8.2 Major cooperative measures

In accordance to the assessment in Section 8.5 that the government is hampered by the UNSC sanctions in its potential to enter international cooperation in the development and use of space launchers, this study has found no sign for any major government-promoted cooperative measure in the field of space launchers (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

However, various researchers theorised or found indicators that North Korea might have previously collaborated with states like China, Iran and Pakistan in this regard. The DPRK might have even supported Iran in building a launch pad.[932] As such, it should not be excluded that the DPRK government might seek to promote some major cooperative space launcher measures after the UNSC sanctions are lifted.

932 Moltz (n 32) 172–173; Harvey, Smid and Pirard (n 500) 450,453,459,464,481-482; Schmucker and Schiller make the argument that all North Korean ballistic missile development, at least until 2010, depended heavily on foreign support: Robert H Schmucker and Markus Schiller, 'The DPRK Missile Show. A Comedy in (Currently) Eight Acts' (Draft paper, Schmucker Technologie 05 May 2010) <http://www.nkeconwatch.com/nk-uploads/schmucker-schiller-the_missile_show_draft_10-05-05-1.pdf> accessed 2 April 2016.

Notably, this study holds that the existence of these sanctions, the rarity and many problems of North Korean space launches since 1998, as well as the lack of public offers to launch payloads for foreign entities on domestic launchers, counter speculations that the North Korean government works towards such collaborative measures like providing commercial space launches and satellite services to foreign entities in the near future.[933]

8.6.9 Human resources

8.6.9.1 Major domestic measures

Due to the opaqueness of North Korea in domestic matters, it is hard to pinpoint major government-promoted domestic space-related human resources-specific measures.

However, considering that UNSC sanctions hamper the DPRK space programme but the country has managed to develop some space launcher and satellite capabilities and capacities, it is safe to say that the government gives domestic education and training in these fields considerable attention. At least one report suggests that North Korean universities have expanded their rocket science programmes in recent years.[934]

This is no surprise considering that the country needs a broad range of experts to pursue its space-related state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage primarily autonomously in the pursuit of the other space-related state preferences.

8.6.9.2 Major cooperative measures

This study has found no major government-promoted cooperative space-related human resources-specific measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector. This is surely a consequence of the UNSC sanctions against the country. As mentioned under Section 8.5, North Korean citizens are even banished for now from attending training on sanction-related space-related subjects under CSSTEAP, in which it is a member.

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933 Moltz refers to such speculations in: Moltz (n 32) 171–172.
934 Talmadge (n 885).

9 <u>Republic of Korea (ROK / South Korea)</u>

9.1 Analytical considerations

This study's main challenge in its particular evaluation of the South Korean government's current space programme is the limited public access to (unofficial) English translations of the known main domestic space-related political documents. However, thanks to the availability of seemingly reliable unofficial translations of the main domestic space-related legal documents and a range of other English material addressing aspects of the ROK government's space programme in the 21st century, this study deems it possible to arrive at plausible findings concerning its primary research interest. In this regard, this study is very grateful to two South Korean space law and policy experts for pointing out or providing parts of the latter material.[935]

9.2 Main domestic political and legal documents

Without claiming completeness, the accessed material allows concluding that at least the following domestic political and legal documents strongly guide the ROK government's current space programme. Similar to the previous five country-specific chapters, these documents' known content deserves special attention throughout this chapter.

The 'Space Development Promotion Act'[936] (SDPA) appears central to the government's current space programme. Initially adopted in 2005 by the National Assembly, which is the ROK's unicameral national legislature, SDPA can be considered South Korea's core national space law. Most importantly here, SDPA, as amended in 2015, requires the government to formulate a basic mid- and long-term plan for the promotion of national space development (henceforward: Basic Space Development Plan; BSDP) every five years, as well as to formulate and execute an annual 'Action Plan for Promotion of Space Development' in accordance with BSDP. Based on its legally prescribed table of content,

935 See also this study's 'Acknowledgements' chapter. Any mistakes in this study are its author's alone.

936 For an unofficial English translation of the act (as last amended 20.01.2015), see: 'Space Development Promotion Act' (*Korea Legislation Research Institute*) <http://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=33560&type=part&key=18> accessed 28 January 2018. Further references to SDPA are to this translation; there is a presidential decree that provides further details on the act's implementation. For an unofficial English translation of the decree (as last amended 31.12.2015), see: 'Enforcement Decree of Space Development Promotion Act' (*Korea Legislation Research Institute*) <https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=39231&type=sogan&key=54> accessed 28 January 2018.

(the currently active) BSDP unquestionably constitutes the government's (present) main space policy and strategy document.[937]

Alongside the quite broad BSDP, SDPA further calls upon the government to formulate a specialised 'Master Plan for Utilization of Satellite Information' every five years, as well as a specialised 'Basic Plan for Preparing against Dangers in Space' every ten years. This shall be accompanied by the formulation and execution of an adequate annual 'Action Plan for Utilization of Satellite Information' and a fitting annual 'Action Plan for Preparing against Dangers in Space'.[938]

The government issued the 1st BSDP in 2007 and the 2nd BSDP in 2011. In 2013, and apparently constituting a revision of the 2nd BSDP, it established a mid- to long-term space development plan covering the years until 2040 (BSDP2013).[939] By 2017, BSDP2013 appears to have still been the government's main space policy and strategy document. However, the government has already worked towards the creation of its 3rd BSDP, which was reportedly released in early 2018.[940] As far as this study was able to ascertain, this new BSDP builds upon and extends the development direction put forward in BSDP2013. As such, this study's research findings for the government's space programme as of 2017 presumably remain overall true for the period of the 3rd BSDP.[941] On a different note, the government seems to have released the first specialised plans addressing the utilisation of satellite information and dangers in space in 2014.[942]

In addition to SDPA, other major domestic space legislation supposedly encompass the 'Act on Compensation for Damage Caused by Space Objects', which focuses in its amended version as of 2017 on compensation and liability issues,[943] and the 'Astronomy

937 See especially SDPA arts 5,5-2.

938 SDPA arts 5-3,5-4,15,15-2.

939 Jong Bum Kim, 'Space Activities in Korea' (Presentation, APRSAF-24, Bengaluru, 16 November 2017) <https://aprsaf.org/annual_meetings/aprsaf24/data/day16/2_7_KARI.pdf> accessed 28 January 2018. This study was unable to obtain English translations of these plans.

940 Based on information in: ibid; Han-joo Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (*Yonhap News Agency*, 5 February 2018) <http://english.yonhapnews.co.kr/business/2018/02/05/0502000000AEN20180205005851320.html> accessed 5 February 2018. This study was unable to obtain an English translation of the 3rd BSDP.

941 Derived from information provided by a ROK space policy expert in 2018.

942 Daniel A Pinkston, 'Joining the Asia Space Race: South Korea's Space Program' (2014) 8 On Korea: Academic Paper Series 1, 6,9; regarding the plan on dangers in space, see also: E Choi, 'Preparedness Plan for Space Hazards in Republic of Korea' (Presentation, 57th UNCOPUOS, Vienna, 13 June 2014) <http://www.unoosa.org/pdf/pres/copuos2014/tech-12.pdf> accessed 2 February 2018. This study was unable to obtain English translations of these plans.

943 For an unofficial English translation of the act (as last amended 26.07.2017), see: 'Act On Compensation For Damage Caused By Space Objects' (*Korea Legislation Research Institute*)

and Space Act', which concentrates in its amended version as of 2017 mostly on the promotion of research, training and education concerning astronomy and space as well as the dissemination of related knowledge.[944] Moreover, there is the 'Aerospace Industry Development and Promotion Act' (AIDPA), which calls in its amended version as of 2016, among others, for the establishment of a 'Master Plan for Aerospace Industry Development'.[945] Such a plan, or some related document, seems to date back to 2013.[946]

Lastly, and without being able to verifiably link them to any of the documents introduced above, this study also wants to point out here that the government apparently has a 'Korean Launch Vehicle Development Plan' in place,[947] and the ROK's Ministry of National Defence has expanded the government's space programme by the adoption of a 'Basic Plan for the Development of Defense Space Power' in 2014.[948]

9.3 Basic domestic decision-making system

Domestic actors covering a variety of portfolios appear to be involved in the basic domestic decision-making system behind the formulation and implementation of the ROK government's present space programme. This study deems it sufficient for its particular assessment of the said programme to have the following knowledge.

<https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=46485&type=sogan&key=54> accessed 28 January 2018.

944 For an unofficial English translation of the act (as last amended 26.07.2017), see: 'Astronomy and Space Act' (*Korea Legislation Research Institute*) <https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=45894&type=sogan&key=54> accessed 28 January 2018. Further references to this act are to this translation; there is a presidential decree that provides further details on the act's implementation. For an unofficial translation of the decree (as last amended 26.07.2017), see: 'Enforcement Decree of the Astronomy and Space Act' (*Korea Legislation Research Institute*) <https://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=45896&type=sogan&key=54> accessed 28 January 2018.

945 For an unofficial English translation of the act (as last amended 29.03.2016), see: 'Aerospace Industry Development Promotion Act' (*Korea Legislation Research Institute*) <http://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=43106&type=part&key=28> accessed 10 February 2018. Further references to AIDPA are to this translation. This study was unable to obtain an English translation of said plan.

946 See the reference to an 'Industrialization Strategy of Space Technology' in: 'The Government, Establishing a Foothold for the Takeoff of Korea as an Aerospace Powerhouse' (*KARI*, 26 November 2013) <https://www.kari.re.kr/cop/bbs/BBSMSTR_000000000031/selectBoardArticle.do?nttId=1019&kind=&mno=sitemap_02&pageIndex=2&searchCnd=&searchWrd=> accessed 3 February 2018.

947 See the reference to the 'Amendment of the Korean Launch Vehicle Development Plan' in: ibid. This study was unable to obtain an English translation of this plan.

948 Ministry of National Defense, Republic of Korea, '2016 Defense White Paper' (White Paper, Publication Registration Number 11-1290000-000446-11, Ministry of National Defense, Republic of Korea 2017) 74–75 <http://www.mnd.go.kr/user/mndEN/upload/pblictn/PBLICTNEBOOK_201705180357180050.pdf> accessed 18 February 2018. This study was unable to obtain an English translation of this plan.

In short, the highest domestic institution behind the formulation and implementation of the government's current space programme seems to be the (15-member) Korea National Space Committee (KNSC), set up by SDPA under the direct control of the South Korean President. Pinkston summarises KNSC's main task neatly as 'oversee[ing] the inter-agency production of the space development plan, and [...] subsequently [… being] responsible for drafting policies and procedures for implementation of the plan.'[949]

Under KNSC, the Ministry of Science and ICT[950] is the most relevant government ministry. Its minister is the chair of KNSC. Moreover, national legislation transfers many other domestic space-related planning, administrative and implementation responsibilities to this ministry or its minister.[951] Also, it is the parent ministry of the Korea Aerospace Research Institute (KARI). Initially established in 1989 and affiliated with the Korea Institute of Machinery and Materials, KARI can be described as South Korea's present national space agency. For example, KARI leads the development of the domestic space launcher project, the national lunar programme and various domestic satellite series. Moreover, it fosters the utilisation and commercialisation of space technology and information. It interacts with the space industry and other entities like research institutes and universities to accomplish its ascribed tasks.[952]

Further government-related institutions under – but partly also being represented in – KNSC with an important role in the formulation and implementation of the government's current space programme appear to encompass, at a minimum, the Ministry of Strategy and Finance, the Ministry of Foreign Affairs, the Ministry of Trade, Industry and Energy, the Ministry of Land, Infrastructure, Transport, the Ministry of Environment, the Ministry of Agriculture, Food and Rural Affairs, the Ministry of Ocean and Fisheries, the Ministry of National Defence, the National Intelligence Service, the Ministry of Interior and Safety, the Korea Meteorological Administration and the National Radio Research

949 SDPA art 6; Pinkston (n 942) 3.

950 ICT stands for 'Information and Communications Technology'.

951 Based on the various provisions in: 'Space Development Promotion Act' (n 936); 'Enforcement Decree of Space Development Promotion Act' (n 936); 'Aerospace Industry Development Promotion Act' (n 945); 'Act On Compensation For Damage Caused By Space Objects' (n 943); 'Astronomy and Space Act' (n 944); 'Enforcement Decree of the Astronomy and Space Act' (n 944).

952 Based on information in: Pinkston (n 942) 2,7-8; 'Major Functions' (*KARI*) <https://www.kari.re.kr/eng/sub01_02.do> accessed 28 January 2018; Kim, 'Space Activities in Korea' (n 939).

Agency. Notably, AIDPA even calls for a (15-member) Aerospace Industry Development Policy Council under the jurisdiction of the Minister of Trade, Industry and Energy.[953]

Additionally, such government-related or academic research institutions like the Agency for Defence Development (ADD), the Electronic Telecommunication Research Institute, the Korea Astronomy and Space Science Institute, and the Korea Advanced Institute of Science and Technology (KAIST), especially through its Satellite Technology Research Centre (SaTReC), seem to be given a considerable role in the implementation of the government's current space programme.[954] Prominent entities within the – still relatively small – South Korean space industry that partake in this programme's implementation apparently are Korea Aerospace Industries, SaTReC Initiative and KT SAT.[955]

9.4 Space-related state preferences

This study identifies various state preferences that seem to underlie the South Korean government's current space programme. Ultimately, these appear somewhat coherent with findings on motivating factors behind the government's space programme in previous years. For example, An determines that South Korean aspirations regarding outer space from the 1950s to 2013 can be divided into four periods, each driven by a dominant 'imagination'. These have been modernisation (1950s~1960s), self-defence (1970~1984), economic security (1985~1997) and national prestige (1998~2013).[956] Moltz argues that economic development, national security, national pride and international prestige motivated the government's space undertakings by around 2012.[957]

953 Based on information in: 'Space Development Promotion Act' (n 936); 'Enforcement Decree of Space Development Promotion Act' (n 936); 'Aerospace Industry Development Promotion Act' (n 945); Kim, 'Space Activities in Korea' (n 939); Ministry of National Defense, Republic of Korea (n 948) 75.

954 'South Korea', in Euroconsult, *Profiles of Government Space Programs. Analysis of over 80 Countries & Agencies* (2015) 45–2.

955 Based on information in: Hyoung Joon An, 'National Aspirations, Imagined Futures, and Space Exploration: The Origin and Development of Korean Space Program 1958-2013' (PhD thesis, Georgia Institute of Technology 2015) 135-142,200 <https://smartech.gatech.edu/bitstream/handle/1853/54426/AN-DISSERTATION-2015.pdf> accessed 7 May 2017; 'About KT SAT' (*KT SAT*) <https://www.ktsat.net/about/> accessed 6 February 2018; 'KAI Chosen as a Company of Korea Space Launch...' (*Korea Aerospace Industries, LTD.*, 21 January 2014) <http://www.koreaaero.com/english/pr_center/cpr_view.asp?pg=1&seq=25734&bbs=10> accessed 10 February 2018.

956 An (n 955) 205–208.

957 Moltz (n 32) 137-138,156.

9.4.1 Socioeconomic state preferences

There are various indicators that the government's current space-related socioeconomic state preference is the advancement of South Korea's socioeconomic development.

Most prominently, the purpose of SDPA, upon which the government's BSDPs rest, is, among others, 'to contribute to [...] the sound growth of the national economy, and the betterment of citizens's [sic!] lives by systematically promoting the development of outer space and by efficiently using and managing space objects.'[958] Also, AIDPA's purpose 'is to contribute to the sound development of the national economy and the improvement of people's lives life [sic!] by supporting and promoting rationally the aerospace industry, and researching and developing efficiently aerospace science and technology.'[959]

One target area under this state preference seems to be the development and application of space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for South Korea. This is apparent by this study's findings on the current major government-promoted space-related measures. For example, certain measures supposedly address, in general terms, issues in such areas like the climate, disaster management, the environment, meteorology, land use, natural resources and transportation (e.g. through navigation-related projects).[960]

The three additional – and somewhat interlinked – target areas of expanding the domestic (private) space industry, extending the domestic space market and enhancing the South Korean space industry's role in the international space market arise from the following narrative.

Based on the available information regarding BSDP2013, the government considers the country's space industry to be still quite small in size. However, it recognises that this industry can potentially contribute to domestic economic progress. For example, a national space industry usually involves high-tech businesses and high paying jobs and can create an economic ripple effect worth billions of dollars. Fittingly, the government's national space technology industrialisation strategy published in 2013 apparently outlines that the government wants to generate growth by, e.g., supporting the domestic private

958 SDPA art 1.
959 AIDPA art 1.
960 See especially this study's Sections 9.6.1-4.

industry's role in space development, broadening the domestic industrial use of satellite information, transferring related technology and applications to the domestic private sector for national and international commercial mass marketing, and strengthening the export of South Korean space-related products and services. In the long run, South Korean entities might even provide international commercial space launch services.[961] The new 3rd BSDP shall reportedly help to 'begin an era of private companies launching orbital space programs in 2026, with a goal of sending up small-sized spacecrafts by private companies starting in 2030.'[962]

9.4.2 Political state preferences

Presently, the government arguably pursues two space-related political state preferences.

One is the advancement of South Korea's international prestige and influence. It emerges from this study's evaluation of the current major government-promoted space-related measures. Some measures can be (partially) explained by the pursuit of such a state preference.[963]

With the long-standing political and military feud between South and North Korea in mind, a researcher can be tempted to assume that the advancement of South Korea's international prestige and influence vis-à-vis North Korea is a particular target area under this state preference. However, as one observer at least concluded about the DPRK space programme around a decade ago, while the DPRK government might see itself in a space race with the South, the latter does not necessarily participate in it.[964] Ultimately, this study has decided to take this target area into account tentatively because it has failed to find clear-cut evidence, e.g. in the form of a government statement, for either policy direction in the available material. One reason for this lack of data might be the fact that – and on which most researchers familiar with the Asian region will agree – South Korea is nowadays already visibly ahead of its Northern neighbour in most space-related (as well

961 Based on information in: Pinkston (n 942) 5–8; 'The Government, Establishing a Foothold for the Takeoff of Korea as an Aerospace Powerhouse' (n 946); Harry Kim, 'South Korea's Race to Space Is Lagging Behind' (*The Diplomat*, 20 November 2017) <https://thediplomat.com/2017/11/south-koreas-race-to-space-is-lagging-behind/> accessed 3 February 2018; 'Utilization of Satellite Images' (*KARI*) <https://www.kari.re.kr/eng/sub03_05.do> accessed 28 January 2018. The first two publications are at the core of this narrative. The other two links provide mostly some supporting information.

962 Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (n 940).

963 See especially this study's Section 9.6.7.

964 Harvey, Smid and Pirard (n 500) 474.

as other technology) activity fields. This circumstance decreases the current necessity for the government to address this topic publicly even if it is of some relevance.[965]

The second space-related political state preference of increasing national pride and, tentatively, public support for the democratically elected government arises from the following context.

First, this study has found that the current major government-promoted space exploration measures seem partially directed towards increasing the South Korean people's national pride.[966] Second, and similar to the cases of India and Japan, it is, tentatively speaking, a reasonable assumption that any democratically elected South Korean government is aware that successfully implemented space undertakings, especially technologically complex ones (e.g. a lunar mission), allow presenting itself to its people as the driver of national progress. This might translate into higher support for the government among the South Korean people.

9.4.3 National security state preferences

Safeguarding South Korea's national security is arguably the national security state preference underlying the government's current space programme.

Most prominently, SDPA's purpose is, among others, 'to contribute to national security [...] by systematically promoting the development of outer space and by efficiently using and managing space objects.'[967] Furthermore, a KARI official indicated a link between South Korea's space undertakings and its national security, while a ministerial South Korean press release referred to the dual-use nature of the country's space technology.[968]

There appears to be at least one target area under this state preference, namely the enhancement of the South Korean military's strategic support system, seemingly especially aiming against North Korea and partially involving interaction with the USA.

965 A comparative look at current major North and South Korean government-promoted space-related measures in this study's Chapters 8 and 9 makes this an easy conclusion.

966 See especially this study's Section 9.6.7.

967 SDPA art 2.

968 Clint Work and Seonhee Kim, 'It's Not About the Moon: The Military and Economic Logics to South Korean Space Exploration' (*Sino-NK*, 31 May 2016) <https://sinonk.com/2016/05/31/its-not-about-the-moon-the-military-and-economic-logics-to-south-korean-space-exploration/> accessed 3 February 2018.

One strong indicator for that is the apparent government-promoted development of some domestic satellite systems for military support.[969] Another is the government's '2016 Defense White Paper' directly mentioning support functions of satellite-based communications and reconnaissance to the national military, as well as the importance of the (space-related) alliance with the USA for South Korea.[970] Also, according to one account, the ROK Air Force has set up a Space Development Branch within its headquarters and entered into an MoU with, among others, KARI to recruit space-related experts, as well as engaged in sending some officers to train on space and security topics with its US counterpart each year.[971] Finally, the accessible information suggests that the ROK has a strong interest in using space-related capabilities to monitor North Korea and improve South Korea's regional early warning system and military counterstrike capabilities, including against North Korean (ballistic missile) attacks.[972]

9.4.4 Science and technology state preferences

The government's current space-related science and technology state preference appears to be the advancement of South Korea's scientific and technological level per se; whereby the reference to 'per se' indicates here more of a basic research and knowledge gathering orientation.

After all, SDPA shall, among others, 'facilitate the peaceful use and scientific exploration of outer space'.[973] Moreover, the domestic Astronomy and Space Act promotes astronomical and space research, education and training, as well as the dissemination of related knowledge.[974] Also, this study's evaluation of current major government-promoted space-related measures has revealed that some of them seem to be (partially) directed towards serving such a state preference.[975]

At the same time, and similar to the Indian case, it shall be noted here that the ROK government's actual pursuit of this state preference apparently still subsists in a limited

969 See especially this study's Sections 9.6.2-4.
970 Ministry of National Defense, Republic of Korea (n 948) 106,110,148-149.
971 Work and Kim (n 968). This article also mentions that the South Korean government's 'National Security Strategy' from 2014 and its previous defence white papers from 2008, 2010, 2012 and 2014 already featured the role of space capabilities for the South Korean military.
972 Based on information in: ibid; Kim, 'South Korea's Race to Space Is Lagging Behind' (n 961); Ministry of National Defense, Republic of Korea (n 948) 110.
973 SDPA art 2.
974 'Astronomy and Space Act' (n 944).
975 See especially this study's Sections 9.6.5 and 9.6.7.

fashion. The identifiable number and scope of current major government-promoted space-related measures serving the pursuit of this state preference seemingly are rather limited within the ROK government's overall space programme, as well as in comparison to the pursuit of a similar state preference in the Chinese and Japanese cases.[976]

9.4.5 Autonomy-oriented state preferences

The South Korean government's current space programme arguably incorporates the pursuit of two autonomy-oriented state preferences.

The first one is to ensure the stable use of outer space for South Korea. It emerges from the following context.

As mentioned under Section 9.2, SDPA calls upon the government to formulate a specialised Basic Plan for Preparing against Dangers in Space every ten years. This plan shall at least address '[m]atters concerning environmental protection and surveillance of space; [...] forecasts and alarms of dangers in space; [...] research and development for the prevention of and preparing against dangers in space; [and …] international cooperation for the prevention of and preparing against dangers in space'. Also, SDPA allows for the governmental designation of a domestic space environment surveillance agency.[977] Lastly, Section 9.6.9 has identified some current major government-promoted space-related measures that suit the pursuit of such a state preference.

The second space-related autonomy-oriented state preference is the development and maintenance of the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

After all, the government's space programme during the BSDP2013 period has apparently aimed at advancing the domestic launcher and satellite development capabilities, including through the participation of private actors, and at achieving a South Korean space sector that is competitive with that of advanced states.[978] Section 9.4.1 has

976 Compare especially the findings on these governments' current major government-promoted space-related measures in this study's Sections 4.6, 7.6 and 9.6.

977 SDPA arts 15,15-2,15-3. For the citation, see SDPA art 15.

978 'The Government, Establishing a Foothold for the Takeoff of Korea as an Aerospace Powerhouse' (n 946).

also indicated that the government gives relevance to strengthening and expanding the domestic (private) space industry. Finally, the findings in this study's South Korea chapter suggest that the government presently puts more emphasis on promoting major domestic than major cooperative space-related measures.[979]

9.5 Basic pol. & leg. framework concerning IGO-based regional space cooperation

While the information in the accessed material is sparse, there are some indicators that the South Korean government currently is, in general, open to participating in IGO-based regional space cooperation.

First, domestic legislation has the government consider international cooperation in various space-related topics, without excluding cooperation through regional space-specific IGOs. For example, SDPA explains that the government's BSDP shall include, *inter alia*, '[m]atters concerning international cooperation for the invigoration of space development[...].' Similarly, the government's Basic Plan for Preparing against Dangers in Space shall address '[m]atters concerning international cooperation for the prevention of and preparing against dangers in space[...].'[980] Besides that, AIDPA has the government's Master Plan for Aerospace Industry Development incorporate '[m]atters concerning international cooperation to revitalize the development of the aerospace industry[...]'.[981] The Astronomy and Space Act further wants the government to prepare and implement policies covering '[m]atters concerning cooperation with foreign governments, international organizations, etc. with respect to astronomical work[...].'[982]

Second, the South Korean government has some history of taking part in institutionalised regional space cooperation. It was an active participant within the Asia Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA) regime, which had its origin in 1992 and later transformed into APSCO, yet ultimately without South Korea becoming a member of the latter.[983] South Korea even hosted the 3rd Conference of AP-MCSTA in 1996[984] and signed, alongside China, Iran, Mongolia,

979 See the findings throughout this study's Section 9.6.
980 SDPA arts 15,15-3.
981 AIDPA art 3.
982 Astronomy and Space Act art 4.
983 'Convention History' (*APSCO*) <http://www.apsco.int/sitesearchOne.asp?ID=76> accessed 7 September 2018.
984 'AP-MCSTA Workshop(Beijing,1992)' (*AP-MCSTA*) <http://www.apmcsta.org/Conferences/conferences.htm> accessed 7 September 2018.

Pakistan and Thailand, an MoU on cooperation concerning an AP-MCSTA-related *Small Multi-Mission Satellite* project in 1998.[985] Moreover, South Korea through KARI is, alongside such states like India, Iran and North Korea, a member of CSSTEAP.[986] Lastly, South Korean government-related (as well as non-governmental) entities have participated in APRSAF,[987] which has also seen an involvement of, among others, Chinese, Indian and Japanese government-related entities.[988]

This study has not come across precise data on the principles governing South Korea's current intergovernmental space cooperation. However, it appears that, similar to the other preeminent Asian governments in the space sector, the ROK government at least abides by the principles outlined in the main international space agreements. It signed and ratified the Outer Space Treaty in 1967,[989] signed the Rescue Agreement in 1968 and ratified it in 1969,[990] signed the Liability Convention in 1972 and ratified it in 1980,[991] and acceded to the Registration Convention in 1981.[992] It has not entered the Moon Agreement.

Finally, it is notable here that South Korea is, together with such states like India and Japan, an MTCR partner.[993] Therefore, the ROK government, if it submits to this regime in earnest, presumably has merely a limited present potential to engage cooperatively with non-partners of MTCR like China, Iran and North Korea in the field of space launcher development.

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985 'Joint Technical Coordination Meeting of the Small Multi-Mission Satellite (SMMS) Project Held in Beijing' (*AP-MCSTA*) <http://www.apmcsta.org/Projects/projects.htm> accessed 7 September 2018.

986 'Governing Board' (n 652).

987 'REPUBLIC OF KOREA' (*APRSAF*) <https://www.aprsaf.org/participants/countries/korea.php> accessed 27 September 2018.

988 'Countries and Regions' (n 405).

989 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies' (*United Nations Treaty Collection*) <https://treaties.un.org/pages/showDetails.aspx?objid=0800000280128cbd> accessed 8 September 2018.

990 'Convention on Registration of Objects Launched into Outer Space' (*United Nations Treaty Collection*) <https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXIV-1&chapter=24&Temp=mtdsg3&clang=_en> accessed 8 September 2018.

991 'Convention on International Liability for Damage Caused by Space Objects' (*Gov.uk*, 1 September 2017) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/641718/10._Damage_caused_by_Space_Objects__1972__Status_List.pdf> accessed 8 September 2018.

992 'Convention on Registration of Objects Launched into Outer Space' (n 990).

993 'MTCR Partners' (n 407). For more information on MTCR, see this study's Section 5.5.

9.6 Major domestic and cooperative space-related measures

9.6.1 APRSAF

The participation of South Korean government-related (and non-governmental) entities in Japan-led APRSAF appears to be the current major South Korean government-promoted institutionalised regional cooperative space-related measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector.

Without claiming completeness, the specific major South Korean government-promoted cooperative space-related measures under APRSAF in recent years seem to have been as follows:

South Korean government-related entities, alongside, among others, Chinese, Indian and Japanese government-related (and non-governmental) entities, have contributed to *Sentinel Asia*, which aims at improving disaster management in the Asia-Pacific region.

The South Korean space agency is, together with, for example, the space agency of Japan, a member of Kibo-ABC that aims at enhancing the utilisation of the Japan-owned and ISS-linked *Kibo* module in the Asia-Pacific region.

(Presumably somewhat government-approved) entities from India, Japan and South Korea participated in the already completed Climate R^3. It was directed toward determining the ability of APRSAF countries and institutions to benefit from certain upcoming climate-related satellite missions.[994]

Following from that and further information on APRSAF provided in Section 7.6.1, the ROK government's engagement in APRSAF appears, for one, to be intended to support the pursuit of its current space-related socioeconomic state preference, in particular the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for South Korea.

Furthermore, it is – at least tentatively – plausible to assume that the ROK government hopes that the South Korean participation in APRSAF and various APRSAF-specific undertakings somewhat aid the pursuit of its current space-related political state

994 For this and more information on APRSAF and the specific measures, see this study's Section 7.6.1.

preference of advancing South Korea's international prestige and influence. For example, other participants in *Sentinel Asia* might profit from the South Korean contribution to their disaster management, which can bolster their positive perception of South Korea.

Also, the planned exchange of information and opinions on, *inter alia*, applications of space science and technology among APRSAF participants as well as Kibo-ABC's partial application for scientific endeavours allows arguing that the ROK government might see APRSAF as an opportunity to foster the pursuit of its current space-related science and technology state preference.

Lastly, it is not unreasonable to consider that the ROK government finds APRSAF a useful mechanism that can temporarily bolster the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining South Korea's domestic human, industrial, scientific and technological capacities and capabilities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. After all, APRSAF is open to the participation of governmental and non-governmental entities, including regional companies, universities and research institutes, has already featured the involvement of South Korean entities, shall include the exchange of information and opinions on space programmes and has seen its plenary meeting hosted by South Korea as far back as 2003.[995]

9.6.2 Remote Sensing

9.6.2.1 Major domestic measures

With these series' roots partially reaching back to the 1990s, the current major government-promoted domestic space-related remote sensing measures appear to be the development and application of these four domestic(ally controlled) satellite series:

First, there is the *Korea Multi-Purpose Satellite* (KOMPSAT; dubbed *Arirang*) series with high- to very high-resolution optical, radar imaging and infrared observation capabilities. Developed under the responsibility of KARI, five such satellites (KOMPSAT-1,-2,-3,-5,-3A) have been launched (1999-2015) so far. While writing, KOMPSAT-6, an all-weather observation satellite, and KOMPSAT-7, a high-resolution EO satellite, are under development. They shall be launched around 2020 and 2021,

995 Concerning the 2003 plenary meeting, see: 'About APRSAF' (n 412).

respectively.[996] Additionally, the government apparently considers to promote the launch of two more KOMPSATs by 2030, and four more by 2040.[997]

Second, there is the *Geostationary Korea Multi-Purpose Satellite* (GEO-KOMPSAT; dubbed *Cheollian*) series with remote sensing and partially also communications and space weather observation capabilities. GEO-KOMPSAT-1, launched in 2010, provides ocean, meteorological and communications services. Scheduled for launch around 2018 and 2019, respectively, two more satellites currently under development are GEO-KOMPSAT-2A for weather and additional space weather monitoring, as well as GEO-KOMPSAT-2B for ocean and environmental monitoring.[998] The government might invest into eleven more GEO-KOMPSATs by 2030, and 14 additional ones by 2040.[999]

Third, there is the *Compact Advanced Satellite 500* (CAS500) series. As part of this series' ongoing first development phase, KARI wants to create a 500kg class standard platform that can be outfitted with domestically developed payloads. The series' second development phase then is the construction of two high-resolution remote sensing satellites referred to as CAS500-1 and CAS500-2. Their launch shall take place around 2019 and 2020, respectively.[1000] For later, the government apparently deliberates the launch of 23 more CAS500s by 2030, and a further 43 by 2040.[1001]

Fourth, the government currently promotes the development and application of a dedicated reconnaissance satellites series for the South Korean military under the code-name *425 Project*[1002]. Reportedly, the military shall receive five such satellites between 2022 and 2024. Relevant South Korean authorities have already planned to engage in

996 'Korea Multi-Purpose Satellite (KOMPSAT, Arirang)' (*KARI*) <https://www.kari.re.kr/eng/sub03_02_01.do> accessed 28 January 2018.

997 Kyung-Ju Min, 'Space Activities in Korea' (Presentation, APRSAF-22, Bali, 3 December 2015) <https://aprsaf.org/annual_meetings/aprsaf22/pdf/program/plenary/D3_1400_Korea_1203_korea_APRSAF22_Plenary_Session_Space_Activities_in_Korea_Dr_Kyung-Ju_Min_final.pdf> accessed 28 January 2018.

998 'Geostationary Korea Multi Purpose Satellite(GEO-KOMPSAT, Cheollian)' (*KARI*) <https://www.kari.re.kr/eng/sub03_02_02.do> accessed 28 January 2018.

999 Min (n 997).

1000 'CAS500 (Compact Advanced Satellite 500)' (*KARI*) <https://www.kari.re.kr/eng/sub03_02_03.do> accessed 28 January 2018.

1001 Min (n 997).

1002 'S. Korea To Get Five Military Spy Satellites Worth US$880M By 2023' (*defenseworld.net*, 25 August 2017) <http://www.defenseworld.net/news/20390/S__Korea_To_Get_Five_Military_Spy_Satellites_Worth_US_880M_By_2023> accessed 3 February 2018.

negotiation about a related ₩1.25 trillion ($1.15 billion) satellite development contract with LIG Nex1, a domestic defence company.[1003]

Altogether, the government seems to promote these major domestic measures especially with a view to foster the pursuit of its current space-related socioeconomic and national security state preferences, including all related target areas.

Indicators for the pursuit of the government's current space-related socioeconomic state preference are, for example, KARI describing the KOMPSAT series as to serve South Korea's national needs and referring to the satellites' usefulness in such socioeconomically relevant areas like disaster management, environmental monitoring, land and resource management, and public safety. Moreover, the series' development background indicates that its construction shall improve the domestic industry's involvement in satellite development and enhance the country's industrial base.[1004] Also, Work and Kim hold that the series shall 'promote the satellite industry for both domestic and export markets.'[1005] Besides that, KARI explains that the GEO-KOMPSAT series is applied in such socioeconomically relevant areas like atmospheric environment and weather monitoring, marine environment monitoring and communications.[1006] While there is little information on the CAS500 series, KARI at least mentions that this series shall meet public needs and has a great potential for commercialisation. Also, the institute wants, based on the CAS500-1 project, transfer satellite technology to the domestic industry so that CAS500-2 can be fully developed by the latter.[1007] As such, the CAS500 series displays a socioeconomic orientation as well.

The pursuit of government's current space-related national security state preference appears to, at a minimum, underlie its KOMPSAT series and the satellites developed under the *425 Project.* Building on Work and Kim's argumentation, the KOMPSAT series has not only a socioeconomic orientation but is nowadays likely also directed towards strengthening the South Korean military's intelligence, surveillance, and reconnaissance capability, presumably especially regarding North Korea that has

1003'Military to Begin Talks with LIG Nex1 for Spy Satellite Project: Source' (*Yonhap News Agency*, 3 December 2017) <http://english.yonhapnews.co.kr/search1/2603000000.html> accessed 3 February 2018.
1004'Korea Multi-Purpose Satellite (KOMPSAT, Arirang)' (n 996).
1005Work and Kim (n 968).
1006'Geostationary Korea Multi Purpose Satellite(GEO-KOMPSAT, Cheollian)' (n 998).
1007'CAS500 (Compact Advanced Satellite 500)' (n 1000).

conducted various missile and nuclear weapon tests over the past decade.[1008] Probably taking over the additional national security role of the KOMPSAT series in the future, the available information suggests that the primary application of the reconnaissance satellites series under the *425 Project* is to improve the domestic military's intelligence gathering capabilities on the DPRK's nuclear and missile activities as well as other regional security-related issues. Moreover, it is likely that the government invests into these satellites to help the South Korean military reduce its strong dependency from US military intelligence gathering capabilities; of course, without challenging the ROK-US alliance.[1009] Notably, this study has not found reliable data on whether the remote sensing elements of GEO-KOMPSAT series and the CAS500 series serve a particular national security purpose. It cannot be ruled out completely.

9.6.2.2 Major cooperative measures

Excluding APRSAF-related measures, current major government-promoted cooperative space-related remote sensing measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector seem to be limited to these few:

South Korea through KARI contributes, alongside the space agencies of, among others, China, India and Japan, remote sensing data from domestic satellites within the International Disaster Charter framework.[1010]

South Korean government-related entities engage in GEO alongside those of China, India, Iran and Japan,[1011] UN-SPIDER alongside those of China, India and Iran,[1012] as well as WMO alongside those of China, India, Iran, Japan and North Korea.[1013]

1008Work and Kim (n 968).

1009Combined information in: 'Military to Begin Talks with LIG Nex1 for Spy Satellite Project: Source' (n 1003); 'S. Korea To Get Five Military Spy Satellites Worth US$880M By 2023' (n 1002); Ministry of National Defense, Republic of Korea (n 948) 54; Yossi Melman, 'Report: South Korea Mulls Leasing Israeli Spy Satellite' (*The Jerusalem Post*, 20 October 2016) <http://www.jpost.com/Israel-News/Report-South-Korea-mulls-leasing-Israeli-spy-satellite-470485> accessed 3 February 2018.

1010'The International Charter Space and Major Disasters' (n 236) 13.

1011'Member List' (n 238).

1012'Republic of Korea' (*UN-SPIDER Knowledge Portal*) <http://www.un-spider.org/network/national-focal-points/republic-korea> accessed 14 October 2018.

1013'Members' (n 240).

The Indian-South Korean MoU 2010 indicates that the two space agencies are open to exchanging information and entering discussions for (further) cooperation in, among others, remote sensing and its application.[1014]

Based on the information presented in the context of these measures, their primary orientation presumably is in most instances towards bolstering the pursuit of the South Korean government's current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for South Korea.

Besides that, the ROK government might consider these measures as useful to foster, e.g. by contributing to others' disaster management, the pursuit of its space-related political state preference of advancing South Korea's international prestige and influence with its respective partners.

9.6.3 Communications and broadcasting

9.6.3.1 Major domestic measures

Except for the government-promoted GEO-KOMPSAT series that includes communications capabilities and has been already introduced under Section 9.6.2, the only other South Korean communications and broadcasting satellite series is the *Koreasat* (dubbed *Mugunghwa*) series. However, for the most part, it is no longer a mainly government-promoted measure. The government has excluded the series from its BSDP since 2005. KT SAT, a domestic company wholly owned by KT Corporation, which was previously a state-owned enterprise but nowadays constitutes a private company, is currently primarily responsible for the development of the series and related services provision (in a primarily commercial capacity). Between 1995 and 2017, eight satellites (*Koreasat-1*,*-2*,*-3*,*-5*,*-6*,*-8*,*-7*,*-5A*) were launched. All have been turnkey satellites commercially obtained from foreign manufacturers and launched by foreign launch providers.[1015]

1014'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) 2.

1015Combined information in: 'About KT SAT' (n 955); An (n 955) 136-142,185; 'Fleet & Coverage' (*KT SAT*) <https://www.ktsat.net/coverage-map/> accessed 6 February 2018; 'South Korea and Satellite Communication Systems' (*Globalsecurity.org*) <https://www.globalsecurity.org/space/world/rok/comm.htm> accessed 6 February 2018.

The government's current limited involvement in the *Koreasat* series is mostly aimed at serving the pursuit of its space-related national security state preference, especially the target area of enhancing the South Korean military's strategic support system. Most prominently, *Koresat-5* is jointly owned and operated by KT Corporation and ADD, and has commercially available and military-controlled transponders. The ROK military, aware of the benefits of satellite-based communications,[1016] uses its capacities to strengthen its communications infrastructure for regional operations and the interoperability of South Korean forces.[1017]

9.6.3.2 Major cooperative measures

As far as this study was able to ascertain, the current major government-promoted cooperative space-related communications and broadcasting measures (with a presumed high potential for) involving preeminent Asian governments in the space sector encompass only the following two:

According to the Indian-South Korean MoU 2010, the two sides want to exchange information and enter discussions for cooperation, among others, in the field of communications.[1018] There is little data that allows determining the specific underlying space-related state preferences. However, it is likely that the ROK government partakes in that in the pursuit of its space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for South Korea.

Furthermore, South Korea is, alongside all the other preeminent Asian governments in the space sector, a member state of ITU. This might be particularly aimed at fostering the pursuit of all space-related state preferences underlying the South Korean government's space-related communications and broadcasting measures.[1019]

1016Ministry of National Defense, Republic of Korea (n 948) 106.

1017Work and Kim (n 968); Stephen Clark, 'South Korean Satellite Launched to Serve Dual Purpose' (*Space.com*, 22 August 2006) <https://www.space.com/2782-south-korean-satellite-launched-serve-dual-purpose.html> accessed 3 February 2018.

1018'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425).

1019For more information, see this study's Section 4.6.3.3.

Within all that, it is not out of the question that the government thinks that such cooperative measures also aid the pursuit of its space-related political state preference of advancing South Korea's international prestige and influence (with India).

9.6.4 Navigation

9.6.4.1 Major domestic measures

This study holds that the government currently promotes two major domestic space-related navigation measures.

The first one is the creation of KASS. It shall constitute a South Korean satellite-based augmented system for the US-controlled GPS and potentially other navigation satellite systems in the future. An open service – free-of-charge except for aircraft – shall be available by around July 2020. The Safety of Life service for aviation is scheduled to commence in October 2022. Notably, the reported involvement of a contract between KARI and Thales Alenia Space in the development of KASS does not necessarily counter the 'domestic' label attributed to this system here. Ultimately, South Korean entities shall control this system.

The expectation is that KASS allows for more overall and less congested air traffic while upholding aviation security and supports domestic industrial growth. Also, it is expected that KASS enhances terrestrial and marine navigation, improves the performance of information and communication devices and helps with social issues like locating senior citizens and lost children, and emergency situations.[1020] As such, KASS seems strongly aimed at serving the pursuit of the government's current space-related socioeconomic state preference, especially the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for South Korea.

Adding to that, this study deems it reasonable to argue that the government might further develop this system to foster the pursuit of its space-related national security state

1020Combined information in: 'Satellite Navigation' <https://www.kari.re.kr/eng/sub03_06.do> accessed 28 January 2018; 'Thales Alenia Space Wins Contract for South Korean Augmentation Satellite System (KASS) with KARI' (*Thales*, 26 October 2016) <https://www.thalesgroup.com/en/worldwide/press-release/thales-alenia-space-wins-contract-south-korean-augmentation-satellite-system> accessed 29 January 2018; Kim, 'Space Activities in Korea' (n 939).

preference, in particular the target area of enhancing the South Korean military's strategic support system. To name just a few, military fighter jets and missiles can benefit from better navigation signals.

The second major domestic space-related navigation measure is the development and application of the *Korean Positioning System* (KPS), a domestically-controlled – presumably regional – navigation satellite system. Even though it is a new project under the 3rd BSDP published in early 2018, this study has decided to consider KPS somewhat as a part of the government's space programme as of 2017. Deliberations on the 3rd BSDP, and thus on KPS, have already taken place throughout most of 2017.[1021]

Reportedly, KPS shall consist of seven satellites and improve the accuracy of satellite navigation services in South Korea from around 10 meters to less than one meter. It shall be operational by around 2034/2035. Towards that end, 'the KPS initiative will develop a ground test in 2021, core satellite navigation technology by 2022 and begin actual satellite production in 2024.' The available information on KPS further suggests that the government wants to use the new system to reduce the South Korean dependency from foreign satellite navigation and positioning systems like the American GPS. Loss of signal to such foreign systems for any reason might have severe effects on daily life in South Korea.[1022]

Based on this information, the aforementioned state preferences underlying KASS and this study's findings regarding other preeminent Asian governments in the space sector's involvement in the field of navigation, it is reasonable to assume here that the government sees KPS ultimately especially serving the pursuit of its space-related socioeconomic and national security state preferences. For example, it is well-known that areas like modern agriculture, fishing, transportation and missile delivery systems benefit from more precise navigation signals.

1021 Extrapolated from information provided by a South Korean space policy expert.

1022 'South Korea to Build Its Own Korean Positioning System' (*Geospatial World*, 5 February 2018) <https://www.geospatialworld.net/news/south-korea-build-korean-positioning-system/> accessed 5 February 2018; Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (n 940).

9.6.4.2 Major cooperative measure

This study has found only evidence for one current major government-promoted cooperative space-related navigation measure (with a high potential for) involving other preeminent Asian governments in the space sector:

The Indian-South Korean MoU 2010 holds that the two sides want to exchange information and enter discussions for cooperation in, *inter alia*, the field of navigation.[1023] They seem to have especially engaged in collaboration to establish interoperability between the Indian GAGAN and South Korean KASS. Moreover, they want to share their experience in using their respective system.[1024]

Lacking detailed information, the ROK government might engage in all that mainly in the pursuit of its space-related socioeconomic state preference, in particular the target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for South Korea.

Furthermore, the ROK government might hope that this aids the pursuit of its space-related political state preference of advancing South Korea's international prestige and influence (with India).

9.6.5 Science and technology research

9.6.5.1 Major domestic measure

This study holds that only the development and application of the NEXTSat series, a 100kg next-generation small satellite series, by SaTReC somewhat fits the category of a current major government-promoted domestic space-related science and technology research measure outside of the government's lunar programme.

According to SaTReC, but without specifying the government's particular involvement, NEXTSat-1 'plays a central role in national space development.' In short, the domestic development and application of this first satellite shall improve the South Korean capabilities regarding miniaturisation, modularisation and standardisation of satellite

1023'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

1024'India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)' (n 458).

technology. Also, it shall involve scientific activities, and further the development of independent space development capabilities and the training of South Korean researchers and scientists in space science and technology.[1025]

Considering all that, this new series appears to serve the pursuit of the government's current space-related science and technology state preference, as well as the current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

9.6.5.2 Major cooperative measure

There appears to be merely one current major government-promoted cooperative space-related navigation measure (with a high potential for) involving other preeminent Asian governments in the space sector:

In particular, the Indian-South Korean MoU 2010 holds that the two sides want to exchange information and enter discussions for cooperation in, among others, the field of space science.[1026]

Overall, for South Korea, this measure might be primarily aimed at serving the pursuit of its current space-related science and technology state preference.

Moreover, the ROK government might hope that this measure aids the pursuit of its space-related political state preference of advancing South Korea's international prestige and influence (with India).

1025 'NEXTSat-1' (*SaTReC, KAIST*) <http://satrec.kaist.ac.kr/e_02_03.php> accessed 28 January 2018. Notably, the KITSAT and STSAT series mentioned on the homepage seem to be already completed.

1026 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

9.6.6 Human spaceflight

Based on this study's findings, human spaceflight is no priority within the government's current space programme. This might have to do with the fact that a South Korean astronaut already spent ten days onboard the ISS in 2008.[1027]

9.6.7 Lunar exploration

9.6.7.1 Major domestic measures

This study holds that the government promotes one major – mostly domestic – lunar exploration measure, namely the *Korean Lunar Exploration Programme* (KLEP), under its current space programme.

In short, KLEP has two consecutive phases. KARI acts as its lead institution. The first phase, running from 2016-2020 and with a budget of around $170 million, shall mainly involve the development, launch (by 2020) and application of the *Pathfinder Lunar Orbiter*, the development and test of further lunar exploration technology, as well as the establishment of a Korean deep-space network. Naturally, all that shall help to build the necessary South Korean foundation for the implementation of the second programme phase. However, at the same time, these activities shall also contribute to such areas like lunar mapping, lunar resources surveying and the study of the lunar environment and surface, as well as allow for the testing of space internet technology. Reportedly, KARI has already signed a cooperation agreement with the USA's National Aeronautics and Space Administration in December 2016 for assistance in the implementation of KLEP's first phase. The following second phase shall then see the primarily domestic development, launch and application of an uncrewed lunar orbiter and lander.[1028] The

1027For more information on this astronaut mission, see: An (n 955) 149,189-194; Pinkston (n 942) 8; 'Korea Sends Its First Astronaut into Space' (*KARI*, 21 April 2008) <https://www.kari.re.kr/cop/bbs/BBSMSTR_000000000031/selectBoardArticle.do?nttId=924&kind=&mno=sitemap_02&pageIndex=6&searchCnd=&searchWrd=> accessed 28 January 2018; 'Korea's First Astronaut Returns to Earth on April 19, with Mission Accomplished' (*KARI*, 25 April 2008) <https://www.kari.re.kr/cop/bbs/BBSMSTR_000000000031/selectBoardArticle.do?nttId=925&kind=&mno=sitemap_02&pageIndex=6&searchCnd=&searchWrd=> accessed 28 January 2018; Moltz (n 32) 146.

1028Combined information in: Gwanghyeok Ju, 'Korean Pathfinder Lunar Orbiter (KPLO) Status Update' (Presentation, Annual Meeting of the Lunar Exploration Analysis Group, Columbia, 10 October 2017) <https://www.hou.usra.edu/meetings/leag2017/presentations/tuesday/ju.pdf> accessed 29 January 2018; 'Korean Lunar Exploration Program' (*KARI*) <https://www.kari.re.kr/eng/sub03_04_01.do> accessed 28 January 2018; 'The Government, Establishing a Foothold for the Takeoff of Korea as an Aerospace Powerhouse' (n 946); Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (n 940).

Korean landing on the lunar surface shall take place around 2030.[1029] A lunar sample return mission might be added in the future.[1030]

The available information suggests that a combination of the government's current space-related political, science and technology as well as socioeconomic state preferences underlies KLEP for now.

The argument that KLEP shall aid the pursuit of the government's current space-related political state preferences emerges, on the one hand, from KARI directly stating that space exploration can strengthen national pride. Moreover, KARI indicates that the successful implementation of KLEP can showcase the country's scientific and technological competitiveness in the world and increase Korea's brand value.[1031] In this regard, it is reasonable to assume that the competition with its political and military opponent North Korea is somewhat on the mind of the South Korean government.

One indicator that KLEP shall foster the pursuit of the government's current space-related science and technology state preference is the aforementioned involvement of lunar research and technology testing in the programme. Also, KARI suggests that lunar exploration undertakings help to advance Korea's space technology level vis-à-vis other states and function as a stepping stone for deep space exploration.[1032]

The pursuit of the government's current space-related socioeconomic state preference, especially the related industry and market-related target areas, arises from KARI mentioning that KLEP's expected tangible and intangible economic value is five times as much as the investment costs. In numbers, the expected economic value is up to ₩3.8 trillion ($3.55 billion).[1033]

1029Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (n 940).

1030As indicated by a KARI presentation in 2016: Joo-Jin Lee, 'Space Activities in Korea' (Presentation, APRSAF-23, Manila, 17 November 2016) slide 10 <https://aprsaf.org/annual_meetings/aprsaf23/pdf/program/plenary/AP23_D3_1330_CR-06_Korea.pdf> accessed 28 January 2018. Notably, the launch dates given for the 1st and 2nd phase changed since then.

1031'Prospective of Korean Space Project, Lunar Exploration' (*KARI*) <https://www.kari.re.kr/eng/sub03_04.do> accessed 28 January 2018; 'Korean Lunar Exploration Program' (n 1028).

1032'Prospective of Korean Space Project, Lunar Exploration' (n 1031).

1033ibid.

9.6.7.2 Major cooperative measures

This study has found no notable current step of the ROK government towards promoting a major cooperative lunar exploration measure (with a presumed high potential for) involving other preeminent Asian governments in the space sector. However, considering that there has been a South Korean-Indian agreement that includes the sharing of lunar surface and radiation data gathered by the Indian *Chandrayaan-1* mission,[1034] it should be not disregarded as a future possibility.

9.6.8 Exploration of other celestial bodies

This study was unable to identify any current major government-promoted domestic or cooperative measure regarding the exploration of other celestial bodies than the Moon. This might change in the future. According to a presentation by a KARI representative in 2016, the government has already considered promoting the launch of a Mars probe by around 2030, and further deep space exploration missions, e.g. to asteroids and other parts of the solar system, by 2040.[1035]

It is reasonable to assume that state preferences similar to those in the field of lunar exploration – as introduced in Section 9.6.7 – will underlie such potential other space exploration measures.

9.6.9 Stable use of outer space

9.6.9.1 Major domestic measures

Coherent with the government's adoption of a Basic Plan for Preparing against Dangers in Space,[1036] this study has found three current major government-promoted domestic measures that are primarily oriented towards fostering the pursuit of its space-related autonomy-oriented state preference of ensuring the stable use of outer space for South Korea.

Two such measures concentrate on the tracking and monitoring of space objects. More precisely, the government wants to establish a domestically-controlled system for the tracking and monitoring of space objects, e.g. space debris, to improve the security of

1034'India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)' (n 458).
1035Lee, 'Space Activities in Korea' (n 1030) slide 10.
1036 For more information, see this study's Section 9.2.

South Korean space assets. By 2020, this system shall be able to track space objects of around 10 cm diameter, and, by 2040, objects of around 1 cm diameter. Besides that, the government wants to create another domestically-controlled system for the tracking and monitoring of space objects with a potential to hit South Korean territory. By 2023, this second system shall be able to assess not only the trajectory but also expected impact sites of space objects with 50 meters in diameter. Overall, the government aims at achieving 80% of US capabilities for the tracking and monitoring of space objects by 2025 and 90% by 2035. Since South Korean entities shall control both systems, the setup of some systems-related tracking and monitoring facilities abroad does not run counter to putting the 'domestic' label to these measures.

The third major government-promoted domestic measure in this regard is the improvement of early warning capabilities against potential damages caused by solar flares to electronics and electrical systems onboard of South Korean spacecraft as well as on Earth. For this, domestic spacecraft, e.g. GEO-KOMPSAT-2A, are (to be) equipped with special sensors.[1037]

9.6.9.2 Major cooperative measures

This study has only come across one current major government-promoted cooperative space-related measure (with a presumed high potential for) involving preeminent Asian governments in the space sector that is primarily aimed at serving the pursuit of the government's autonomy-oriented state preference of ensuring the stable use of outer space for South Korea.

This is the South Korean participation in IADC that involves, *inter alia*, also the space agencies of China, India and Japan.[1038]

9.6.10 Launchers

9.6.10.1 Major domestic measures

Developing and maintaining domestic space launch capabilities and capacities is a long-standing major government-promoted domestic space-related measure.

1037Pinkston (n 942) 9–11; Choi (n 942).
1038'Inter-Agency Space Debris Coordination Committee' (n 343).

KARI developed and launched three *Korean Sounding Rocket* series between 1998-2002.[1039] It became the foundation for the development of the domestically-controlled *Korea Space Launch Vehicle-I* (KSLV-I; dubbed: *Naroho*/*Naro*) series.

Notably, South Korea entered into a partnership with Russia to shorten the KSLV-I development timeline, after – for the development of South Korean space launchers important step of – revising the US-ROK missile guidelines alongside joining MTCR in 2001. In the end, Russia provided the series' first stage, and KARI was, with some Russian technical support, responsible for the second stage. Both further collaborated in the construction of the Naro Space Centre, South Korea's space launch facility, and KSLV-I launch operations. After two failed satellite launch attempts in 2009 and 2010, a domestically-controlled KSLV-I finally put a domestic satellite successfully into orbit in 2013.[1040] Since South Korean entities have ultimately control over the KSLV-I series and the space centre, this study considers it reasonable to discuss them as part of the domestic space launch capabilities and capacities.

All this laid the groundwork for the development of the domestic *Korea Space Launch Vehicle-II* (KSLV-II) series, which officially commenced in 2010, involves a ten-year budget of ₩1.957 trillion (ca. $1.9 billion) and appears to be still ongoing under the government's current space programme. In short, the plan is to have the KSLV-II series, with a capability of transporting a 1.5t satellite into an orbit of around 600-800km, fully operational by around 2020-2021. For the future, the government further considers the development of the domestic *Korea Space Launch Vehicle-III* series with a launch capability of a 3t payload to mid-level orbit and smaller payloads to geostationary orbit by around 2027, as well as the development of even larger domestic launch vehicles by around 2033. The Naro Space Centre shall also be continuously expanded until 2040 to allow for the domestic launch of the various generations of South Korean launchers.[1041]

1039An (n 955) 150–159.

1040Combined information provided in: ibid 157-158,176-184,200-203. Citation on 179; Pinkston (n 942) 3–4; 'First Korea Space Launch Vehicle Naroho (KSLV-I)' (*KARI*) <https://www.kari.re.kr/eng/sub03_03_02.do> accessed 28 January 2018; 'Space Launch Vehicle' (*KARI*) <https://www.kari.re.kr/eng/sub03_03.do> accessed 28 January 2018. For more specific information on the South Korean path to becoming an MTCR member and the revision of the US-ROK missile guidelines, see this footnote's first reference.

1041Combined information in: Pinkston (n 942) 4–5; An (n 955) 203–204; 'Korea Space Launch Vehicle KSLV-II' (*KARI*) <https://www.kari.re.kr/eng/sub03_03_01.do> accessed 28 January 2018; 'Space Launch Vehicle' (n 1040).

One space-related state preference underlying the development and maintenance of domestic space launch capabilities and capacities seems to be the pursuit of the government's current space-related political state preferences. In terms of international prestige, political competition with North Korea might sometimes play a role. After all, the launch of North Korea's KMS-3-2 onboard its domestic *Unha-3* launcher in December 2012 reportedly shocked South Koreans and strengthened national support for South Korea's space programme.[1042] Also, only a small number of states have domestic space launch capabilities.[1043] As such, South Korea joining this relatively exclusive club can translate into national pride and international prestige and influence.

Second, there is the pursuit of the government's current space-related socioeconomic state preference, especially the industry and market-related target areas. For example, the government hopes to enter the international launch service market and create a space industry fitting a technologically advanced country.[1044] The KSLV-II series shall be the first step into this market. After 2025, KARI intends to involve domestic private sector actors in the field of satellite launch services.[1045]

Naturally, the development and maintenance of domestic launcher capabilities and capacities link to the pursuit of the government's current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences. They are necessary to enable the implementation of many of the aforementioned major government-promoted domestic measures. According to An's research, a partial motivation behind the development of the KSLV-I series was a 'desire to emerge from a long dependency on foreign technology.'[1046]

1042Dong-jun Lee, 'South Korea Quietly Determined to Tackle Space after North's Launch' (*Global Times*, 30 January 2013) <http://www.globaltimes.cn/content/759158.shtml> accessed 31 January 2018; An (n 955) 203–204; Moltz also mentions the competition between North and South Korea in launcher development in 2009 and 2010: Moltz (n 32) 147.

1043'Space Launch Vehicle' (n 1040).

1044ibid; 'The Government, Establishing a Foothold for the Takeoff of Korea as an Aerospace Powerhouse' (n 946); An (n 955) 203.

1045Pinkston (n 942) 4–5.

1046An (n 955) 203.

9.6.10.2 Major cooperative measures

This study has found no hard facts regarding a current major government-promoted cooperative space launcher measure (with a presumed potential for) involving other preeminent Asian governments in the space sector.

At most, India and South Korea apparently agree that there might be a potential for technical cooperation in satellite launching.[1047] However, the Indian side seems to focus here on offering commercial launch services to South Korea.[1048]

9.6.11 Human resources

9.6.11.1 Major domestic measures

The available English literature provides merely a limited amount of information on major government-promoted domestic space-related human resources-specific measures.

Nevertheless, this study has found that the government acknowledges that domestic and cooperative space-related human resource development needs to be incorporated in its evolving space programme. Experts have to be in place for the proper implementation of the government's more and more complex and broader space undertakings, e.g. to develop the necessary technology or to increase the public and commercial utilisation of satellite imagery. For this, the government apparently promotes in its various plans and strategies the education and training of relevant South Korean students and personnel, including by setting up relevant domestic facilities and encouraging joint research and international cooperation. It also supports national activities that help job seekers to get in contact with suitable public and private space-related actors.[1049] Furthermore, there are national activities like an annual Cansat Camp and Competition to engage more elementary and college students in satellite development and space science and technology.[1050] Notably, deliberations regarding the 3rd BSDP also speak of hiring around 1500 additional space-related experts in South Korea by 2022.[1051]

1047 'India - Republic of Korea Joint Statement for Special Strategic Partnership (May 18, 2015)' (n 458).

1048 'India- Republic of Korea Joint Statement for Expansion of the Strategic Partnership' (n 425).

1049 'The Government, Establishing a Foothold for the Takeoff of Korea as an Aerospace Powerhouse' (n 946); Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (n 940); Pinkston (n 942) 7–8.

1050 'Cansat Camp & Competition Korea' (*SaTReC, KAIST*) <http://satrec.kaist.ac.kr/e_02_04.php> accessed 28 January 2018.

1051 Kim, '(LEAD) S. Korea Aims to Explore the Moon by 2030' (n 940).

Altogether, this space-related human resource development approach, which seems to have a strong domestic orientation, fits the pursuit of the government's space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

9.6.11.2 Major cooperative measures

Outside of APRSAF, and without claiming completeness, the major government-promoted cooperative space-related human resources-specific measures (with a presumed high potential for) involving other preeminent Asian governments in the space sector apparently encompass only the following:

First of all, South Korea is a member of CSSTEAP that offers joint training and education in a variety of activity fields in the space sector among its member states, which, among others, encompass three other preeminent Asian governments in the space sector, namely India, Iran and North Korea.[1052]

Second, the Indian-South Korean MoU 2010 has the two sides exchange information and enter discussions concerning personnel exchange.[1053]

In short, the South Korean government likely sees these measures primarily as a temporarily useful instrument for the pursuit of its current space-related autonomy-oriented state preference of developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences.

1052 'Centre for Space Science and Technology Education in Asia and the Pacific' (n 27).

1053 'Memorandum of Understanding Between Indian Space Research Organization And Korea Aerospace Research Institute For Cooperation in the Peaceful Uses of Outer Space' (n 425) art 2.

10 Conclusions

10.1 Current ASA potential

10.1.1 Analytical proceeding: second and third methodological step

As outlined in Section 2.3.2 and Table 2, this study's second methodological step is the comparison of the current space-related state preferences amongst the preeminent Asian governments in the space sector[1054] to detect current space-related mixed-motive games amongst them.[1055] The particular focus is on determining the (set of) current space-related mixed-motive game(s) amongst the preeminent Asian governments in the space sector that arguably involves at least a majority of these governments and concerns the pursuit of a significant portion of the latter's overall current space-related state preferences. Analytically, these governments are considered to be situated in a space-related mixed-motive game if a plausible argument can be made that their space-related state preference-based situation is mixed such that cooperation in the pursuit of their space-related state preferences can notably improve benefits or reduce or prevent losses for each side relative to the unilateral pursuit of their space-related state preferences.

In this regard, Section 10.1.2 first works out the set of current space-related mixed-motive games that involves at least a majority of the preeminent Asian governments in the space sector. It then resolves whether the just identified set of games also concerns the pursuit of a significant portion of the involved governments' overall current space-related state preferences. It finds that it is hard to make a compelling argument that this set of games meets this specific 'significance' condition, which challenges this study's hypothesis.

Finally, Section 10.1.3 takes a special combined look at this study's third methodological step as outlined in Section 2.3.3 and Table 2 and its findings on the six selected governments' second current space-related autonomy-oriented state preferences. Arguably, this suffices to draw a tenable conclusion about this study's primary research question. In short, the conclusion contradicts this study's hypothesis. There is no need to apply the third methodological step in full.

1054As identified throughout the country-specific Chapters 4-9.

1055After all, this study deems space-related mixed-motive games, in general, as the most suitable springboard for governments to reasonably engage in negotiations towards establishing an intergovernmental space cooperation mechanism.

10.1.2 Application of second methodological step

10.1.2.1 Space-related socioeconomic mixed-motive games

As shown in Table 6, this study has determined that, generally speaking, five of the six preeminent Asian governments in the space sector, namely the Chinese, Indian, Iranian, Japanese and South Korean governments, currently pursue the similar space-related socioeconomic state preference of advancing their respective country's domestic socioeconomic development.

Table 6: Comparative overview of space-related socioeconomic state preferences

China	India	Iran	Japan	South Korea	North Korea
Space-related socioeconomic state preferences					
Advancing the country's socioeconomic development	"	"	"	"	" *(tentatively)*
Related target areas					
Developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for the country	"	"	"	"	Developing and applying space-related capabilities and capacities to deal with a few socioeconomically highly relevant issue-areas for the country (focus apparently on the areas of agriculture, disaster management, forestry and meteorology) *(tentatively)*
Expanding the domestic (private) space industry	Expanding the domestic (private) space industry's involvement in the government-promoted space-related upstream sector	Expanding the domestic non-governmental space industry	Expanding the domestic (private) space industry	"	–
Extending the domestic space market	To a limited degree, extending the domestic space market and enhancing the country's entities' role in the international space market in both the upstream and downstream sector	Extending the domestic commercialisation of space technology	Extending the domestic space market	"	–
Enhancing the country's entities' role in the international space market		–	Enhancing the country's space industry's role in the international space market	"	–

(**Colour key**: mixed-motive game / no mixed-motive game)

A further comparison of the specific target areas under each of these five governments' similar space-related socioeconomic state preference (see also Table 6) then allows arguing that a current space-related socioeconomic mixed-motive game amongst these governments exists regarding their common target area of developing and applying space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for one's respective country.

First, this study's country-specific findings suggest that these five governments have an interest in tackling issues in a somewhat similar pool of socioeconomically relevant areas, including such frequently transnational ones like the climate/climate change, disaster management, the environment, meteorology and transportation.

Second, while each of these governments surely profits from addressing this common target area unilaterally,[1056] it is reasonable to assume that a committed intergovernmental partnership in this context potentially offers more benefits to each of them. For example, collaboration in the development of the target area-specific capabilities and capacities can, for each side, reduce the associated development price tags (e.g. by sharing of costs), result in capabilities with an overall higher technological quality and reliability, as well as speed up capacity building (e.g. through specialisation and exchange of technology and expertise). Besides that, an agreed mutual application of the jointly developed target area-specific capabilities and capacities can lead to a higher and faster learning effect among the partners in using such items and the derived data, as well as to the creation of more effective and efficient issue-area-pertinent products and services for each side. Additionally, even collaborative application in the form of steady sharing and joint interpretation of data generated by their respective domestically controlled target area-specific capabilities and capacities can notably benefit each side in verifying and expanding its datasets employed to deal with its socioeconomically relevant issue-areas, as well as in bringing about more precise and reliable issue-area-pertinent products and services. Moreover, an agreed reciprocal application of their respective domestically controlled target area-specific capabilities and capacities like in the form of allowing each other access to some data transponders within the domestic space-related infrastructure or mutually guaranteeing to generate special domestic satellite-derived datasets upon request by a partner can help each side to overcome (temporary) shortcomings in dealing with socioeconomically relevant issue-areas adequately. For instance, a government might be confronted with a (suddenly) malfunctioning domestic space-related system, suffer (unexpected) delays in domestic space-related capacity building or have to address (unforeseen) events overburdening domestic space-related capabilities and capacities.

This study considers the DPRK government only tentatively and partially to be party to the space-related socioeconomic mixed-motive game just outlined above. As argued in

1056After all, this study has shown throughout its country-specific chapters that each of these governments has apparently engaged in major domestic measures in this direction.

this study's North Korea chapter, the North Korean government has, while there are some indicators in this regard, yet to provide tangible proof for its actual pursuit of the space-related state preference of advancing the country's socioeconomic development. Also, and similarly lacking tangible proof, the DPRK government seems, in contrast to the other five preeminent Asian governments in the space sector, target area-wise to be primarily interested in developing and applying space-related capabilities and capacities to deal with issues in merely a few socioeconomically highly relevant areas for the country. In sum, the DPRK government appears, if at all, only to be a part of the aforementioned space-related socioeconomic mixed-motive game concerning the areas of agriculture, disaster management, forestry and meteorology.

With the North Korean government's current space programme not displaying any such policy direction, this study finally holds that the Chinese, Indian, Iranian, Japanese and South Korean governments' respective space industry and market-specific target areas in the wake of the pursuit of their similar space-related socioeconomic state preference do not line up to form space-related mixed-motive games amongst them.

Arguably, all these governments are less likely to profit substantially from intergovernmental cooperation than from their respective unilateral engagement in addressing these target areas. After all, any government that aims at expanding its domestic (private/non-governmental) space industry, extending its domestic space market/domestic commercialisation of space technology and enhancing its country's entities'/space industry's role in the international space market in a stable and sustainable manner does well to create conditions that favour the growth of its domestic (private/non-governmental) industry and its country's entities'/space industry's competitiveness in the national and international space market over foreign entities/space industries.

10.1.2.2 Space-related political mixed-motive games

As outlined in Table 7, the preeminent Asian governments in the space sector' current space programmes seem somewhat devoted to serving domestic governance-oriented political state preferences. More specifically, the Chinese government wants to secure the legitimacy of the CPC's rule over all of China. Similarly, the North Korean government wants to secure the legitimacy of the Supreme Leader's rule over the DPRK. The Iranian government wants to increase the Iranian people's support for the authoritarian political system. Besides that, this study has decided to take into account tentatively that the democratically elected governments of India, Japan and South Korea promote space endeavours with a view to increasing public support for the respective government among their respective people. Notably, the Iranian and South Korean governments apparently also hope to strengthen their respective people's national pride through their respective space programmes. This is likely linked with their respective aforementioned goal of increasing the Iranian people's support for the authoritarian political system and increasing public support for the democratically elected South Korean government.

Overall, the pursuit of their respective domestic governance-oriented space-related political state preferences arguably constitutes no space-related mixed-motive game amongst them. A government's successful realisation of (complex) space-related undertakings through intergovernmental cooperation might usually be much less advantageous to consolidating its respective domestic governance system or improving its standing among its people than if it can highlight that its space-related accomplishments resulted solely from its unilateral engagement.

Table 7: Comparative overview of space-related political state preferences

China	India	Iran	Japan	South Korea	North Korea
Space-related political state preferences (I)					
Securing the legitimacy of the CPC's rule over all of China	Increasing public support for the democratically elected government *(tentatively)*	Increasing the Iranian people's national pride and support for the authoritarian political system	Increasing public support for the democratically elected government *(tentatively)*	Increasing national pride and public support for the democratically elected government *(2nd aspect: tentatively)*	Securing the legitimacy of the Supreme Leader's rule over the DPRK
Space-related political state preferences (II)					
Advancing the country's international prestige and influence	"	"	"	"	"
Related target areas (II)					
–	Advancing India's international prestige and influence in its direct neighbourhood in South Asia Counterbalancing China's striving for influence in Asia	Attaining the regional first place in the conquest of space (region likely means here: Islamic world; Middle East and neighbouring states, Central Asia and the Caucasus region) Becoming a top ten space-faring state in the world by 2025	–	Advancing South Korea's international prestige and influence vis-à-vis North Korea *(tentatively)*	Advancing North Korea's international status as a technologically and scientifically powerful independent state vis-à-vis South Korea

(**Colour key**: mixed-motive game / no mixed-motive game)

Withal, and as also shown in Table 7, each preeminent Asian government in the space sector currently pursues the similar second space-related political state preference of advancing its respective country's international prestige and influence. Arguably, this state preference-based situation does likewise not constitute a space-related mixed-motive game amongst them.

First, the preeminent Asian governments in the space sector's respective unilateral space-related engagement or respective cooperation with technology-wise asymmetrically dependent states presumably advance their respective country's international prestige and influence much more than their direct intergovernmental space-related cooperation. For one, it is plausible to assume that external observers usually mark a government's unilaterally realised successful (complex) space-related undertakings as much more impressive than if it has relied on intergovernmental cooperation in this regard. Also, by being the main partner of technology-wise asymmetrically dependent states, a preeminent Asian government in the space sector presumably gains more influence over such latter states than the other preeminent Asian governments in the space sector. Adding to all that, the identified target areas under the preeminent Asian governments in the space sector's similar second space-related political state preference suggest that some of these governments are in some sort of zero-sum games regarding the space-related advancement of their respective country's (regional) prestige and influence.

Notably, this study is aware that there might be circumstances in which intergovernmental space cooperation amongst the preeminent Asian governments in the space sector might considerably contribute to the advancement of their respective country's international prestige and influence. For example, as indicated in this study's deliberation of current space-related national security and autonomy-oriented mixed-motive games in Sections 10.1.2.3 and 10.1.2.5, a jointly developed and promoted standpoints on specific issues can presumably increase their position of influence during the discussion of and their impact in pushing for a sustainable, long-term solution of such issues (on the international level). Yet, in this context, the influence aspect seems inextricably linked to the pursuit of another space-related state preference and thus can be considered to belong more to the latter than to the advancement of a country's international prestige and influence in the main.

10.1.2.3 Space-related national security mixed-motive games

As showcased in Table 8, this study's country-specific findings suggest that the preeminent Asian governments in the space sector presently pursue the similar space-related national security state preference of safeguarding their respective country's national security.

Table 8: Comparative overview of space-related national security state preferences

China	India	Iran	Japan	South Korea	North Korea
Space-related national security state preferences					
Safeguarding the country's	"	"	"	"	"
national security					
Related target areas					
Enhancing the strategic support system of the country's military	"	"	" (presumably especially against China, Iran and North Korea) Improving the US-Japanese alliance, with a focus on furthering their deterrence and response capabilities (presumably especially against China, Iran and North Korea)	" (presumably especially against North Korea and partially in interaction with the USA)	" (presumably especially against Japan, South Korea and the USA)
Preventing the weaponisation of and an arms race in outer space	"	– (*Tentatively speaking*, the prevention of the weaponisation of and an arms race in outer space is presumably important to the government as well)	" *(tentatively)*	– (*Tentatively speaking*, the prevention of the weaponisation of and an arms race in outer space is presumably important to the government as well)	"
Hedging against potential enemies' use of their space capabilities during armed conflict with the country	" *(tentatively)*	–	" *(tentatively)*	–	–
–	–	Establishing efficient domestic long-range (nuclear-armed) ballistic missile strike capabilities *(tentatively)*	–	–	Establishing efficient domestic nuclear weapon (counter-)strike capabilities (presumably especially against Japan, South Korea and the USA)

(**Colour key**: mixed-motive game / no mixed-motive game)

A further comparative look at these governments' respective related target areas – as far as this study was able to identify them (see also Table 8) – then allows arguing that there currently is, at most, one space-related national security mixed-motive game amongst them. More specifically, the six selected governments can, with some uncertainties, be considered to be in a space-related national security mixed-motive game concerning the target area of preventing the weaponisation of and an arms race in outer space.

To start with, this study's country-specific chapters have determined that the Chinese, Indian and North Korean governments include this target area within their current space programmes. In the Japanese government's case, the accessed information at least allows taking such a target area into account tentatively. In contrast to that, this study was unable to identify evidence or strong indicators for the existence of a similar target area in Iranian and South Korean governments' present space programmes. However, it is not farfetched to argue and thus assume tentatively that these two governments likewise do not want to see a weaponisation of and an arms race in outer space occur anytime soon. Such a development would presumably be detrimental to their national security status considering that states like the USA, Russia and China are known to have a much higher (willingness and capacity to expand their) military budget. In support of these considerations about the Japanese and South Korean governments, it is notable here that this study has not come across robust indicators that these two would, despite the importance that each of them gives to its respective (space-related) alliance with the USA, necessarily benefit from a potential US engagement towards the weaponisation of and an arms race in outer space. Their alliances seem to focus on other topics.

The preeminent Asian governments in the space sector's space-related national security mixed-motive game regarding this (tentatively assumed) common target area then emerges from the following narrative.

These governments' unilateral activities to forestall the weaponisation of and an arms race in outer space (among themselves and internationally), e.g. in the form of calling out or sanctioning others' related undertakings to discourage further developments in this direction, likely have no sustainable, long-lasting impact. Their cooperative engagement, however, has the potential to provide them with some notable benefits. For example, by entering into an intergovernmental agreement amongst themselves forbidding activities that can contribute to the weaponisation of and an arms race in outer space, as well as establishing a control mechanism to monitor their respective adherence to such a ban, they can avoid inadvertently triggering such a weaponisation and arms race amongst themselves. Moreover, their agreement might make it less likely that their space undertakings are misinterpreted by other actors as to be aimed at weaponising or commencing an arms race in outer space, which might also reduce the danger that these actors inadvertently engage in such a direction. Finally, by partnering up, exchanging information and ideas, developing joint standpoints and presenting a united front globally, the six selected governments might be in a much stronger position to influence the discussion of and push for a sustainable, long-term solution of this topic at the international level.

Concerning their other (tentatively assumed) target areas under their similar current space-related national security state preference, the preeminent Asian governments in the space sector arguably are not situated in space-related mixed-motive games.

One problem for these governments to enter into meaningful space-related cooperation with each other regarding their present common target area of enhancing their respective country's military's strategic support system is that such cooperation might, in the long run, create space-related dependencies among them. These dependencies might ultimately diminish their respective potential to safeguard their national security effectively and efficiently. Another problem for their space-related cooperation in this target area is that some of the governments currently seem to aim at enhancing their respective country's military's strategic support system, including through space-related means, to address perceived threats to their respective national security status emanating from some of the others' military capabilities. For example, the South Korean government apparently considers the North Korean military a danger to its national security, whereby the North Korean government supposedly views, among others, the Japanese and South Korean militaries as to endanger its national security. Also, the Japanese government apparently worries about Chinese, Iranian and North Korean military capabilities. Besides that, it shall not be forgotten here that, as shown in the respective country-specific chapters, the Japanese and South Korean governments seemingly have decided to ally especially with the USA in the context of enhancing their respective country's military's space-related strategic support system. If they want to keep these alliances up, the Japanese and South Korean governments presumably have to forgo engaging in substantial cooperation on this topic with China, Iran and North Korea because, as is well-known, the USA eyes, *inter alia*, these latter countries' military development critically. Finally, it is noteworthy that China and North Korea have a mutual defence treaty,[1057] which might complicate setting up significant Sino-South Korean and Sino-Japanese space-related military support system relations. The Indian and Chinese militaries also sometimes engage in skirmishes at a disputed Sino-Indian border region,[1058] which might make establishing notable Sino-Indian space-related military support system relations a real challenge.

In terms of the (tentatively assumed) respective target areas of some preeminent Asian governments in the space sector concerning the hedging against potential enemies' use of their space capabilities during armed conflict, as well as the establishment of efficient domestic long-range (nuclear-armed) ballistic missile strike capabilities/efficient domestic nuclear weapon (counter-)strike capabilities, the pursuit of any of these target areas by one side arguably constitutes a problem for the national security quality of all the others. As such, they seem to be zero-sum and not mixed-motive game situations.

10.1.2.4 Space-related science and technology mixed-motive games

Table 9 showcases that the Chinese and Japanese governments, as well as in a more limited fashion also the Indian, Iranian and South Korean governments, currently pursue the similar space-related science and technology state preference of advancing their respective country's scientific and technological level per se; whereby the reference to 'per se' indicates here more of a basic research and knowledge gathering orientation.

Following a line of argument akin to the determination of their specific space-related socioeconomic mixed-motive game, this study holds that this state preference-based situation constitutes a space-related science and technology mixed-motive game amongst these five governments.

It is reasonable to assume that these governments can, while surely benefiting from addressing this common target area unilaterally,[1059] expect higher payoffs for each side by committing to an intergovernmental partnership in this regard. For example, their

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1057Ankit Panda, 'China and North Korea Have a Mutual Defense Treaty, But When Would It Apply?' (*The Diplomat*, 14 August 2017) <https://thediplomat.com/2017/08/china-and-north-korea-have-a-mutual-defense-treaty-but-when-would-it-apply/> accessed 13 December 2018.

1058'China Blames India for Latest Skirmish in Disputed Border Region' (*South China Morning Post*, 21 August 2017) <https://www.scmp.com/news/china/diplomacy-defence/article/2107668/china-blames-india-latest-skirmish-disputed-border> accessed 1 September 2018.

1059After all, this study has found throughout its country-specific chapters that many of these governments have apparently engaged in some major domestic measures in this direction.

collaboration in developing target area-specific capabilities and capacities, e.g. astronomy and technology test satellites or space science payloads, can, for each side, reduce the associated development costs (e.g. by sharing of costs), result in capabilities with an overall higher quality and reliability, and accelerate capacity building (e.g. through specialisation and exchange of technology and expertise). The latter aspect might be especially interesting to those three governments that apparently have so far only engaged in this topic in a limited fashion. Moreover, an agreed mutual application of the jointly developed target area-specific capabilities and capacities can lead to a higher and faster learning effect among the partners in using such items and the derived data, as well as to a more effective and efficient basic research and knowledge gathering process. Additionally, even joint application in the form of steady sharing and joint interpretation of data generated by their respective domestically controlled target area-specific capabilities and capacities can strongly aid each side in verifying and expanding its datasets aimed at fostering scientific and technological progress per se.

Table 9: Comparative overview of space-related science and technology state preferences

China	India	Iran	Japan	South Korea	North Korea
Space-related science and technology state preferences					
Advancing the country's scientific and technological level per se	" (although in a limited fashion so far)	" (although in a limited fashion so far)	"	" (although in a limited fashion so far)	– (The advancement of North Korea's scientific and technological level per se might become relevant under the government's future space programme)

(**Colour key**: mixed-motive game / no mixed-motive game)

Notably, this study has found no evidence or robust indicators that a dedicated space-related science and technology state preference exists under the DPRK government's current space programme. However, there are signs that the pursuit of a space-related science and technology state preference similar to the other five preeminent Asian governments in the space sector might become relevant under the DPRK government's future space programme.

10.1.2.5 Space-related autonomy-orientated mixed-motive games

As summarised in Table 10, this study's has found evidence or solid indicators in its country-specific chapters that the Chinese, Indian, Iranian, Japanese and South Korean governments currently pursue the similar space-related autonomy-oriented state preference of ensuring the stable use of outer space for their respective country. Additionally, and while it has not come across such evidence or indicators concerning the DPRK government's present space programme, this study holds that it is not outlandish to consider here tentatively that the North Korean government currently also possesses such a space-related autonomy-oriented state preference. Eventually, an unstable space environment – stemming from, e.g., an increasing amount of space debris, the congestion of space by space assets of a growing number of actors, and space weather events – can harmfully interfere with North Korean government-promoted space undertakings as well. In the future, more and better information might be available to determine the DPRK government's policy objective for sure.

Table 10: Comparative overview of space-related autonomy-oriented state preferences

China	India	Iran	Japan	South Korea	North Korea
Space-related autonomy-oriented state preferences					
Ensuring the stable use of outer space for the country	"	"	"	"	– (*Tentatively speaking*, the ensuring of the stable use of outer space for the country is presumably also important to the government)
Developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of other space-related state preferences	"	"	"	"	Developing and maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage primarily independently in the pursuit of other space-related state preferences

(**Colour key**: mixed-motive game / no mixed-motive game)

Ultimately, this study concludes that the preeminent Asian governments in the space sector's (tentatively assumed) pursuit of the similar space-related autonomy-oriented state preference of ensuring the stable use of outer space for their respective country constitutes a space-related mixed-motive game.

Somewhat following the line of argument presented during the determination of their specific current space-related socioeconomic and science and technology mixed-motive games above, this study is aware that each of these governments can surely profit from addressing this state preference unilaterally.[1060] However, their cooperation in this regard probably generates much more beneficial outcomes for each side. For example, their joint development of capabilities and capacities to track space objects, observe the space weather and mitigate or actively remove space debris can, for each side, reduce associated development costs (e.g. by sharing of costs), result in capabilities with an overall higher quality and reliability, and speed up capacity building (e.g. through specialisation and exchange of technology and expertise). Furthermore, an agreed mutual application of the jointly developed target area-specific capabilities and capacities can lead to a higher and faster learning effect among the partners in using such items and the derived data, as well as to the creation of more effective and efficient products and services for space-related tracking and observation and debris mitigation and removal on each side. Besides that, even a steady sharing and joint interpretation of data derived from and an interlinking of their respective domestically controlled space tracking and observation capabilities and capacities across different geographical/spatial locations can notably assist each side in verifying and expanding its respective (real-time) space object and space weather datasets, as well as in bringing about more precise and reliable space object and weather-pertinent products and services (e.g. to assess collision risks and solar flare hazards). The partners' continuous exchange of expertise, experience and ideas concerning space debris mitigation during space missions can further result in the formulation of more effective and efficient debris mitigation guidelines and protocols on each side. Finally, and akin to this study's assessment of their specific current space-related national security mixed-motive game above, by partnering up, exchanging information and ideas, developing joint standpoints and presenting a united front globally, the six selected governments might be in a much stronger position to influence the discussion of and push for a sustainable, long-term solution to ensure the stable use of outer space at the international level.

As further showcased in Table 10, the Chinese, Indian, Iranian, Japanese and South Korean governments' second similar current space-related autonomy-oriented state preference seems to be the development and maintenance of the respective domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently in the pursuit of their respective other space-related state preferences. In the North Korean case, its government goes in a comparable but stricter direction. More precisely, it presently aims at developing and

1060 After all, this study has found throughout its country-specific chapters that many of these governments have apparently engaged in some major domestic measures in this direction.

maintaining the domestic human, industrial, scientific and technological capabilities and capacities necessary to engage primarily independently in the pursuit of its other space-related state preferences.

Eventually, this study argues that these governments' pursuit of their respective second similar/comparable current space-related autonomy-oriented state preference does not fall into the category of a space-related mixed-motive game.

After all, these governments would clearly go against their respective state preference's basic/prioritised domestic independence quality if they put the development and maintenance of the respective human, industrial, scientific and technological capabilities and capacities necessary to engage, on a basic level/in the main, in the pursuit of their respective other space-related state preferences under a (sustainable, long-term) intergovernmental cooperation mechanism.

Notably, and as discussed further in the upcoming sections, it is the preeminent Asian governments in the space sector's pursuit of their respective second similar/comparable current space-related autonomy-oriented state preference that has the most severe impact on their present reasonable potential to enter negotiations towards establishing an ASA.

10.1.2.6 Conclusion of second methodological step: a challenged ASA potential

The findings in this study's Sections 10.1.2.1-5 allow arguing that, as looked for under its second methodological step, there is a set of (tentatively assumed) current space-related (socioeconomic, national security, science and technology and autonomy-oriented) mixed-motive games amongst the preeminent Asian governments in the space sector that involves an overlapping majority – in most cases even all – of these governments.

More specifically, five of the six preeminent Asian governments in the space sector appear to be in a space-related socioeconomic mixed-motive game regarding the development and application of space-related capabilities and capacities to deal with a broad set of socioeconomically relevant issue-areas for their respective country. The DPRK government can tentatively be deemed part of this game concerning issues in the few areas of agriculture, disaster management, forestry and meteorology.

Furthermore, the Chinese, Indian and North Korean governments, as well as, tentatively speaking, the Iranian, Japanese and South Korean governments, seem to be altogether situated in a space-related national security mixed-motive game regarding the prevention of the weaponisation of and an arms race in outer space.

Besides that, the Chinese, Indian, Iranian, Japanese and South Korean governments, with the North Korean government potentially becoming a participant in the future, arguably are in a space-related science and technology mixed-motive game regarding the advancement of their respective country's scientific and technological level per se.

Lastly, the Chinese, Indian, Iranian, Japanese and South Korean governments, as well as, tentatively speaking, the North Korean government, altogether seemingly are in a space-related autonomy-oriented mixed-motive game to ensure the stable use of outer space for their respective country.

However, this study regards it as quite hard to put forward a compelling line of argument that this set of current space-related mixed-motive games, as further looked for under this study's second methodological step, also concerns the pursuit of a significant portion of the involved governments' overall current space-related state preferences. After all, these governments' additional pursuit of their (tentatively assumed) respective two space-related political state preferences, second space-related autonomy-oriented state preference, and other target areas under their respective space-related socioeconomic and national security state preferences outside of mixed-motive games can be reasonably considered to still encompass the pursuit of a sizeable share of their overall current space-related state preferences.

Thus, this study already deems it challenging at this point to contend that the preeminent Asian governments in the space sector can reasonably initiate negotiations towards establishing an ASA.

10.1.3 Appl. and conclusion of third method. step: no current ASA potential

In the case that a researcher recognises the above-identified set of current space-related mixed-motive games to fully comply with both conditions outlined in its second methodological step,[1061] this study eventually holds that a subsequent particular partial application of its third methodological step[1062] suffices to draw a tenable (unfavourable) conclusion about its primary research question. There is no need to apply this study's third methodological step in full.

More specifically, an additional application of this study's third methodological step's second element in the context of its findings on the six selected governments' respective second similar/comparable current space-related autonomy-oriented state preference in Section 10.1.2.5 allows concluding:

> *In contrast to the hypothesis put forward in Section 1.3, there is no reasonable potential amongst the preeminent Asian governments in the space sector to commence negotiations towards establishing an ASA based on the general political and legal status quo of their space programmes as of 2017.*

On a more detailed level, it follows from this study's third ASA-oriented methodological step that the preeminent Asian governments in the space sector involved in the identified set of current space-related mixed-motive games[1063] also must at least not be opposed to

- entering an agreement for regional IGO-based cooperation, and
- a transfer of a significant portion of their respective current major government-promoted (domestic and cooperative) space-related measures regarding the pursuit of their mixed-motive games-defining current space-related state preferences under the responsibility of a regional IGO.

However, the identified pursuit of their respective second similar/comparable current space-related autonomy-oriented state preference[1064] arguably makes it extremely unlikely, presumably even impossible, for them to meet the second of these two elements. Building on the findings in Section 10.1.2.5, the governments would **surely run counter to** this state preference's **basic/prioritised domestic independence quality if** they enter into an **agreement to transfer a significant portion** of their respective current major government-promoted (domestic and cooperative) space-related measures regarding the

1061 For the two conditions and the issue of compliance, see Section 10.1.2.6.

1062 As outlined in Section 2.3.3 and Table 2.

1063 If they are considered to comply with both conditions outlined in the second methodological step.

1064 Again, their respective second similar/comparable current space-related autonomy-oriented state preference is the development and maintenance of the respective domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently/engage primarily independently in the pursuit of their respective other space-related state preferences.

pursuit of their mixed-motive games-defining current space-related state preferences **under the responsibility of a regional IGO** (or any other intergovernmental cooperation mechanism for that matter), especially in a sustainable and long-term manner.

IGO-based (and other) intergovernmental cooperation concerning the identified set of current mixed-motive games amongst the preeminent Asian governments in the space sector presumably can mainly incorporate those of their (compatible) major government-promoted (domestic and cooperative) space-related measures that

- go beyond the already accomplished, or
- allow overcoming temporary shortcomings/impediments in the

development and maintenance of the respective domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently/engage primarily independently in the pursuit of their respective games-defining space-related state preferences.

Notably, this latter reasoning offers a reasonable (partial) explanation why the scope of cooperation amongst the preeminent Asian governments in the space sector in the pursuit of their respective mixed-motive games-specific space-related state preferences, including within APSCO and APRSAF, has remained rather limited so far.

10.2 Potential regional space agency variant: ASA *light*

For a more positive and practical ending, this study uses its ample findings at this point to discuss generally the closest IGO-based regional space agency variant to its fully-fledged ASA format[1065] about which the preeminent Asian governments in the space sector might reasonably negotiate regarding the identified set of current space-related mixed-motive games amongst them. In this regard, it especially builds on and partially adapts the five basic political and legal ASA characteristics determined in Section 2.2. As a short form, it refers to this more feasible space agency variant henceforward as an 'ASA *light*'.[1066]

Before going into any detail about an ASA *light*, it shall first be acknowledged that a comparison of the six selected governments' current basic political and legal frameworks

1065 As stipulated in Section 1.2 and characterised politically and legally on a basic level in Section 2.2.

1066 This designator is appropriate because of the agency's apparent ASA-orientation. Also, as explained in Section 2.2, there is no authoritative 'regional space agency' definition. Other researchers might decide to work with a less strict interpretation of an ASA than this study in the first place.

concerning IGO-based regional space cooperation indicates that none of them is, in general, opposed to entering into an agreement for IGO-based regional space cooperation to address their current space-related mixed-motive games. What is more, all seem to abide by the principles and provisions in the main international space agreements, namely the Outer Space Treaty, the Rescue Agreement, the Registration Convention and the Liability Convention. Their other principles for intergovernmental (space) cooperation, as far as this study was able to identify them, also appear to be fairly compatible.[1067]

In the context of the five basic political and legal ASA characteristics, the main differences between the (more feasible) ASA *light* and this study's (unlikely realisable) fully-fledged ASA format arguably are regarding those two points:

The first difference pertains to the third basic political and legal ASA characteristic. Originally, it maintains that an ASA's purpose is the pursuit of a significant portion of the overall current space-related state preferences of its government members. The latter, as laid down in the second basic political and legal ASA characteristic, consist of at least a majority of the Asian governments with dedicated space programmes, while this group of governments also covers at least a majority of the preeminent Asian governments in the space sector.

Yet, as argued in Section 10.1.2.6, this study regards it as quite hard to put forward a compelling line of argument that the identified set of current space-related mixed-motive games amongst the preeminent Asian governments in the space sector, while involving an overlapping majority – in most cases even all – of the latter, concerns the pursuit of a significant portion of the involved governments' overall current space-related state preferences. The ASA *light*'s maximum purpose is, with regard to the preeminent Asian governments in the space sector, limited to the pursuit of their space-related state preferences constituting their set of current space-related (socioeconomic, national security, science and technology and autonomy-oriented) mixed-motive games.

The second difference pertains to the fourth basic political and legal ASA characteristic. Originally, it holds that an ASA's actor role(s) and function(s) are such that it is

1067 See especially this study's findings in Sections 4.5, 5.5, 6.5, 7.5, 8.5 and 9.5.

responsible for a significant portion of its government members’ current major government-promoted space-related measures regarding its ascribed purpose.

However, the ASA *light*’s actor role(s) and function(s) cannot reach such a breadth with regard to the preeminent Asian governments in the space sector.

First, and leaning on the argumentation provided in Sections 10.1.2.5 and 10.1.3, the transfer of a significant portion of these governments’ current major (domestic and cooperative) government-promoted space-related measures regarding the ASA *light*’s just identified purpose would surely run counter to their respective second similar/comparable current space-related autonomy-oriented state preference’s basic/prioritised domestic independence quality. Generally speaking, the ASA *light*’s maximum actor role(s) and function(s) appear, with regard to the preeminent Asian governments in the space sector, limited to such that it is responsible for the involved governments’ (compatible) major government-promoted (domestic and cooperative) space-related measures that

- go beyond the already accomplished, or
- allow overcoming temporary shortcomings/impediments in the

development and maintenance of the respective domestic human, industrial, scientific and technological capabilities and capacities necessary to engage, at least on a basic level, independently/engage primarily independently in the pursuit of their respective current space-related state preferences amounting to the ASA *light*’s purpose.

Second, the UNSC sanctions situation against Iran and North Korea, the Chinese export control regime and the Indian, Japanese and South Korean participation in MTCR suggest some further restraints to the ASA *light*’s maximum actor role(s) and function(s) involving the respective governments.

For one, the UNSC sanctions against the DPRK presumably translate, collaboration-wise, into a full prohibition for other governments to engage cooperatively with the DPRK government in the development and application of space launcher and satellite capabilities and capacities.

Also, the UNSC sanctions situation against Iran might limit the Iranian government’s potential to engage cooperatively with other governments in space launcher and satellite-related topics. But in contrast to the DPRK's case, the situation allows for more flexibility. The Iranian cooperation potential depends on the others' particular space-related interpretation of the UNSC sanctions against Iran, and their respective willingness to cross the USA and abide by the international agreement from 2015.

The Chinese export control regime might hamper the Chinese government's present potential for intergovernmental collaboration in the development and use of space-related products with a possible dual-use quality like space launch systems. Ultimately, this regime's effect depends on whether the Chinese government is willing to use its – due to China being an authoritarian one-party state – assumed considerable room to manoeuvre.

Finally, India, Japan and South Korea being MTCR partners presumably restricts their potential to cooperate with non-partners of MTCR like China, Iran and North Korea in the field of space launcher development.[1068]

10.3 Policy and regulatory recommendations

As its last analytical endeavour, this study uses its ample findings here to provide a few general policy and regulatory-related recommendations on how the preeminent Asian governments in the space sector might be able to move towards a broad(er than now) (IGO-based) intergovernmental space cooperation mechanism regarding their set of current space-related mixed-motive games, potentially up to an ASA *light*. This is not only worthwhile because of the many benefits associated to their cooperation in the context of such games, but also because it might serve the development towards a fully-fledged ASA in the future if their space programmes change accordingly.

Process-wise, this study thinks that a first reasonable step to widen and intensify the six selected governments' cooperation regarding their set of current space-related mixed-motive games is that they enter, e.g. by one's invitation, into a general space policy and regulatory consultation in which they acknowledge the existence of these games amongst them. In this regard, they shall also confirm with each other that, based on their current space programmes, they are not opposed to (IGO-based) regional space cooperation,

1068 For more details on these regimes and sanctions, see especially this study's findings in Sections 4.5, 5.5, 6.5, 7.5, 8.5 and 9.5.

abide by the principles and provision in the main international space agreements and follow fairly compatible other principles for intergovernmental (space) cooperation.

This study then considers it a useful second step that the governments' set up working groups for each of their current space-related mixed-motive games. These working groups shall involve ministerial and other experts from each side and negotiate about and specify the greatest extent to which the governments' current major government-promoted (domestic and cooperative) space-related measures regarding the pursuit of their current mixed-motive games-defining space-related state preferences can be put under an (IGO-based) intergovernmental cooperation mechanism. This shall especially take the governments' respective current second similar/comparable space-related autonomy-oriented state preference, their respective basic political and legal framework concerning (IGO-based) regional space cooperation and the specific compatibility of their respective current major government-promoted (domestic and cooperative) space-related measures into account.

After having done all that, the governments can, in a third step, engage in negotiations about the most suitable intergovernmental cooperation format. In the case that they find it hard to sign an agreement for broad collaboration, this study recommends that they first conduct a small project in each of their space-related mixed-motive games as a confidence-building measure.

Policy-wise, this study's primary recommendation to broaden and intensify the six selected governments' cooperation regarding their set of current space-related mixed-motive games is that they avoid having their major government-promoted domestic space-related measures serve mixed-motive game-defining and non-mixed motive game-specific space-related state preferences simultaneously.[1069] A clear separation simplifies the determination and potentially increases the scope of domestic measures that can be reasonably transferred under an intergovernmental cooperation mechanism.

1069 For example, this study has found major government-promoted domestic human spaceflight measures that presumably serve non-mixed motive game-specific space-related political state preferences, as well as a mixed-motive game-defining space-related science and technology state preference. Also, there are major government-promoted domestic space-related remote sensing, communications and broadcasting and navigation measures that apparently aim at fostering the pursuit of mixed-motive game-defining socioeconomically-oriented target areas, as well as non-mixed-motive game-specific national security-oriented target areas.

Concerning the DPRK, this study recommends that the North Korean government has to convince UNSC to revoke (at least) the space-related elements from the sanctions bundle against the DPRK if it ever wants to engage in intergovernmental cooperation involving space launcher and satellite development and application even in a limited form in a sustainable manner. This might, among others, necessitate a transparent division of the measures that the DPRK government employs in the pursuit of its mixed-motive games-defining space-related state preferences and those regarding its – presumably particularly UNSC sanctions-relevant – two non-mixed-motive game-specific national security-oriented target areas of establishing efficient domestic nuclear weapon (counter-)strike capabilities, and enhancing the country's military's strategic support system.

In the context of the UNSC sanctions situation against Iran, the Chinese export control regime and the Indian, Japanese and South Korean governments participation in MTCR, this study advises all governments to take an as flexible stance as possible regarding such factors' influence on their intergovernmental space cooperation potential to be able to reap as many benefits as possible in tackling their space-related mixed-motive games. Of course, their stance shall not corrupt the pursuit of their respective non-mixed-motive game-specific space-related state preferences.

Naturally, in all future attempts to establish broad(er than now) (IGO-based) intergovernmental space cooperation, the preeminent governments in the space sector shall especially take their experience with and the potential to evolve APSCO and APRSAF into account. Since they already involve other Asian governments with dedicated space programmes, e.g. Malaysia and Pakistan, this study is unable to pinpoint their exact potential to evolve here. It needs another dedicated research undertaking.

Lastly, for the sake of completion, this study wants to add at this point that it is aware that the preeminent Asian governments in the space sector might have policy and regulatory-wise also to deal with non-space-specific factors in working towards a broad(er than now) (IGO-based) intergovernmental space cooperation mechanism, and maybe an ASA later on. In particular, there are various geopolitical, historical and normative factors that presumably interfere negatively – as some kind of spill-over effect – with these and other Asian governments' willingness to cooperate in the space sector.

Some like the regional alliances of Japan and South Korea with the USA while China, Iran and North Korea see the USA as a problem to their national security, as well as the Sino-Indian border skirmishes and the inter-Korean conflict, have already been somewhat mentioned throughout this study. Others that come to mind are the distrust and resentment between the Chinese, Japanese and South Korean nations due to terrible events that occurred between them in the past two centuries.[1070] Also, Japan and China have an ongoing territorial dispute about a set of islands (called Senkaku/Diaoyu Islands) in the East China Sea.[1071] Furthermore, especially the North Korean government is accused of serious human rights abuses,[1072] which can limit other states' willingness to engage with the DPRK cooperatively. Additionally, there is the still unresolved historical issue of the North Korea government abducting Japanese citizens.[1073] Finally, India's ongoing conflictual relationship with Pakistan[1074] and the sovereignty dispute in the South China Sea involving, *inter alia*, China, Malaysia, the Philippines and Vietnam[1075] might limit the potential establish an intergovernmental space cooperation mechanism involving certain preeminent Asian governments in the space sector and other Asian governments with dedicated space programmes.

10.4 Outlook and future research

While the establishment of an ASA might be out of the question as of 2017, this study thinks that the six selected governments will use more of their space-related cooperative potential in the near future. After all, too much can be gained from cooperation.

Future researchers can contribute and add to such a development in many ways. To name just a few, they can build on this study's results and attempt to offer an even more detailed overview of the six selected governments' space programmes, especially if they

1070 Peter J Seybolt, 'China, Korea and Japan: Forgiveness and Mourning' (*Asia Society*) <https://asiasociety.org/china-korea-and-japan-forgiveness-and-mourning> accessed 27 February 2019; Stephen Evans, 'Bad Blood between Japan and Korea Persists' (28 April 2015) <https://www.bbc.com/news/world-asia-32477794> accessed 27 February 2019.

1071 Nyshka Chandran, 'A Second Territorial Dispute in Asia Could Be More Dangerous than the South China Sea' (*CNBC*, 21 December 2017) <https://www.cnbc.com/2017/12/20/east-china-sea-could-be-riskier-than-south-china-sea.html> accessed 27 February 2019.

1072 'North Korea Events of 2017' (*Human Rights Watch*) <https://www.hrw.org/world-report/2018/country-chapters/north-korea> accessed 27 February 2019.

1073 'Japan Struggles to Resolve North Korea Abduction Issue as Kin Age' (*The Japan Times*, 17 December 2017) <https://www.japantimes.co.jp/news/2017/12/17/national/japan-struggles-resolve-north-korea-abduction-issue-kin-age/> accessed 27 February 2019.

1074 Andrew Whitehead, 'Partition 70 Years on: The Turmoil, Trauma - and Legacy' (*BBC*, 27 July 2017) <https://www.bbc.com/news/world-asia-40643413> accessed 27 February 2019.

1075 'South China Sea Dispute: China Lands Bombers on Island' (*BBC*, 19 May 2018) <https://www.bbc.com/news/world-asia-china-44180773> accessed 27 February 2019.

are proficient in the country's respective official language. They can assess the other Asian governments with dedicated space programmes' space-related state preferences and related major measures, and identify their potential to engage cooperatively with the preeminent Asian governments in the space sector. Finally, they can draw on this study's findings and aim at identifying APSCO's and APRSAF's potential to evolve into even broader intergovernmental space cooperation mechanisms. As introduced in Section 1.1, Suzuki has already endorsed a merger of APSCO and APRSAF to establish an Asia and the Pacific Space Agency.

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