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**SOUTHEAST ASIAN SPACE PROGRAMS: MOTIVES,
COOPERATION, AND COMPETITION**

by

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COMPETITION**

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ABSTRACT

The developing countries of Southeast Asia are rapidly increasing their investments in space technologies and formalized national space agencies. The inherent dual-uses and broad applications of space technologies as tools of security and development and the geopolitical importance of Southeast Asia make this examination of small-state space programs useful in exploring a number of themes.

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The thesis concludes that cooperative and competitive forces complement each other as they operate at various levels within a multi-scalar international network. Patterns of space cooperation and competition among Southeast Asian space programs balance these two activities, as well as regional centrifugal and centripetal forces, in a relatively peaceful, positive sum game for national and regional space development.

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LIST OF ACRONYMS AND ABBREVIATIONS

AEC	ASEAN Economic Community
ADMM	ASEAN Defense Ministers' Meeting
AMMST	ASEAN Ministerial Meeting on Science and Technology
ANGKASA	National Space Agency (Malaysia)
APOSOS	Asia-Pacific Ground-based Optical Satellite Observation System
APRSAF	Asia-Pacific Regional Space Agency Forum
APSC	ASEAN Political-Security Community
APSCO	Asia-Pacific Space Cooperation Organization
ARF	ASEAN Regional Forum
ASCC	ASEAN Socio-Cultural Community
ASEAN	Association of Southeast Asian Nations
ASEAN-EOS	ASEAN Earth Observation Satellite
ASO	ASEAN Space Organization
COST	Committee on Science and Technology
CRISP	Centre for Remote Imaging, Sensing, and Processing
CSSTEAP	Centre for Space Science Technology Education in Asia and the Pacific
DPR	People's Representative Council (Indonesia)
EMSA	Emerging Space Actor
ESA	European Space Agency
EU	European Union
FTA	free trade agreement, or free trade area
GDP	gross domestic product
GISTDA	Geo-Informatics and Space Technology Development Agency
IAe	Indonesian Aerospace
IPTN	Industri Pesawat Terbang Nusantara
ISRO	Indian Space Research Organisation
<i>ISS</i>	<i>International Space Station</i>
ITAR	International Traffic in Arms Regulations
JAXA	Japanese Aerospace Exploration Agency

LAPAN	National Institute of Aeronautics and Space (Indonesia)
LDC	least developed country
LEO	low Earth orbit
MTCR	Missile Technology Control Regime
NAMRIA	National Mapping and Resource Information Authority
NASA	National Aeronautics and Space Administration
NAST	National Authority for Science and Technology
ODA	official development assistance
PAGASA	Philippine Atmospheric, Geophysical, and Astronomical Services Administration
PAP	People's Action Party
PDR	People's Democratic Republic
PIS	priority integration sector
PTDI	PT Dirgantara Indonesia
R&D	research and development
S&T	science and technology
SCOSA	Sub-Committee on Space Technology and Applications
SMMS	Small Multi-Mission Satellite
STCC-COSTA	Science and Technology Coordinating Council Committee on Space Technology Applications
THEOS	Thailand Earth Observation System
TNI	Tentara Nasional Indonesia (military)
UAV	unmanned aerial vehicle
UN	United Nations
UNOOSA	United Nations Office of Outer Space Affairs
VAST	Vietnam Academy of Science and Technology
VCP	Vietnamese Communist Party
VNSC	Vietnam National Satellite Center

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I. INTRODUCTION

A. RESEARCH QUESTION

The countries of Southeast Asia have increased their acquisitions of a number of space technologies, with the amount and sophistication of investment growing such that nearly every nation in the region now participates in space activities. Given the distinctive physics of the orbital environment, inherent dual-use applications, and substantial expense, space systems are at a unique crossroads of opportunity for cooperation and competition. This thesis seeks to identify and explain patterns of international cooperation and competition among Southeast Asian space programs: What are the conditions under which Association of Southeast Asian Nations (ASEAN) member states invest in space programs to compete or cooperate with each other and other international space powers?

B. IMPORTANCE

These relationships among regional space programs lay at a junction of themes, including a changing world order, a frontier of persistently disruptive technological applications, and the decision-making processes within and between states in one of the world's most rapidly changing regions, with implications for U.S. regional and global policy. Firstly, the increase in nations accessing space reflects a 21st century shift to a multipolar world, as previous monopolies on power are diminished.¹ Robert Harding makes the case that “since the end of the Cold War, the gap between ambitions, achievements, and relative power of developed and developing states has begun to narrow,” including in such important areas as “economic performance and influence in the international system.”² The declining costs of orbital access have resulted in a much more crowded field of national space actors, as a multitude of developing nations have

¹ Rather than belabor that point here, see: Thomas L. Friedman, *The World Is Flat: A Brief History of the Twenty-First Century* (New York: Farrar, Straus and Giroux, 2005); Moisés Naim, *The End of Power: From Boardrooms to Battlefields and Churches to States, Why Being in Charge Isn't What It Used to Be* (New York: Basic Books, 2013); Fareed Zakaria, *The Post-American World* (New York: W. W. Norton, 2008).

² Robert C. Harding, *Space Policy in Developing Countries: The Search for Security and Development on the Final Frontier* (London: Routledge, 2013), 72.

increased their space activities over the last few decades.³ These reduced barriers to entry indicate that space access is transitioning from the costly “ascent” phase of spaceflight’s first half century, in which a few powers demonstrated the technology, into a “diffusion” phase, marked by greater technological maturity and market penetration through widespread acceptance of the benefits.⁴ Thus, democratized entry into space by a quorum of ASEAN’s member states suggests a second space age with distinctly different levels of participation and political, economic, and social effects both on earth and on orbit. Therefore, this thesis offers insight into the behavior of the growing number of nations that aspire to greater roles in space.

Secondly, space lies at a unique confluence of technology, politics, and economics; though isolatable as a single issue, its relevance spans a wide range of human activities, including navigation, military modernization, communications, commerce, domain awareness, national prestige (both domestic and international), and a variety of other applications. It is therefore a useful prism through which to study a range of variables in national strategies and international relations. Space still presents high relative costs to developing nations, so understanding “the political, economic, and cultural rationales” by which developing nations pursue space programs as an increasingly “integral component of their national policies” offers revealing insight toward internal and external national decision-making calculi.⁵ This thesis fills a current gap in knowledge regarding space policies within the regional subset of nations representing Southeast Asia.

Thirdly, space’s perceptual transition from “ultimate high ground” to “final frontier” to “crowded” commons increases its relevance as both a source of problems and opportunity in international cooperation.⁶ Southeast Asia is one of the world’s most

³ Ibid., 2.

⁴ Everett Rogers’ cycle of diffusion of innovations suggests that the innovators and early majority are now being joined by a late majority near the top of the bell curve of adoption. James Fleck, “Learning by Trying: The Implementation of Configurational Technology,” in *The Social Shaping of Technology*, 2nd ed., eds. Donald MacKenzie and Judy Wajcman (Philadelphia: Open University Press, 1999), 28.

⁵ Harding, *Space Policy in Developing Countries*, ix and 2.

⁶ See: James Clay Moltz, *Crowded Orbits: Conflict and Cooperation in Space* (New York: Columbia University Press, 2014).

dynamic regions: with a population of 600 million, a combined economy among the world's top ten (both growing rapidly), modernizing militaries, a fluid regional security situation, and an ambitious regionalization agenda, Southeast Asia represents more than merely a crossroads of geography, markets, and great power spheres of influence.⁷ Because space overlaps so many functional areas, it provides a useful reference point to determine Southeast Asia's changing place within the world system. Southeast Asia's emerging space programs function, therefore, as a windsock, indicating both the prevailing direction and intensity of the winds of change in the regional geopolitical, technological, and socioeconomic order.

Understanding this shifting geopolitical—and orbital—landscape is relevant if the United States seeks to stay ahead of such changes as the predominant status quo power. Therefore, while the United States often preoccupies itself with scrutinizing the biggest emerging space powers, protecting its technological lead to the detriment of space cooperation, or chasing grand strategies of “space control” or “space dominance,” it risks limiting its field of view such that it misses the expanding galaxy by zeroing in on the brightest stars. To appreciate the relevance of this new “silent majority” of space actors, closer examination of their space programs' roles as vehicles for cooperation or competition is warranted. By analyzing existing patterns of cooperation among Southeast Asian space programs, this thesis explains fundamental conditions under which those countries choose to cooperate (or not to cooperate) through either ASEAN, other international institutions, or bilateral arrangements. Understanding how and why Southeast Asian nations reconcile their national interests in space today reveals insights into tomorrow's geopolitical frontier.

C. PROBLEMS AND HYPOTHESES

Two problems addressed by this thesis are ASEAN's potential for achieving its rhetorical goals of regional community-building despite potentially conflicting national space strategies and tensions between dueling perceptions and applications of space technology. While the arc of *longue durée* may indicate increasing integration within the

⁷ “ASEAN Statistics,” Association of Southeast Asian Nations, accessed August 21, 2014, www.asean.org.

Southeast Asian community, significant hurdles remain toward achieving greater practical cooperation (particularly within high-tech industries), including recidivist nationalist protectionism, developmental and financial constraints, and shortfalls of technical capacity. ASEAN's consensus-based model of decision-making—part of the “ASEAN Way” much heralded prior to the 1997 Asian financial crisis and now somewhat muted by intervening events—may impede practical cooperation on transnational issues despite the ambitious agenda for regionalization. ASEAN's three-pillared community-building agenda, including full implementation by 2015 of an ASEAN Political-Security Community (APSC), ASEAN Economic Community (AEC), and ASEAN Socio-Cultural Community (ASCC), has been limited to date by a spotty track record of cooperation on transnational issues. Greater regional cooperation within science and technology academies and bureaucracies through multi-faceted space applications could offer an appealing avenue for greater cooperation.

Another problem is born of viewer perspective—whether one sees space as a forum for techno-national competition or a cooperative commons. The historic dual-use tug-of-war between civil and military uses of space is certainly affected by inserting into the system a large volume of users with strongly developmental agendas in space, as a majority of space stakeholders with explicit declarations for exclusively peaceful uses of outer space could decisively tip the balance in international discourse. Furthermore, for developing countries in particular, space may be uniquely conducive to cooperation due to the high costs of entry and technical hurdles, but it is also prone to perceptions of “space race” competition along the classic realist vein of a security dilemma. Unlike the larger Asia-Pacific region, Southeast Asia's ASEAN-altered security paradigm and consensus-based model may have uniquely mitigated much of the race aspect within the region. Yet, cooperation is somewhat limited due to technical considerations that encourage collaboration with external space powers and competing national objectives that limit perceived benefits from regional cooperation; it may remain limited if space's dual-use nature creates structural pull toward future militarization. The role of these external alignments within regional politics is itself an interesting problem, given certain views of “Southeast Asian security [as] mostly a function of major power policies and

preferences: less a function of ASEAN [and more] a product of coincident great power interests.”⁸

Several hypotheses grow out of these initial conditions:

(1) Terrestrial politics are likely to shape the dynamics of the orbital landscape. Realist theories suggest that within an interdependent economic paradigm dominated by large power blocs, nations with smaller resource bases frequently make the rational decision to cooperate with each other in order to compete with larger powers, resulting in a multi-scalar international system as space access democratizes. Such realities could significantly affect ASEAN integration, as space nationalism could succumb to cooperative expediency as Southeast Asian nations are induced to externally balance collectively against extra-regional actors. Or, divergent extra-regional alignments and persistent mutual insecurities could preempt greater regional cooperation, as states pursue independent, national space policies to internally balance against not only great powers but also each other.

(2) Technological deterministic theories may presume that the physical realities of the orbital environment require either cooperative or competitive statecraft over its alternative. But this binary opposition in perspectives of space as a cooperative or competitive environment may be too simplistic in assessing patterns of national interaction in that medium. More likely, technological determinants are influenced by their social construction. Such considerations further imply that the space technologies of Southeast Asian countries, even if primarily developmental in application, cannot be viewed as purely economic apparatuses; because of fundamental dual-use utility and national perceptions of space investments as *economic* multipliers, space pursuits within Southeast Asia must be viewed comprehensively along a broad spectrum encompassing both development and security.

(3) Experience indicates that cooperation at the sub-regional bilateral and multi-lateral levels has often been the “avenue of choice among ASEAN countries” and a

⁸ Alice Ba, “The Association of Southeast Asian Nations,” in *The Routledge Handbook of Asian Security Studies*, ed. Sumit Ganguly, Andrew Scobell, and Joseph Chinyong Liow (London: Routledge, 2010), 210.

precursor to expanded cooperation, especially regarding more wicked problems.⁹ Based on liberal theories of gradually thickening patterns of interdependence, Southeast Asian space cooperation may initially continue to be dominated by coordination with larger, external spacefaring states due to issues of technical capacity, then move into a period in which interested and more technically advanced regional leaders cooperate in issue-specific breakout groups, before eventually becoming commonplace with potential formalization at the regional institutional level.

(4) If similar space and technology bureaucracies cooperate positively with each other across national boundaries, constructivist theories suggest that an epistemic community could be a driver for broader Southeast Asian cooperation. While rhetoric could continue to outpace measurable progress, a thickening web of norm acculturation and a positive feedback cycle among all three pillars of the ASEAN Community would continue to propel the slow march toward greater integration within the ASEAN Community. Organizational international cooperation in space science and technology offers unique benchmarks by which to measure regional cooperative patterns.

D. LITERATURE REVIEW

Given the position of this thesis' subject matter at the interstices between space policies and motivations and Southeast Asian regionalism, there is a large and growing library relevant to this study. Consolidating the existing scholarship to provide a platform from which to launch into the unknown requires background information in several critical areas: describing Southeast Asian space efforts and plans to date; exploring how realist, liberal, and constructivist theories offer various perspectives on space cooperation; and building a context of current regional cooperation within ASEAN.

1. Defining Southeast Asian Space Programs

Space pursuits of developing countries, which by definition are more resource-constrained than larger spacefaring leaders, present an interesting guns-versus-butter argument with regard to state policy choice. Though not focused on any particular region,

⁹ Narayanan Ganesan, "Bilateral Tensions in ASEAN," in *The Routledge Handbook of Asian Security Studies*, ed. Sumit Ganguly, Andrew Scobell, and Joseph Chinyong Liow (London: Routledge, 2010), 210.

on the matter of *Space Policy in Developing Countries* Robert Harding concludes that the “pursuit of space-related endeavors is part of a logical progression in a state’s assurance of its national security and economic development.”¹⁰ He divides “emerging space actors (EMSAs)” into three tiers based on level of investment and sophistication of indigenous capability. By his metric, all of Southeast Asia’s EMSAs join the third tier of “smaller, but no less enthusiastic states [that] now make up the majority of the world’s space actors.”¹¹ Danielle Wood and Annalisa Weigel offer an alternative tiered approach to categorization, the “space ladder,” which establishes milestones against which to measure space programs’ comparative capabilities.¹²

Because “both opportunity cost and comparative advantage drive political and strategic decisions in space,” there is considerable consensus that the “developmental trajectory” followed by new entrants to space tracks that of the first generation of space actors.¹³ If strategy is understood as a process of identifying a political objective then matching national “instruments of power” (the means) to such ends, the establishment of space agencies to act on behalf of a nation indicates conscious strategic formulation.¹⁴ Therefore, expenditures of scarce national resources in space represent the conclusion of a rational calculus that determines space to be valuable for either: prestige (the price of admission for a seat at the 21st century table); economic development (a net positive cost-benefit venture); national security (as a capacity multiplier); or, more often, all three.

Within Southeast Asia, Indonesia, Malaysia, Thailand, Vietnam, Singapore, the Philippines, and even Laos participate in space activities and possess some form of government space bureaucracy to coordinate space policies. The region has no natural leader in space; while some countries specialize in comparative advantages, they each

¹⁰ Harding, *Space Policy in Developing Countries*, 13.

¹¹ Harding, *Space Policy in Developing Countries*, 14, 78–79.

¹² Danielle Wood and Annalisa Weigel, “Charting the evolution of satellite programs in developing countries—The Space Technology Ladder,” *Space Policy* 28, no. 1 (February 2012), 15, <http://dx.doi.org/10.1016/j.spacepol.2011.11.001>.

¹³ Eligar Sadeh, “Introduction: Towards Space Strategy,” in Eligar Sadeh, ed., *Space Strategy in the 21st Century: Theory and Policy* (London: Routledge, 2013), 7; Harding, *Space Policy in Developing Countries*, 74.

¹⁴ “Lesson 1: Strategy,” *National and International Security Studies (8902)*, Marine Corps Command and Staff College Distance Education Program (Quantico, VA: Marine Corps University, AY-13), 1-1.

seek to broaden their independent capabilities to reduce reliance on regional and foreign providers. Though a Vietnamese cosmonaut and a Malaysian *angkasawan* have flown in space to raise national prestige, overall, the developmental focus of Southeast Asian nations in space drives competition primarily into the economic realm; therefore, the space security dimension within Southeast Asian programs—while present—operates at a more nuanced level than it does among the larger global space powers. The region’s gathering momentum in space in the last few decades is demonstrated by a number of metrics: expansion of the number of nations operating in space since 1990 and their collaboration on projects with larger space powers; the proliferation of formalized government space agencies since 2000 (adding Vietnam, Malaysia, Thailand, and Laos, with the Philippines a future possibility); and future ambitions backed by significant investment increases (such as a Indonesia’s substantial space budget increase since 2000 and Vietnam’s construction of a large satellite control center).¹⁵

Complicating regional cooperation in space is the inseparable competitive aspect. Only Indonesia within Southeast Asia has demonstrated serious interest in building the sort of independent launch capability historically associated with missile technology, and regional programs have focused predominantly on telecommunications, Earth observation, and remote sensing; however, other irrevocably dual-use space applications ensure cooperation will always be countered by equal and opposite apprehensions of competition in a sort of Newton’s third law of international space interactions. For example, while a reconnaissance satellite may not constitute a “threat,” such national capabilities inevitably provoke sentiments of asymmetric disadvantage among those lacking similar organic capabilities.

2. International Relations Theories on Orbit

The more things change, the more they stay the same; because space technologies are designed and implemented by *people*, traditional international relations theories retain some relevance when lifted into the extraterrestrial environment. Though geopolitical

¹⁵ James Clay Moltz, *Asia’s Space Race: National Motivations, Regional Rivalries, and International Risks* (New York: Columbia University Press, 2012), Kindle edition.

concepts such as sovereignty are increasingly in flux given the highly-networked transnational challenges of the 21st century, traditional realist, structural, liberal, and constructivist models of international relations theory each provide some insight into the calculus of Southeast Asian strategies in space.¹⁶ One can thus leverage a body of work dedicated to understanding patterns of cooperation and competition by more established space powers. James Clay Moltz offers a helpful catalogue that places these theories into space-based context: (1) *space nationalism*, rooted in classical realism, (2) *technological determinism*, discussed here in a context of structural realism, (3) *global institutionalism*, based in liberal perspectives of international interdependence, and (4) *social interactionism*, encapsulating a constructivist bent on space relations.¹⁷

a. Space Nationalism

Given views of space's utility as a military or economic multiplier (or both), perceptions of power provide a critical lens through which to view a state's place and trajectory within a specific international context. Harding notes that "states have traditionally structured national space policy in ways that are not at all unlike their terrestrial national security and developmental priorities—that, in a Hobbesian world of competitive states, space power serves to ensure not only the survival of the state but its prosperity."¹⁸ Everett Carl Dolman's realism views even "ostensibly cooperative" space projects as façades for advancement of "political, strategic, and economic goals of the individual state;" promoting "'international cooperation' for the 'good of all mankind'" is merely a Trojan horse.¹⁹ Southeast Asia's more developmentally oriented space programs, then, "fit squarely within the realist realm of competitive self-interest, even as

¹⁶ To completely disregard traditional international relations theories built upon the body of experience constituted by known human history smacks of extreme "chronocentricity—the egotism that one's own generation is poised on the very cusp of history." Tom Standage, *The Victorian Internet: The Remarkable Story of the Telegraph and the Nineteenth Century's On-line Pioneers* (New York: Berkeley Books, 1998), 213.

¹⁷ Though derived from international relations theories, Moltz focuses on policy choices driven by their various applications. This thesis focuses more on the explanatory power of these theoretical frameworks. James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 2nd ed. (Stanford, CA: Stanford University Press, 2011), Kindle edition, 23.

¹⁸ Harding, *Space Policy in Developing Countries*, 13.

¹⁹ *Ibid.*, 17.

the justifications for a state's space policy escape the orbit of classical hard power."²⁰ Even such realist mutual suspicion does not reach far enough for Dolman, whose *astropolitik* embeds military strategy into a state-centric space regime, accepting militarization as an inevitable means to a realist end.²¹ A "world of modern territorial nation-states" will project its security dilemma into space at every level (even within cooperative regions), preventing "those political entities from cooperatively exploiting the realm"; efforts at cooperation will inadvertently provoke "countervailing results."²² Because space is an "environment of relative scarcity...conflict can be expected"²³ so assuredly that even Southeast Asia's relatively modest space programs should be tailored to brace their nations as tools of "cross-domain deterrence."²⁴

Neorealism offers multiple insights relevant to cooperative patterns among Southeast Asia's space programs, ranging from structural constraints that impel actors into space then guide their actions through technological determinism. Contrasting predominantly peaceful programs such as the European Space Agency (ESA) or Southeast Asia's national programs with early American, Soviet, or Chinese efforts, neorealists such as Kenneth Waltz would argue that though space programs may originate from different focal origins, the realities of dual-purpose applications and structural influences of the international system "oblige states to [grow] functionally alike," so that the full spectrum application of space systems ultimately converges, "constrained only by the comparative resources available to them."²⁵ Steven Lambakis emphasizes the role of technology transfer in bending commercial, scientific, and civil space projects toward military applications.²⁶ If Southeast Asia's national programs are viewed from this

²⁰ Ibid., 146.

²¹ Dolman, *Astropolitik*, 183.

²² Ibid., 3.

²³ Everett Carl Dolman, "New Frontiers, Old Realities," *Strategic Studies Quarterly* 6, no. 1 (2012), 80.

²⁴ James A. Lewis, "Reconsidering Deterrence for Space and Cyberspace," in Michael Krepon and Julia Thompson, eds., *Anti-satellite Weapons, Deterrence and Sino-American Space Relations* (Washington, DC: Stimson Center, September 2013), 67.

²⁵ Michael Sheehan, *The International Politics of Space* (London: Routledge, 2007), 11.

²⁶ Steven Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, KY: University Press of Kentucky, 2001), 48.

perspective—assuming greater eventual militarization (such as increased security-minded use of surveillance or domain awareness)—then incentives to cooperate regionally are wholly dependent on regional interpretations of the security dilemma.

b. *Technological Determinism*

The influence of dual-use technology in shaping the international system is highly dependent on the degree of agency vested in technology. “Hard” technological determinism imputes technological systems with substantial power to effect change or limit freedom of action for human actors; its “soft” alternative views technological applications as a “history of human actions” woven together with a variety of agents in a complex tapestry.²⁷ Because technological devices interact with human users as part of a system,²⁸ the “technique” by which rockets, satellites, and other accoutrements of space access are integrated into society constructs the world they are used in²⁹ while they in turn are “designed, consciously or unconsciously, to open certain social options and close others.”³⁰ For example, the evolution of rocketry and orbital reconnaissance in an era of hot and cold conflict dictated many of the directions space programs took. The resultant applications in turn shaped the world order, influencing negotiations on arms control regimes by permitting new levels of compliance verification. Thus, depending upon one’s vantage point, space cooperation is likely to either have effects on international relations as an important avenue for cooperation, be entirely shaped by the nature of regional cooperation itself, or lie somewhere in the middle.

Peter Perdue argues that “technology constrains...it does not determine,” which reflects a middle-path perspective regarding agency and technique.³¹ Technology’s role

²⁷ Leo Marx and Merritt Roe Smith, “Introduction,” in *Does Technology Drive History: The Dilemma of Technological Determinism*, ed. Merritt Roe Smith and Leo Marx (Cambridge, MA: The MIT Press, 1994), xii.

²⁸ Donald MacKenzie and Judy Wajcman, eds., *The Social Shaping of Technology*, 2nd ed. (Philadelphia: Open University Press, 1999), 10.

²⁹ *Ibid.*, 10.

³⁰ MacKenzie and Wajcman, *Social Shaping of Technology*, 4.

³¹ Peter C. Perdue, “Technological Determinism in Agrarian Societies,” in *Does Technology Drive History: The Dilemma of Technological Determinism*, ed. Merritt Roe Smith and Leo Marx (Cambridge, MA: The MIT Press, 1994), 169.

outside of “physical calculations and material constraints” is particularly pertinent to a study of Southeast Asian space programs, given a unique marriage in the region between advanced technology and state aspirations. Sulfikar Amir’s study of technology’s role in coloring Indonesian authoritarianism dubs the unique developmental model a “technological state.”³² Sulfikar’s “techno-national” complex recalls the concept of power:

Technology and politics are mutually reinforcing in the production of power; on one hand, the material configurations of technology have political effects and are effective in use for political purposes. On the other hand, the shaping of technology is greatly influenced by the context of power relations which operate in the space where technology exists.³³

Technology’s relationship to power politics is developed by Joan Johnson-Freese specifically in *Space as a Strategic Asset*, where she argues that “especially in today’s globalized environment, technology advancements can be viewed to indicate national stature and, potentially, power; techno-nationalism—using technology to build stature and power perceptions—is a useful and valid geopolitical consideration.”³⁴ Particularly since the end of the Cold War, national perceptions of security have evolved to “embrace social, environmental, and economic dimensions.”³⁵ Concepts of state power expanded in scope, particularly with the popularization of “soft” power and “whole of government” approaches.³⁶ Socioeconomic development moved from primarily a source of domestic legitimacy toward a prime factor of “deep security”³⁷ against existential threats, with increased emphasis on sustainable innovation-driven endogenous models of economic

³² Sulfikar Amir, *The Technological State in Indonesia: The Co-Constitution of High Technology and Authoritarian Politics* (London: Routledge, 2013), 160.

³³ Sulfikar, *Technological State*, 160.

³⁴ Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), 11.

³⁵ Sheehan, *Politics of Space*, 1.

³⁶ Joseph S. Nye, Jr., *Soft Power: The Means to Success in World Politics* (New York: Perseus Books Group, 2004).

³⁷ The concept of deep security seeks to integrate “revolutionary forces,” including technology, that act on the international environment with the “demands and responsibilities that...established power” requires; see: Joshua Cooper Ramo, *The Age of the Unthinkable: Why the New World Disorder Constantly Surprises Us and What to Do About It* (New York: Hatchette Book Group, 2009), Kindle edition, loc. 238.

growth.³⁸ For Harding's lower-tier EMSAs, the "application of space-based assets still addresses the issue of national security, just from a less narrow scope than that employed during the earlier realist approach to the space race."³⁹

Within the emerging economies of Southeast Asia, advanced technology, of which space exploitation is a flagship enterprise, is increasingly viewed as "an open-ended source of economic growth and cultural integration," that can serve to tie the region together so that it can better compete in a world dominated by greater powers.⁴⁰ With particular relevance to ASEAN, Michael Sheehan notes that "in the contemporary international system the development of advanced technology has now become the key system variable in the way that military power and alliance membership previously was, and geo-technological maneuvering has replaced geopolitical rivalry in the global competition for status and political influence."⁴¹ Realists may be reassured, however, that today's predominantly "scientific and economic cooperation," of which Southeast Asia's space entry is an important dimension, is still "coupled with a military reality."⁴²

c. Global Institutionalism

Historically, because the major spacefaring nations have possessed an "abundance of technological, scientific, financial, and political capability," theories of competition offered sufficient explanation for many; however, today's lower threshold for space entry has carried to orbit more development-centric agendas, requiring a "contrasting emphasis on cooperation" offered by liberal theories of global institutionalism.⁴³ By the 1990s, when the "flow economy" of trade, capital, and intellectual property began to dwarf the "territorial economy," Southeast Asian nations sought better ways to link themselves into

³⁸ Michel E. Porter, "Enhancing the Microeconomic Foundations of Prosperity: The Current Competitiveness Index," *The Global Competitiveness Report 2002* (2001), 2.

³⁹ Harding, *Space Policy in Developing Countries*, 196.

⁴⁰ Michael L. Smith, "Recourse of Empire: Landscapes of Progress in Technological America," in *Does Technology Drive History: The Dilemma of Technological Determinism*, ed. Merritt Roe Smith and Leo Marx (Cambridge, MA: The MIT Press, 1994), 37.

⁴¹ Sheehan, *Politics of Space*, 9.

⁴² *Ibid.*, 13.

⁴³ Sheehan, *Politics of Space*, 10.

global supply chains.⁴⁴ Accordingly, “liberals have emphasized the increasing irrelevance of national borders to the conduct and organization of economic activity,” particularly relevant over a half century after Sputnik’s global overflight forever altered perceptions of national boundaries.⁴⁵ In an interdependent world, mutual restraint and stakeholding gain at the expense of an anarchic world of self-serving nation-states.

Incentivizing accession to treaties governing behavior in space and to bodies such as the International Telecommunications Union (ITU) to de-conflict orbital slots, space exploitation is often considered an inherently “federative” activity—of particular relevance to the community-building agenda of ASEAN.⁴⁶ Nancy Gallagher assumes activities within the space environment are interdependent by nature, with parallel incentive to cooperate alongside competition.⁴⁷ Furthermore, as states shrink worldwide, constraints on national budgets and pools of technical skill further incentivize cooperation on expensive space activities—one reason Southeast Asian nations are forced to collaborate with larger space powers and each other to meet shared goals.⁴⁸ Finally, theories of functionalist cooperation originating from European Union (EU) and ESA examples and frequently applied to ASEAN hypothesize that transnational institutions can grow through iterative repetition to displace national competition and national loyalties.⁴⁹ Within functionalism, scientific and technical cooperation is viewed as a vanguard cooperative effort due to perceptions of its political innocuousness.⁵⁰

⁴⁴ Chia Lin Sien, *Southeast Asia Transformed: A Geography of Change* (Singapore: Institute of Southeast Asian Studies, 2003), 267-8.

⁴⁵ Sheehan, *Politics of Space*, 16.

⁴⁶ Marietta Benko and Kai-Uwe Schrogl, “Space Benefits: Towards a Useful Framework for International Cooperation,” *Space Policy* 11 (1995), quoted in Michael Sheehan, *The International Politics of Space* (London: Routledge, 2007), 13.

⁴⁷ Cited in Sadeh, “Towards Space Strategy,” 5.

⁴⁸ On the shrinking state, see: Naim, *End of Power*, 76-81.

⁴⁹ Sheehan, *Politics of Space*, 72.

⁵⁰ *Ibid.*, 72-73.

d. Social Interactionism

In the example of EU and ESA integration, a new order of frequent interactions under a long shadow of the future played a role that is often transposed onto the ASEAN template, as is the critical role played by an “epistemic community” of scientists “who were able to influence national interpretations of state interests, and increase the likelihood of convergence in state behavior at the international level.”⁵¹ Such social interactionist and bureaucratic-organizational theories offer potential insight into the Southeast Asian experiences with regional integration and space cooperation. While opposing national policy logics can hinder cooperation, there are countervailing forces *beneath* the national level that can oppose such dilemmas. Both space nationalist Dolman and institutionalist Sheehan concede to some degree that competition in space is largely what states make of it.⁵² As orbits crowd, to avoid spillover effects and harmful interference it will become increasingly necessary for an ever-larger number of space stakeholders to establish norms that ensure uninterrupted access to their substantial orbital investments⁵³; indeed, the iterative processes of norm acculturation in space and ASEAN are each a half century old.

The process of furthering national space strategies has resulted in the formation of similar national space bureaucracies throughout Southeast Asia. Ernst Haas’ work on the three models of “adaptation” or “learning” by international organizations regarding their evolving mission orientations offers a method to analyze ASEAN’s organizational development as a node within a growing web of national and regional bureaucracies.⁵⁴ Similarly, Haas’s examination of “international science and technology programs

⁵¹ Sheehan, *Politics of Space*, 73.

⁵² Dolman notes in the context of his *astropolitik* that “benevolence or malevolence will become apparent only as it is applied, and by whom,” in: Dolman, *Astropolitik*, 4; Sheehan notes that “what we perceive space to be shapes our views of how it should be exploited,” in: Sheehan, *Politics of Space*, 5.

⁵³ Chia-Jui Cheng and Doo Hwan Kim, eds., *The Utilization of the World’s Air Space and Free Outer Space in the 21st Century: Proceedings of the International Conference on Air and Space Policy, Law and Industry for the 21st Century held in Seoul from 23-25 June 1997* (The Hague: Kluwer Law International, 2000), 377.

⁵⁴ The three models are adaptive “incremental growth” or “turbulent nongrowth” and learning through “managed interdependence.” Haas viewed ASEAN in its first decade as one of only two organizations to “display evidence of learning.” See: Ernst B. Haas, *When Knowledge is Power: Three Models of Change in International Organizations* (Berkeley: University of California Press, 1990), 4 and 159.

[becoming] more comprehensive and more ambitious in linking specialized knowledge to expanding economic, social, and political goals” offers additional insight into the unique role technical bureaucracies can play in national and international politics as “scientific culture has become coterminous with political life.”⁵⁵ It is possible technocratic organizations have a special claim in political imaginations that “empower[s] them to prescribe major changes” in a complex world.⁵⁶ If similar national bureaucratic agencies such as scientific communities interact positively with each other and their societies, especially under facilitative umbrella organizations such as the Subcommittee on Space Technology and Applications (SCOSA) within ASEAN’s Committee on Science and Technology (COST), it is possible a more powerful regional epistemic community could emerge. Bureaucratic self-interest can act with significant agency in determining national perspectives and agendas, particularly if similar bureaucracies are more prone to cooperate with each other irrespective of national borders. Within the nascent ASEAN Community, bureaucratic and economic elites are often among the largest stakeholders in an expanded regional identity; thus, the community of scientists and academics with vested interests in expanding their functional scope and organizational budgets though international cooperation are likely to be active “norm entrepreneurs” of the regionalization process.⁵⁷ On the other hand, these cosmopolitan bureaucracies must compete against other bureaucracies with more primordialist inclinations; within Southeast Asia, state militaries and other nationalistic bureaucracies retain substantial influence and tend to counteract such internationalist trends.

3. Contextualizing Southeast Asian Cooperation and Competition to Date

So what of these theories where they coincide with ASEAN regionalism through the lens of space cooperation? Southeast Asia’s culture of non-interference and tradition of ideas such as a regional Zone of Freedom, Peace, and Neutrality and a Nuclear

⁵⁵ Ernst B. Haas, Mary Pat Williams, and Don Babai, *Scientists and World Order: The Uses of Technical Knowledge in International Organizations* (Berkeley: University of California Press, 1977), 355.

⁵⁶ Haas et al, *Scientists and World Order*, 4.

⁵⁷ Max M. Mutschler and Christophe Venet, “The European Union as an Emerging Actor in Space Security?” *Space Policy* 28 (2012), 123, doi:10.1016/j.spacepol.2012.02.005.

Weapons Free Zone are prone to support establishment of a “space sanctuary” to assure unmitigated access.⁵⁸ While the regional orientation suggests common positions in international dialogue on space policy, patterns of collaboration on space projects can also indicate progress toward increased regional institutionalism, toward which liberal theories offer insight.

ASEAN’s founding in 1967 by five non-communist nations implies a security dimension in the forum’s origin, though ASEAN now also includes the region’s communist states. Despite the APSC goal and continuing regional security dialogues, economic cooperation (to balance other large economic blocs) has been one of its most quantifiable successes. Despite recent emphasis on this interdependence, Alice Ba holds that ASEAN is still “best characterized as a political-security organization” in which economic cooperation plays only a supporting role.⁵⁹ Barry Buzan applies the term “security complex” to similarly emphasize that Southeast Asia’s “national securities cannot realistically be considered apart from one another.”⁶⁰ Alan Collins notes that internal threats and external interference in Southeast Asia could only be countered by concerted action, requiring ASEAN to adopt a policy of “regional resilience” encompassing all aspects of state- and region-building.⁶¹ Hence, the interest in multi-dimensional space-based development projects mirrors the three-pillared nature of the 2015 ASEAN Community agenda formalized by the long-awaited 2007 ASEAN Charter. Science and technology cooperation offers a venue for both national and regional development agendas, with direct applications toward regional transnational problems such as maritime domain awareness and environmental monitoring. These insights into Southeast Asian behavior hit on a junction between both liberal theories of cooperation and realist theories of competition—while states may compete with each other across a

⁵⁸ Bruce DeBlois, “Space Sanctuary: A Viable National Strategy,” *Aerospace Power Journal* (Winter 1998), <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj98/win98/deblois.html>.

⁵⁹ Ba, “Association of Southeast Asian Nations,” 205.

⁶⁰ Cited in: Alan Collins, *The Security Dilemmas of Southeast Asia* (Singapore: Institute of Southeast Asian Studies, 2000), 109.

⁶¹ Collins notes that the concept is borrowed from Suharto’s “national resilience...emerging from the strength of national development... [covering] all aspects of nation-building—ideological, political, economic, social, cultural....” See: Collins, *Security Dilemmas of Southeast Asia*, 111.

broad spectrum they may also cooperate to some degree in order to competitively balance larger extra-regional actors to preserve their postcolonial autonomy.

While the non-interference and consensus-based model was appealing and facilitated regional expansion (ASEAN encompassed all Southeast Asian states except Timor Leste by 1999), Jürgen Rüländ and Anja Jetschke note that ASEAN's "marked success in pacifying an erstwhile turbulent region" has not been matched by its "ambiguous record in responding to the challenges associated with globalization," suggesting that practical cooperation in developmental space policies may be limited.⁶² Their concern that "implementation lags...rhetoric" is a common sentiment in academic and policy circles⁶³; Jones and Smith criticize ASEAN for "making process, not progress,"⁶⁴ while Ravichandran Moorthy and Guido Benny note the ambitious timeframe for implementation of the ASEAN Community compared to other similar organizations, particularly given the lack of regional identity or involvement by most of the region's 600 million people.⁶⁵ Constructivist theories of social interactionism offer a lens through which to better examine the role of similar national space bureaucracies (and the epistemic communities they may represent) in affecting patterns of cooperation and competition among states.

Also pessimistic are those such as Richard Bitzinger, who regard the rapid rise in regional military spending in 21st century Southeast Asia as an indication of a negative "arms dynamic."⁶⁶ National space investments encourage such perceptions, which would diminish incentives to cooperate on development of such capabilities. Hari Singh's 2000

⁶² Jürgen Rüländ and Anja Jetschke, "40 Years of ASEAN: Perspectives, Performance, and Lessons for Change," *The Pacific Review* 21, no. 4 (December 2008): 397, doi: 10.1080/09512740802294705.

⁶³ Anja Jetschke and Jürgen Rüländ, "Decoupling Rhetoric and Practice: The Cultural Limits of ASEAN Cooperation," *Pacific Review* 22, no. 2 (May 2009): 179-80, 10.1080/09512740902815326.

⁶⁴ David Martin Jones and Michael L. R. Smith, "Making Process, Not Progress: ASEAN and the Evolving East Asian Regional Order," *International Security* 32, no. 1 (Summer 2007), 149.

⁶⁵ Ravichandran Moorthy and Guido Benny, "Is an 'ASEAN Community' Achievable? A Public Perception Analysis in Indonesia, Malaysia, and Singapore on the Perceived Obstacles to Regional Community," *Asian Survey* 52, no. 6 (2012): 1044, doi: AS.2012.52.6.1043.

⁶⁶ His "arms dynamic" falls short of the vicious cycle of an "arms race," but exceeds "mere modernization." Richard A. Bitzinger, "A New Arms Race? Explaining Recent Southeast Asian Military Acquisitions," *Contemporary Southeast Asia: A Journal of International and Strategic Affairs* 32, no. 1 (April 2010): 50-51, doi: 10.1355/cs32-1c.

assertion that “states within ASEAN are potential adversaries despite pretensions of being a ‘security community’”⁶⁷ would cite defense expenditure increases since then as further evidence of a persistent security dilemma in the region.⁶⁸ Thus, all the aforementioned shifting valuations of power and deep security have not altered a fundamental security dilemma, but merely widened its arena and broadened the context; in such conceptions, space-based intelligence—whether providing advantages in harvest efficiency, resistance to natural disasters, or monitoring adversary capabilities—proves more than ever that knowledge is power.⁶⁹ Again, the dual-use dilemma rises to the surface; the degree to which technological deterministic views and structural realist theoretical perspectives explain or drive behavior influences how patterns of state cooperation and competition in space can be viewed.

In a 2008 Ph.D. dissertation, Chukeat Noichim cites SCOSA’s limitations in furthering regionalization, arguing that a formal “ASEAN Space Organization” would offer better practical progress toward all three pillars of the ASEAN Community as a “focal point for broader international cooperation.”⁷⁰ Referencing precedents such as ESA, he thoroughly examines legal and feasibility issues of the prospect; yet, little discussion has followed. SCOSA remains a small shop, and several member states still lack even formal national space agencies. Moltz’s broader survey of Asian space programs identifies a “missing middle” of cooperation among the continent’s largest regional space actors⁷¹; despite substantial cooperation between Southeast Asian nations and external space powers for obvious reasons of capacity, the concern that “expanded

⁶⁷ Hari Singh, “Vietnam and ASEAN: The Politics of Accommodation,” *Australian Journal of International Affairs* 51, no. 2 (1997) quoted in Alan Collins, *The Security Dilemmas of Southeast Asia* (Singapore: Institute of Southeast Asian Studies, 2000), 89.

⁶⁸ Collins, *Security Dilemmas of Southeast Asia*, 92-103.

⁶⁹ In this context, space-derived “intelligence” itself can be placed on a spectrum from basic remote sensing and earth observation to optical and signals reconnaissance of the sort provided by the more sophisticated satellites operated by the advanced space powers.

⁷⁰ Chukeat Noichim, “The ASEAN Space Organization: Legal Aspects and Feasibility” (PhD diss., Leiden University, 2008), 168-69, <https://openaccess.leidenuniv.nl/bitstream/handle/1887/13358/Full%20text.pdf?sequence=6>.

⁷¹ Moltz, *Asia’s Space Race*, 33.

[Asian] regional space cooperation is an unlikely near-term outcome” may be similarly translated to the Southeast Asian sub-region as well.⁷²

A final consideration guiding Southeast Asia’s cooperative space activities is this reliance on external powers to provide technical and financial support for its national space-based activities. Great power competition for influence in the region could hinder regionalization by supporting opposing alignments, but changing regional threat perceptions could also provoke cooperative balancing responses.⁷³ Joey Long uses a lens of great power politics to explore the important position of Southeast Asia at the confluence of competing interests of the United States, China, India, and Japan; all are also space powers.⁷⁴ Great power relationships with ASEAN’s nation-states work both ways, as “ASEAN states seek to enmesh the great powers” using the United Nations and other multilateral institutions to thicken interdependent connections.⁷⁵ But, to some, such acculturating “norms advanced by an association of weak states...can only be what stronger states make of them.”⁷⁶ This suggests that ASEAN cooperation in space and on international space policy will be highly regulated by its members’ relationships with external powers.

Amid such voluminous relevant contextual information, this thesis seeks to fill a gap in the existing literature that tends to treat Southeast Asia’s space programs as peripheral to other, primary units of analysis. Therefore, while there is abundant information on international relations theories on earth and on orbit, a similar amount on ASEAN non-space cooperative enterprises, and disaggregated encyclopedic information on Southeast Asian space programs (except for a few key studies that are generally surveys of capabilities), there is very little on this subset of regional space programs as a

⁷² James Clay Moltz, “China, the United States, and Prospects for Asian Space Cooperation,” in *China and East Asian Regionalism: Economic and Security Cooperation and Institution-Building* (London: Routledge, 2012), 145.

⁷³ For valuable perspectives on threat balancing, see: Stephen M. Walt, “Alliance Formation and the Balance of World Power,” *International Security* 19, no. 4 (Spring 1985): 3-43.

⁷⁴ Joey Long, “Great Power Politics and Southeast Asian Security,” in *The Routledge Handbook of Asian Security Studies*, ed. Sumit Ganguly, Andrew Scobell, and Joseph Chinyong Liow (London: Routledge, 2010), 231-32.

⁷⁵ Long, “Great Power Politics,” 233; Sheehan, *Politics of Space*, 130.

⁷⁶ Jones and Smith, “Process, Not Progress, 184.

vehicle for or indicator of regional cooperation or patterns of alignment. Thus, while the EU and ESA are often applied as case studies for the ASEAN Community, an “Asia-Pacific Space Organization,” or even an “ASEAN Space Organization,” differences in developmental levels, geopolitical context, and regional organizational models limit the compatibility of this comparison. National space strategies in the developing countries of ASEAN, including their relationships to each other and external powers, warrant independent consideration to determine what such advanced technical interaction reveals regarding not only their future motions in space but also larger trends in regional integration.

E. METHODS AND SOURCES

In seeking balance at the confluence of ASEAN regionalism and space technology development, this thesis first seeks to correct academic oversight by moving Southeast Asian space programs from peripheral consideration to center focus as the units of analysis. While essentially a case study of this cluster of regional space programs, it seeks to achieve greater clarity by drawing the lines connecting individual points within this dim constellation while also defining and fixing those individual positions within a larger family. It is thus a study of organic network formation as much as of individual nodes. While the level of analysis is primarily regional, actions of domestic organizations that reach beyond the Southeast Asian region will also be examined.

Fortunately, the working language of ASEAN and much of the international scientific community is English, opening many relevant primary sources. Most national space agencies post information on projects publicly, and the developmental (rather than security-centric) focus and collaborative nature of Southeast Asian space programs means a great deal of information is unclassified. Therefore, open source news, launch logs, progress reports, charters, minutes, official literature, and analyses of cooperation will be cross-referenced within the framework to construct a more detailed map of cooperative patterns. This map can then be compared to stated regional goals and similar attempts at practical international cooperation before conclusions are drawn.

F. THESIS OVERVIEW

Given the now-established context of the thesis within international relations theory, a greater exploration of the several themes can progress. Chapter II will further describe the origins, capabilities, and character of Southeast Asian space programs. Commonalities and opposing national strategies will be highlighted. While the focus is primarily on national space programs, any summary of Southeast Asian space efforts to date necessarily mentions some collaborative efforts with a number of external space powers, due to the financial and technical constraints on national governments.

Chapter III will scrutinize the underlying factors influencing Southeast Asian countries' cooperative ventures with foreign space powers: *Why* do they choose the partners they do? Why does Vietnam cooperate with Japan, despite a contentious history? Why is Thailand, historically aligned closely with the United States, a founding member of China's Asia-Pacific Space Cooperation Organization (APSCO)? The answers to these questions are as often found domestically as internationally, so chapter III bridges foreign policy and domestic politics. After briefly leveraging comparisons with extra-regional cooperative endeavors, this chapter will attempt to develop a more coherent map of these networks and to determine what effects external influences have on national and regional strategies.

Chapter IV examines space cooperation within ASEAN and among its member states, both formalized at the organizational level and informal at the bureaucratic one, and on individual projects such as earth observation, remote sensing, and telecommunications. Choices of cooperation at the regional level will be compared to extra-regional examples and alternative arrangements for collaboration within bilateral and multilateral regional groupings. This information will also shed light on the progress and pitfalls of the regional community-building process. As chapter III charts extra-regional interactions, chapter IV will do the same for intra-regional engagement.

While each of the international relations theories is relevant to each subject, readers should note that chapter II's discussion of national space programs is tightly coupled to perspectives of space nationalism. Chapter III's span across foreign and

domestic influences enters multiple theoretical contexts but is also rooted heavily in realism, particularly many structural influences of technological determinism. Chapter IV rounds out the thesis and the theories by relying more on the lenses of global institutionalism and social interactionism.

Finally, the three chapters will be collated to highlight vectors for space cooperation and competition and prospects for regional integration within the ASEAN Community member states' space programs, before briefly drawing conclusions for U.S. policy in interacting with the region on Earth and in outer space.

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II. SOUTHEAST ASIA'S NATIONAL SPACE PROGRAMS

A. INTRODUCTION

Throughout the developing world, government bureaucracies have been established to process satellite data or to conduct or control remote sensing operations. The fear of exploitation by the developed states emerged because information is power and remote sensing offered the power to develop resources. Many developing countries feared that since they would not be in control of the dissemination of sensed data their dependency on the developed world would simply be reinforced. In particular, they feared that they would be placed at a disadvantage in negotiations with multinational corporations, who would have access to satellite data which would put them in a superior bargaining position when negotiating for rights to exploit resources.⁷⁷

Southeast Asian nations face increasing pressure to improve their national capabilities in space for two reasons. First, there is an “up or out” perception—if developing nations do not work to converge with developed nations they risk persistent vulnerabilities to neocolonialism. The second reason is rooted in “a sense of technology’s power as a crucial agent of change...in the culture of modernity.”⁷⁸ The first reason represents security motivations; the second, economic incentives. Space is viewed as a multiplier for political and socioeconomic security, in perceptions of state power strongly affected by space nationalism. But what do national efforts to enter space reveal regarding these states’ cooperation—or competition—with others in space? This chapter contributes to an answer by building context as a starting point; therefore, its focus will be primarily domestic and historic.

While there is no clear threshold of what qualifies as a national space program, Moltz offers that national programs must be viewed on a “continuum” ranging from embryonic national interest to “possession of a full spectrum of civil, commercial, and military space assets.”⁷⁹ Rather than attempt to specifically rank Southeast Asian national

⁷⁷ Sheehan, *Politics of Space*, 128.

⁷⁸ Marx and Smith, “Introduction,” ix.

⁷⁹ James Clay Moltz, *Asia's Space Race: National Motivations, Regional Rivalries, and International Risks* (New York: Columbia University Press, 2012), Kindle edition, loc 3521.

achievements in space via a tiered or ladder system, this chapter explores each nation's space strategy by describing its past, present, and future vectors in space. Large and populous Indonesia receives the most elaborate exposition, as its space program's longevity and range of pursuits provide a useful reference for themes present across the region. Overall, the developmental focus of Southeast Asian nations in space drives competition primarily into the economic realm, with space's security dimension within Southeast Asian programs operating at a more subdued level across the region than it does among the larger global space powers.

B. SOUTHEAST ASIA'S INCREASING SPACE INVESTMENTS

Global government spending on space increased from \$35 billion in 2000 to \$72.9 billion by 2012, despite the intervening effects of the Global Financial Crisis.⁸⁰ The preponderance of the balance was sourced by the established and emerging space powers, such as the United States, Europe, Russia, China, Japan, and India). However, a notable portion of the increase (especially in light of relative economic size) was driven by developing countries across the Global South and Southeast Asia in particular.⁸¹ In 2012, Vietnam led the region with \$93 million, followed by Laos at \$87 million, Indonesia at \$38 million, Thailand at \$20 million, and Malaysia at \$18 million.⁸² Many outside industry experts validate these expenses as the development-oriented expenses their governments tout them as. Regional governments tend to view such investments as seed money for economic growth similar to such spending in developed nations: the Royal Observatory of Belgium claims that for each euro that country spends on space, three are generated toward GNP.⁸³ Other governments make similar claims. Critics, however, are

⁸⁰ Any such figures require a certain degree of estimation, as they may be split among various organizations and large portions of many budgets are classified. "Is Asian Space Science Harming Development?" *SciDevNet*, May 16, 2013, <http://www.scidev.net/global/climate-change/feature/is-asian-space-science-drive-harming-development--2.html>.

⁸¹ In 2003, 37 countries spent over \$10 million on space, but by 2013 that number had increased to 53, with 22 more planning investments in the future. Though 2013 saw the first global downturn in the global aggregate space budget since 1995 (down to \$72.1 billion from 2012's \$72.9), that phenomenon was almost entirely due to budget cuts within the United States, which has shed \$8.8 billion from its 2009 peak. Peter Apps, "Global Spending on Space Falls, Emerging States Are Spending More," *Reuters*, February 14, 2014, <http://in.reuters.com/article/2014/02/13/space-spending-idINDEEA1C0I120140213>.

⁸² Ibid.

⁸³ Ibid.

concerned that such expenditures represent misplaced priorities for developing countries in a region where public-sector spending on education remains underwhelming and health spending averages only half as much as percentage of GDP as in OECD states.⁸⁴ For example, while Laos, one of the region's poorest countries, was spending such high startup fees for its new space program, it was receiving \$153 million in Australian investment for basic education.⁸⁵ Sustained budgets indicate, however, that Southeast Asian governments largely reference the former argument in evaluating space investments.

C. INDONESIA

As Southeast Asia's largest and most populous state (nearly half of ASEAN) with nearly 250 million people, 17,000 islands spanning an area longer than the continental United States, and a favorable equatorial geography for launches and orbital exploitation, Indonesia has strong motivations and potential to develop a robust space program for a lower-middle income country. As a pioneer of the Cold War non-aligned movement with jealously protected postcolonial independence and an archipelagic geography that incentivizes use of space as a big tent under which to strengthen national unity, Indonesia's space strategy has sought to knit together its diverse community by enhancing governance through communication, education, and economic growth. The Indonesian state's investments in its space program indicate a push for economic modernization in a continuation of historic developmental state policies that seek to strengthen the regime and internally balance against a range of perceived challenges.

Having established a formal space program as early as 1963, there was excitement as late as the 1990s that Indonesia could be one of Asia's big three space programs (after Japan and China).⁸⁶ While actual progress was much more modest, by virtue of its large aggregate resource base Indonesia is still a leader in the region with regard to space

⁸⁴ Ibid.

⁸⁵ "Space Science Harming Development?"

⁸⁶ Patrick M. Mayerchak, "Asia in Space: The Programs of China, Japan, and Indonesia," in *Space: National Programs and International Cooperation*, ed. Wayne C. Thompson and Stephen W. Guerrier (Boulder, CO: Westview Press, 1989), 96.

investment and ambitions. It still hopes to be one of Asia's top four space powers (though it has since been surpassed by India and South Korea, if not others).⁸⁷ Indonesia's geography provides a challenge for domain awareness and satellite imagery offers substantial cost reductions; however, purchasing large amounts of commercial imagery or high volumes of payload capacity from foreign providers imposes other costs that have encouraged Indonesia to climb the space ladder.⁸⁸

Setting the stage for a space economy that would pace simultaneous developmental-minded attempts to develop a domestic aerospace industry, Sukarno established the National Institute of Aeronautics and Space (LAPAN) in 1963 under the National Council for Aeronautics and Space of the Republic of Indonesia (DEPANRI) as part of a "constellation of national organizations regarding space [and aerospace] activities"⁸⁹ that included ties with a range of state ministries from defense to development.⁹⁰ LAPAN was built upon the Initial Scientific and Military Rocket Project (PRIMA), an affiliation between the Indonesian Air Force and Bandung Institute of Technology, and it is still tasked with developing space policy and a range of aerospace (including rocket and satellite) technologies through research and development (R&D).⁹¹ LAPAN's strong developmental orientation has focused on earth-oriented applications and eschewed prestige projects such as manned spaceflight; since Indonesia's first astronaut candidate's scheduled trip in 1986 aboard the U.S. *Challenger* shuttle was canceled by the intervening disaster, LAPAN has not renewed its interest.⁹² Rather, its slow progress has focused on climbing the space ladder by incrementally building its independent capacity to relieve the costs of its current commercially-purchased

⁸⁷ Erwida Maulia, "Indonesia's First Satellite Ready for Takeoff," *The Jakarta Globe*, January 7, 2014, <http://www.thejakartaglobe.com/news/indonesias-first-satellite-ready-for-take-off/>.

⁸⁸ Moltz, *Asia's Space Race*, loc 3699.

⁸⁹ H. Wiryosumarto, "Indonesia's Space Activities," *Proceedings of the Euro-Asia Space Week on Cooperation in Space—'Where East & West Finally Meet,' 23-27 November 1998*, (European Space Agency, 1999).

⁹⁰ Moltz, *Asia's Space Race*, loc 3684.

⁹¹ "Vision and Mission" and "History," National Institute of Aeronautics and Space of Indonesia (LAPAN), accessed 16 March 2014, www.lapan.go.id.

⁹² Mayerchak, "Asia in Space," 97.

architecture, with projects always promoted “within the scope of peaceful purposes and national development priorities.”⁹³

Indonesia has operated its own domestic satellites since 1976, as one of the first developing states and the fifteenth overall to do so.⁹⁴ Its American-built *Palapa* series of satellites, named by Suharto himself after a fourteenth-century Hindu-Javanese leader’s oath to achieve national unity,⁹⁵ provides regional telecommunications services (augmented in the late 1990s by the *Indostar-1* or *Cakrawarta-1*).⁹⁶ In addition to the two control stations and nine initial receiving stations included in the *Palapa* deal, Indonesia operates a ground station in Parepare, South Sulawesi, to downlink data from remote sensing satellites.⁹⁷ LAPAN also partnered on development of the *Sahadev* Satellite Early Warning System, which integrates satellite and terrestrial sensors for natural disaster monitoring.⁹⁸

LAPAN has received an enormous influx of attention and resources in the 21st century following democratization and overthrow of Suharto’s New Order which disrupted previous patterns of state-led aerospace development. Historically, Indonesia’s state-led aviation company, IPTN, played the flagship role in the New Order’s developmental policies. The twentieth century Indonesian aerospace industry, including both IPTN and LAPAN, were expected to create high-quality jobs, enhance the economy’s technological sophistication, contribute to national defense, and instill national pride as both a symbolic banner of state achievement and economic multiplier.⁹⁹ IPTN, however, received the vast majority of state investment in a series of expensive

⁹³ Wiryosumarto, “Indonesia’s Space Activities.”

⁹⁴ Robert C. Harding, *Space Policy in Developing Countries: The Search for Security and Development on the Final Frontier* (London: Routledge, 2013), 10-11.

⁹⁵ Mayerchak, “Asia in Space,” 96; K. K. Nair, *Space: The Frontiers of Modern Defence* (New Delhi: Knowledge World, 2006), 187.

⁹⁶ Wiryosumarto, “Indonesia’s Space Activities.”

⁹⁷ Initially receiving Landsat signals, Indonesia added SPOT, ERS-1, and JERS-1 capabilities in the mid-1990s. Moltz, *Asia’s Space Race*, loc 3684; Wiryosumarto, “Indonesia’s Space Activities.”

⁹⁸ “Satellite Early Warning System (Sahadev),” National Institute of Aeronautics and Space of Indonesia (LAPAN), accessed 16 March 2014, www.lapan.go.id.

⁹⁹ John Bowen, “Airline Hubs in Southeast Asia: National Economic Development and Nodal Accessibility,” *Journal of Transport Geography* 8, no. 1 (2000): 26, [http://dx.doi.org/10.1016/S0966-6923\(99\)00030-7](http://dx.doi.org/10.1016/S0966-6923(99)00030-7).

efforts to build the domestic aviation industry. When Suharto and Golkar were overthrown in 1998, IPTN's close connections to President B. J. Habibie and absence of any profits (ever) resulted in its removal from its formerly cozy government embrace. IPTN was forced to privatize as crony networks were broken up during democratization and liberalization, and it was reorganized as PTDI, also known as Indonesian Aerospace (IAe).¹⁰⁰ But old habits die hard, and by 2011, the democratic government had already floated two trillion rupiah (\$234 million) to IAe to keep it solvent.¹⁰¹ Industry Minister Mohommed S. Hidayat reiterated in 2014 plans to develop and protect the local aerospace industry to meet Indonesia's strategic demands.¹⁰² Hidayat also cast this effort as part of a broader "focus on deepening the industrial structure" of Indonesia, including small- and medium-sized businesses, though much emphasis is on high-tech projects that are expected to trickle down through the economy.¹⁰³

Overall, however, government support for IAe has shifted to less direct methods, using LAPAN (which as a state agency faces little pressure to privatize) as a subsidy back door to provide lucrative contracts for IAe and the broader aerospace industry. In a more savory nod to democratic, market-based policies in 2014, the government provided LAPAN with 400 billion rupiah (\$40 million) for R&D on a new joint project with IAe, the N219 aircraft.¹⁰⁴ Part of the democratic government's return on investment for aerospace subsidies is the expectation—shared between the executive and now co-equal legislative branches—that benefits will ripple through the economy into other industries, building national resilience and creating a technological-industrial complex, similar to

¹⁰⁰ "Our History," Indonesian Aerospace, updated 2011, <http://www.indonesian-aerospace.com/aboutus.php?m=aboutus&t=aboutus8>; "Manufacturing in Indonesia: On a Wing and a Prayer," *The Economist*, 15 February 2014, <http://www.economist.com/news/business/21596589-state-aerospace-firm-risks-forgetting-lessons-asian-crisis-wing-and-prayer>.

¹⁰¹ "OSC Analysis: Overview of Indonesia's National Science and Technology Ambitions," *Open Source Center*, April 23, 2014.

¹⁰² "Analysis: Aerospace Industry Will Be Developed and Protected," *AntaraNews*, March 7, 2014, <http://www.antaranews.com/berita/422746/menperin-industri-dirgantara-akan-dikembangkan-dan-dilindungi>.

¹⁰³ "Analysis: Aerospace Industry."

¹⁰⁴ "LAPAN and PTDI Ready to Build Passenger Aircraft," National Institute of Aeronautics and Space of Indonesia (LAPAN), 25 March 2014, www.lapan.go.id; "Analysis: Aerospace Industry."

how NASA operates across dozens of constituencies across all 50 United States.¹⁰⁵ LAPAN has grown to currently operate 16 primary facilities spread over ten locations throughout the archipelago but centered on its Jakarta headquarters.¹⁰⁶ The government imagines each of these as seeds for a new series of techno-industrial clusters, much as IPTN turned Bandung into a hub in Indonesia's growing strategic arms industry.¹⁰⁷ But LAPAN's resurgence is much more than simply as a front organization for IAe; rather, the LAPAN-IAe agenda is part of a broader national economic program launched by President S. B. Yudhoyono targeting 15 strategic industries, including revitalization of the defense industry.¹⁰⁸

As part of this economic plan, LAPAN received more funding and new mandates, including for a new series of increasingly domestically-sourced satellite projects. The *LAPAN-A2* microsatellite, Indonesia's first domestically designed and manufactured satellite, is scheduled to piggyback a ride aboard a foreign booster in 2015.¹⁰⁹ *LAPAN-A2* was conceived in 2008, following a capacity-building program in Germany to transfer procurement, licensing, and testing capabilities to LAPAN engineers that produced the *LAPAN-A1*, launched in 2007.¹¹⁰ *LAPAN-A1* has forwarded basic video data for seven years, allowing domestic operators to train on data retrieval; its now-degrading orbit offers its own lessons.¹¹¹ Indonesia seeks to expand its current capacity to a wider range spanning from telecommunications to forest fire and reef monitoring, and *LAPAN-A2*'s more advanced payload indicates movement in this direction. In addition to a more advanced digital camera, it also carries a test message repeater for the Indonesian

¹⁰⁵ "Analysis: Aerospace Industry."

¹⁰⁶ "Location," National Institute of Aeronautics and Space of Indonesia (LAPAN), accessed 16 March 2014, www.lapan.go.id.

¹⁰⁷ Iwan Santosa, "Bandung, Strategic Industry Center," *Kompas*, November 12, 2014, via *Open Source Center*.

¹⁰⁸ Ibid.

¹⁰⁹ Maulia, "Indonesia's First Satellite."

¹¹⁰ *LAPAN-A1* is also known as *LAPAN-TubSat*. Maulia, "Indonesia's First Satellite."

¹¹¹ Maulia, "Indonesia's First Satellite."

Amateur Radio Organization (Orari) to use in disaster relief and an Automatic Identification System for ships to expand its maritime domain awareness.¹¹²

In all, five satellites are planned in the *LAPAN-A* series as part of Indonesia's satellite development roadmap. *LAPAN-A3* is planned to carry a magnetometer to study solar activities (the first LAPAN project to look beyond Earth) and an agricultural project in partnership with the Bogor Institute of Agriculture.¹¹³ A remote sensing B-series (built upon earlier *LAPSAT-1* and *-2* engineering models¹¹⁴) and a C-series for communications are both scheduled to follow in 2018.¹¹⁵

LAPAN-A2 was more than triple the \$1 million cost of its predecessor; however, the Indonesian People's Representative Council's (DPR) 2013 Space Law more than provided by expanding LAPAN's 2014 budget nearly 60 percent over the 526 billion (\$52 million) rupiah budget of 2013.¹¹⁶ LAPAN's budget had already more than quadrupled in the previous decade, and quintupled since the beginning of the century.¹¹⁷ The new Space Law also mandates further satellite and rocket technology development, bilateral and international cooperation to facilitate greater technology transfer, and development of a new 25-year master plan for building Indonesia's space industry; it also reiterates legal restrictions that space applications be for purely peaceful purposes and regulates space port construction and private sector partnerships.¹¹⁸

LAPAN's primary launch facility for its experimental and sounding rockets is currently its West Java Pameungpeuk launch pad. Indonesia, however, has aspired for some time to capitalize on its equatorial geography by constructing a larger space port to support its own launcher ambitions as well as commercial launches. After eyeing locations in Sumatra and West Papua, Indonesia has recently made moves toward

¹¹² For this reason *LAPAN-A2* is also known as *LAPAN-Orari*. "Satellite LAPAN-A2," National Institute of Aeronautics and Space of Indonesia (LAPAN), November 6, 2013, <http://lapan.go.id>.

¹¹³ Ibid.

¹¹⁴ Noichim, "ASEAN Space Organization," 93.

¹¹⁵ Maulia, "Indonesia's First Satellite."

¹¹⁶ Ibid.

¹¹⁷ Moltz, *Asia's Space Race*, loc 3728.

¹¹⁸ Maulia, "Indonesia's First Satellite."

building the long-awaited spaceport on Morotai Island in the Moluccas. Favored for its low population, Pacific orientation, and equatorial location, Morotai hosted a series of LAPAN rocket launches accompanied by unmanned aerial vehicle (UAV) surveys in December 2013.¹¹⁹ Indonesia's eyeing of Biak, Papua, before settling on Morotai for its proposed spaceport is also partially rooted in desires to spread development—and therefore national stakeholding—to its more restive outer islands.¹²⁰

After decades of development, the rocket program to populate such a facility is still just reaching adolescence; though Indonesia has launched multiple successively-larger RX-250, RX-320, and RX-420 sub-orbital rockets since 1987, the three-stage RX-420 in July 2009 only reached an altitude of around 66 kilometers, well short of the 100 kilometer altitude commonly considered the boundary of space and even further below the energy required for orbit.¹²¹ While LAPAN's rocket program progresses on a variety of rockets, including defense cooperation with the Indonesian National Armed Forces (TNI) on the Rhan series,¹²² the latest LAPAN rocket launched still only had a theoretical range between 100 and 200 kilometers.¹²³

It is in LAPAN's rocketry development that the difference between rhetoric and reality in the Space Law's mandate of peaceful practices is most noticeable, as clearly some gray area exists within the dual-use conundrum. LAPAN's cooperation with the TNI on rocketry includes plans to adapt 122mm rockets for use by the army and navy.¹²⁴ In 2014 LAPAN tested rockets for naval applications and suborbital launches as well as its LSU 03 surveillance UAV for long-endurance missions and airborne remote

¹¹⁹ "LAPAN Eyes Morotai Island for Indonesia Space Launches," *The Jakarta Globe*, December 11, 2013, <http://www.thejakartaglobe.com/news/lapan-eyes-morotai-island-for-indonesia-space-launches/>.

¹²⁰ Ibid.

¹²¹ Moltz, *Asia's Space Race*, loc 3714.

¹²² "Team Rocket Defense Consortium Launches Successful Rhan," National Institute of Aeronautics and Space of Indonesia (LAPAN), 5 March 2014, www.lapan.go.id.

¹²³ Maulia, "Indonesia's First Satellite."

¹²⁴ "LAPAN Strategic Plan: 2010-2014," LAPAN, translation by Google, 1-3, <http://www2.lapan.go.id/page.php?vpag=renstra.htm>.

sensing.¹²⁵ Regarding rocketry, Indonesia specifically cites self-reliance to avoid dependence on raw materials (including propellant) that could face greater restrictions in the future under an expanded Missile Technology Control Regime (MTCR).¹²⁶ LAPAN is not exactly a wolf in sheep's clothing, but it is certainly an incubator for Indonesia's domestically-sourced arms industry. Both LAPAN and IAe are therefore active in Indonesia's shift from constructing support platforms toward increased domestic sourcing of primary weapons systems, including warships, submarines, and assault rifles in addition to LAPAN's short-range rockets, medium-range missiles, and UAVs. Editorials argue such weapons are essential to "keep the peace" and put Indonesia on par with the limited number of nations with such achievements to increase international respect.¹²⁷

LAPAN's rhetoric frequently emphasizes how its technological forays benefit both security and economic modernization. LAPAN's chief frequently reiterates the connection between technological and national independence now enshrined in the 2013 Space Law, citing independent and proprietary national information-gathering assets as a precondition for security.¹²⁸ Other LAPAN dual-use technologies are increasingly integrated into national security. Indonesia's Maritime Security Coordination Agency (Bakorkamla) is integrating LAPAN's radars with other institutional assets into a comprehensive system for safeguarding Indonesian waters.¹²⁹

LAPAN's 2010–2014 Strategic Plan is revealing in its aspirations for socioeconomic development based on competitive advantage, natural and human resources, and cultural mastery of science and technology to improve national security,

¹²⁵ "LAPAN Strategic Plan," 5; "Indonesia: LAPAN tests LSU 03 UAV, Inaugurates Surveillance Aircraft," *Open Source Center Australia*, January 25, 2014.

¹²⁶ Currently, neither space partners China and India nor any Southeast Asian state is a member of the MTCR. "LAPAN Strategic Plan," 5, 19.

¹²⁷ "Editorial on Indonesia's Transition to Self-Reliance in Science, Technology for Defense," from *Jakarta Republika*, August 30, 2015, from *Open Source Center*.

¹²⁸ "Indonesian Satellites Needed to Defend Independence," *AntaraNews*, April 21, 2014.

¹²⁹ "Indonesia: Bakorkamla to Focus on Integrating Radars Operated By Other Institutions," *Koran Jakarta*, January 31, 2013, translated by *Open Source Center*.

justice, democracy, and prosperity.¹³⁰ In it, LAPAN plays a “crucial role” in achieving national progress in ways that also build national unity and uphold religious values.¹³¹ It consistently emphasizes national self-reliance in the field of aerospace technology, in particular the need to strengthen the domestic missile industry, bolster satellite remote sensing for increased mapping of border and post-conflict areas and development of outer islands, and facilitate natural disaster mitigation through increased early warning and emergency response.¹³² It also specifies long-term transformation of younger generations through education in science and technology (S&T), including increased “space mindedness.”¹³³ To that end, LAPAN recently partnered with seven Indonesian universities,¹³⁴ and in 2013 the Indonesian Research Ministry chose aerospace as the theme for its Technology Awakening Day.¹³⁵ Counter to challenges that Indonesia’s aerospace expenditures are made at the expense of more important investments in health and education, Indonesian elites share a general consensus that these expenditures *are* such investments.¹³⁶ National security, economic and educational development, and environmental security are not compartmentalized.

Indonesia’s active space program (and larger aerospace industrial complex) is thus an illustrative example of persistent policies of state development, developing country power aggregation, and building national resilience. These themes will remain

¹³⁰ “LAPAN Strategic Plan: 2010-2014,” LAPAN, translation by Google, 1-3, <http://www2.lapan.go.id/page.php?vpape=renstra.htm>. Another invaluable resource on Indonesia’s national science and technology ambitions is: “OSC Analysis: Overview of Indonesia’s National Science and Technology Ambitions,” *Open Source Center*, April 23, 2014.

¹³¹ Ibid.

¹³² Ibid.

¹³³ Ibid., 5-6, 11.

¹³⁴ The universities are: Padjadjaran University and Telkom University in Bandung, Universitas Gadjah Mada (UGM) in Yogyakarta, Universitas Diponegoro in Semarang, Electronic Engineering Polytechnic Institute of Surabaya (PENS), Surya University in Tangerang, and Nusa Cendana University in Kupang. Notably, all are on Java but the last, which is on Timor. “Universities Partner with LAPAN to Boost Innovation,” *Harian Terbit*, Thursday, May 8, 2014, <http://www.harianterbit.com/read/2014/05/08/1939/22/22/Tingkatkan-Inovasi-Lapan-Gandengn-Perguruan-Tinggi-Indonesia>.

¹³⁵ Goenawan Wybisana, “Indonesian Research Ministry Takes Aerospace as Theme for Technology Awakening Day,” *Antara News*, July 30, 2013.

¹³⁶ “Is Asian Space Science Drive Harming Development?” *SciDevNet*, accessed June 17, 2014, <http://www.scidev.net/global/climate-change/feature/is-asian-space-science-drive-harming-development--2.html>.

important as the discussion extends to other Southeast Asian states. Rather than responding to the shock of a Sputnik moment, Indonesia has demonstrated marked consistency in its desire to leverage aerospace technologies. Indonesia's persistence and respectable investment in space applications has been furthered substantially by the inertia its large size bestows upon it; likewise, its rising aggregate wealth fueled by its abundant natural resources and the twin dynamos of democratization and liberalization has contributed new momentum toward its space ambitions. With the largest domestic market for space applications and a long history of incremental progress, it is likely to remain the regional space player with the most ambitious agenda for a full spectrum space program. But Indonesian efforts in space will continue to be hobbled in the short term by relatively low technical capacity rooted in its modest educational base in a country where over 100 million still live on under \$2 per day.¹³⁷ Many of LAPAN's engineers must still be educated overseas and critics are concerned that throwing money at LAPAN will only go so far without matching investments in human resources.¹³⁸ Indonesia has long chased backward linkages from LAPAN and its aerospace industry into building a stronger technical society: one of the early goals of its telecom satellites was to speed coverage of remote areas by university-level education.¹³⁹ In the future, these twin forces of size and human resources will be the greatest determinants of Indonesia's altitude in space in relation to its regional neighbors, many of whom have made notable achievements themselves.

D. MALAYSIA

Malaysia is one of the most advanced Southeast Asian nations measured by economic size, per capita income, education, infrastructure, and institutions inherited after a peaceful transition to independence from British colonialism. Its bifurcated geography, position astride busy strategic maritime routes, and land- and sea-based natural resources all potentially benefit from space applications. In 2002, it established

¹³⁷ "Poverty headcount ratio at \$2 a day (PPP) (% of population)," World Bank Data, accessed August 21, 2014, <http://data.worldbank.org/indicator/SI.POV.2DAY>.

¹³⁸ Maulia, "Indonesia's First Satellite."

¹³⁹ Wiryosumarto, "Indonesia's Space Activities."

the National Space Agency, called ANGKASA after the Malay word for “space,” within the Ministry of Science, Technology, and Innovation (MOSTI) to better promote peaceful uses of outer space, international cooperation, the advancement of space knowledge, reinforcement of national policies, and “information system support of diversified applications.”¹⁴⁰ ANGKASA’s vision and mission explicitly mention the primacy of development within its agenda, referencing “knowledge generation” for “wealth creation” and “societal well-being” through support for “development of the new economy.”¹⁴¹

Its 2002 formalization merely provided a flagship agency to head ongoing national efforts across a range of space activities. Malaysia has utilized remote sensing for forestry applications since the 1970s, establishing in 1988 a national resource and environmental management program coordinated by the Malaysia Centre for Remote Sensing, now Malaysia Remote Sensing Agency.¹⁴² In 1989, Malaysia established its first government space office, the Planetarium Division, to foster greater scientific educational outreach; this division is indicative of the focus on inspiring youth toward cutting edge industries as a complementary goal to the developmental focus.¹⁴³ The Planetarium Division was absorbed by the Space Science Studies institution (BAKSA) to expand its responsibilities. BAKSA was itself absorbed into ANGKASA in 2004.

Telecommunications and broadcasting have been a huge sector for space applications in Malaysia’s rapidly developing economy. By 1996 Malaysia had contracted to launch *MEASAT-1* and -2 to better domestically support this infrastructure.¹⁴⁴ It then stepped up the space ladder with a training program to learn how to construct its own satellites in an effort to transfer technology toward building a domestic satellite-manufacturing industry, culminating in the *Tiungsat* microsatellite in

¹⁴⁰ Noichim, “ASEAN Space Organization,” 92.

¹⁴¹ “Vision & Mission,” National Space Agency (ANGKASA), accessed March 17, 2014, www.angkasa.gov.my.

¹⁴² “About Us,” Agensi Remote Sensing Malaysia, accessed March 16, 2014, <http://www.remotesensing.gov.my/>; Daphne Burleson, *Space Programs Outside the United States: All Exploration and Research Efforts, Country By Country* (Jefferson, NC: McFarland & Company, 2005), 193.

¹⁴³ “About Us,” National Space Agency (ANGKASA), accessed March 17, 2014, www.angkasa.gov.my.

¹⁴⁴ Both satellites were built by Boeing and launched via Ariane rocket. Noichim, “ASEAN Space Organization,” 86.

2000 that carried a variety of communications and remote sensing capabilities into Low Earth Orbit (LEO).¹⁴⁵ *Tiungsat* was followed by the much larger (and foreign-built) earth imaging satellite *RazakSat*, with a high resolution camera to provide more timely data to “cater to Malaysia’s specific use” after being launched into equatorial orbit on a SpaceX Falcon rocket in 2009; Malaysia sought to fill a niche for equatorial countries underserved by foreign satellites in non-equatorial orbits with higher absentee ratios.¹⁴⁶ Malaysia now has several dedicated satellite technology development facilities at both government agencies and Malaysian universities.¹⁴⁷ Its remote sensing and other space applications are also well tied into the nation’s university system, which is itself a regional leader.¹⁴⁸

MEASAT, or the Malaysia East Asia Satellite, which by its own affirmation facilitated a “rapid increase in Malaysian infrastructure development in both the telecommunications and broadcasting industries,” became fully commercial in 1998 under MEASAT Satellite Systems, which has grown to operate a fleet of five satellites offering services worldwide from its center in Cyberjaya and control center on Pulau Langkawi.¹⁴⁹ Malaysia now also operates over a half dozen meteorological ground stations, while continuing its efforts in space science, educational outreach, and generally building societal infrastructure to support further space endeavors.¹⁵⁰ Aside from its operational success in the industry, Malaysian space competency has been well-represented internationally, particularly by Dr. Mazlan Othman, director of the UN Office for Outer Space Affairs (UNOOSA) between 1999 and 2013, minus a five-year hiatus from 2002 until 2007 to establish ANGKASA as its first director.¹⁵¹ Malaysia also sought to raise its profile in space (useful in creating a market for its commercial space

¹⁴⁵ Danielle Wood and Annalisa Weigel, “Charting the evolution of satellite programs in developing countries—The Space Technology Ladder,” *Space Policy* 28, no. 1 (February 2012), 19, <http://dx.doi.org/10.1016/j.spacepol.2011.11.001>; Burleson, *Space Programs*, 193.

¹⁴⁶ “RazakSat,” National Space Agency (ANGKASA), accessed March 17, 2014, www.angkasa.gov.my.

¹⁴⁷ Noichim, “ASEAN Space Organization,” 94.

¹⁴⁸ Burleson, *Space Programs*, 193.

¹⁴⁹ Moltz, *Asia’s Space Race*, loc 3740.

¹⁵⁰ Noichim, “ASEAN Space Organization,” 86.

¹⁵¹ Moltz, *Asia’s Space Race*, loc 3771.

aspirations) and further promote public support for space investments through its first *angkasawan* (astronaut) program; as part of a defense acquisition from Russia, a Malaysian orthopedic surgeon, Dr. Sheikh Muszaphar Shukor, was trained and flown to the *International Space Station (ISS)* for ten days in 2007.¹⁵²

Within the region, Malaysia's economic and international leadership translate into a high degree of space aptitude relative to its neighbors. Like other Southeast Asian space programs, it devotes its space applications toward a peaceful development agenda, albeit with a highly market-based, commercialized, and internationalized application of its space activities toward broader socioeconomic development.

E. THAILAND

Thailand has Southeast Asia's second-largest economy and also one of its most sophisticated. Though strongly influenced by the region's former colonial powers, it maintained titular independence throughout that period and has since sustained its historic leadership role within the region. Having benefitted substantially from American investment during the Cold War and Vietnam conflict, Thailand has leveraged its central geographical position toward establishing itself as a regional hub for commerce and international political discourse; this national strategy guides its investments in space. Thailand's space activities have centered mostly on natural resource management and its now-experienced use of space data that positions it as a regional space services provider.¹⁵³

Thailand has been utilizing remote sensing from NASA's *ERTS-I/Landsat* since 1971 through the Thailand Remote Sensing Programme and later under the National Research Council of Thailand.¹⁵⁴ The initialization of Thailand's Ground Receiving Station at Lad Krabang, Bangkok, in 1982 marked a regional first, establishing Thailand early as a regional distribution hub for Landsat, SPOT, NOAA, ERS, and MOS satellite

¹⁵² Ibid.

¹⁵³ Ibid., loc 4059.

¹⁵⁴ "Profile," Geo-Informatics and Space Technology Development Agency (GISTDA), accessed March 16, 2014, www.gistda.or.th.

data.¹⁵⁵ Thailand's first of six commercial *Thaicom* geostationary communications satellites was launched in 1993 under a "30-year Domestic Communications Satellite Operating Agreement" established in 1991 by the then Ministry of Transport and Communications. The venture was dubbed "Thaicom" by the king himself "as a symbol of the linkage between Thailand and modern communications technology."¹⁵⁶ Thaicom's lease and operations were originally operated by the Shinawatra Satellite Company, founded and owned by later Prime Minister Thaksin Shinawatra; conflicts of interest and controversy regarding the sale of the family's shares to a Singaporean company and coincident amendments to Thai telecommunications regulations brought Thaicom into the midst of protests and the subsequent coup that resulted in Shinawatra's ouster and exile in 2006.¹⁵⁷ Thaicom was again caught in the middle of domestic turbulence when the government compelled it to resort to electronic jamming to block broadcasts from the anti-government People Channel Television (PCT) company in 2010.¹⁵⁸ Thaksin's sister, Yingluck Shinawatra, was subsequently deposed as prime minister by a 2014 coup.

After a series of reorganizations, the public Geo-Informatics and Space Technology Development Agency (GISTDA) was formed under the now Ministry of Science and Technology in 2000 to assume "all responsibilities and activities for space technology and geo-informatics applications."¹⁵⁹ Since 2008, Thailand has operated the *Thailand Remote Observation Satellite (THEOS)* from its THEOS Control and Receiving Station in Sriracha, Chonburi.¹⁶⁰ Similar to the Indonesian *Palapa* series, *THEOS* was also named *Thaichote* by the Thai king, "signifying the glory of Thailand."¹⁶¹ Thailand has aggressively sought to maintain its regional leadership in space services by

¹⁵⁵ Ibid.; Burleson, *Space Programs*, 300.

¹⁵⁶ The contract has since been transferred to the Ministry of Information and Communication Technology (MICT). The latest launch was in January 2014 aboard Falcon 9; the three earliest satellites have since been deorbited. "Company Profile," Thaicom Public Company Limited, accessed March 16, 2014, www.thaicom.net.

¹⁵⁷ Burleson, *Space Programs*, 299-300.

¹⁵⁸ Moltz, *Asia's Space Race*, loc 4103.

¹⁵⁹ "Profile," GISTDA.

¹⁶⁰ Ibid.

¹⁶¹ Ibid.

thickening training pipelines for its space industry, leveraging both international cooperation and domestic cooperation between GISTDA and domestic universities.¹⁶² The European contract for *THEOS* also included training for Thai scientists and engineers which could be leveraged toward future projects.¹⁶³ A similar technology transfer program in the United Kingdom in which 12 Thai engineers from Mahanikorn University in Bangkok participated culminated in the launch of *Thai-Paht*, Thailand's first microsatellite, which carried earth observation and store-and-forward communications payloads.¹⁶⁴ These projects helped develop programs within multiple Thai educational institutions that now feed its space sector.

Thailand established an early lead as a hub for regional space services; its space strategy has consistently sought to exploit and reinforce this role within the regional space community. It has approached this policy from multiple angles, including expanding data hub services through a "worldwide network of distributors" and maintaining an active role in space law.¹⁶⁵ Aside from its geocentric name, GISTDA's earthbound focus on space data market and international networking is indicated by its lack of participation in prestige projects such as manned spaceflight.¹⁶⁶ Domestic awareness of space activities is high for the region, providing the sort of cultural inertia that could prove valuable to the nation in future space ambitions. Recurring political turmoil, however, continues to dampen growth in an otherwise regional standout; periodic government legitimacy crises undoubtedly do little to forward consistent investments in space strategy. Finding a middle ground between its entrenched political factions could give a strong boost to an otherwise central regional space program before things fall apart.

¹⁶² Moltz, *Asia's Space Race*, loc 4103.

¹⁶³ Ibid., loc 4088.

¹⁶⁴ "Thai-Paht," Surrey Satellite Technology Limited, accessed March 16, 2014, <http://www.sstl.co.uk/Missions/Thai-Paht--Launched-1998/Thai-Paht/Thai-Paht--TMSat---The-Mission>; Noichim, "ASEAN Space Organization," 110.

¹⁶⁵ "Profile," GISTDA.

¹⁶⁶ So far the leading contender to be the first Thai into space is a GISTDA engineer who won a spot on a commercial suborbital flight promised for 2015 through the international "Axe Apollo Project" marketing competition. "The Final Frontier," *Bangkok Post*, March 18, 2014, <http://www.bangkokpost.com/lifestyle/interview/395785/the-final-frontier>.

F. VIETNAM

Vietnam has been a Thai rival for influence in mainland Southeast Asia for several centuries. Its communist government presided over a half-century of regional conflict until the end of the Cold War, as Vietnam became a battleground of post-colonial French, American, Soviet, and Chinese spheres of influence. The end of the Cold War was followed by a period of steady economic growth and incrementally-increasing openness, as Vietnam sought to reestablish its historic role as a regional cultural and economic power. Indeed, Vietnam's GDP increased 700 percent between 1985 and 2010, with a corresponding poverty rate reduction from 60 percent to 10.6 percent, uplifting it to lower middle income status.¹⁶⁷ Seeking to leverage development toward regional ends and also toward domestic political legitimacy, the party government has pursued a space policy that focuses primarily on economic growth and security with some prestige projects to bolster its agenda.

Vietnam put the first Southeast Asian in space in 1980 through its strategic partnership with the Soviet Union, when cosmonaut-researcher Pham Tuan rode a Soyuz to the *Salyut* station as part of the Soviet *Interkosmos* program.¹⁶⁸ Aside from this highlight—largely a project of Cold War prestige politicking—*Vietnam's* space program, established that same year as the National Committee for Space Research and Application of Vietnam, made little progress.¹⁶⁹ That committee's mandate to direct space research and mobilization of technological resources toward economic development demonstrated few noteworthy results until Vietnam's loss of its Soviet patron in the 1990s forced the country to align its policies toward greater reform and opening. In 2006, the Vietnamese government established the Space Technology Institute (STI) within the Vietnam Academy of Science and Technology (VAST) with a broader mandate encompassing a range of earth-based space applications with particular emphasis on climbing the space ladder through technology transfer and increasingly

¹⁶⁷ Le Hong Hiep, "Vietnam's Strategic Trajectory: From Internal Development to External Engagement," *ASPI Strategic Insights*, no. 59 (2012): 3.

¹⁶⁸ Noichim, "ASEAN Space Organization," 116.

¹⁶⁹ *Ibid.*, 113.

independent projects.¹⁷⁰ VAST is also tasked with building a domestic space industrial base by cooperating with universities on postgraduate education and the public on popularization of space science and technology.¹⁷¹

VAST operates at least two receivers for remote sensing data from foreign satellites in addition to newer receivers for its first geostationary communications satellite, *Vinasat-1*, launched by foreign booster at a cost of \$180 million to end Vietnam's \$15 million per year reliance on satellite services from regional rival Thailand.¹⁷² *Vinasat-2* followed in 2012, focusing on remote area communications for a larger regional audience. Both *Vinasats* are also touted by domestic scientists as symbols of Vietnam's newly-elevated international image and improved economic performance.¹⁷³ Vietnam also began operating its first earth observation satellite, the Vietnam National Resources, Environment, and Disaster Monitoring Satellite System (*VNREDSat-1*), in 2013 in a hedge to mitigate losses to the Vietnamese economy from natural disasters and environmental degradation. A follow-up, *VNREDSat-1b* is scheduled for 2017 to augment the program's capabilities. *VNREDSat*'s disaster management applications point to space investments as a response to increasing questions of regime legitimacy following communism's post-Cold War retrenchment. The Vietnamese regime clearly recalls the string of natural disasters that combined with economic chaos and international challenges in the 1980s to threaten regime legitimacy post-reunification.¹⁷⁴

Vietnam's plans to continuously upgrade GPS applications to facilitate coastal construction projects and maritime management play an important role in multiple aspects of national development in this long, littoral nation with its rugged highlands. Its installation of GPS receivers on thousands of fishing vessels for weather and rescue

¹⁷⁰ "Vietnam Space Technology Institute," Vietnam Academy of Science and Technology (VAST), accessed March 16, 2014, <http://www.sti.vast.ac.vn/>.

¹⁷¹ Ibid.

¹⁷² Moltz, *Asia's Space Race*, loc 4129.

¹⁷³ Ibid.

¹⁷⁴ Kim Ninh, "Vietnam: Struggle and Cooperation," in *Asian Security Practice: Material and Ideational Influences*, edited by Muthiah Alagappa (Stanford: Stanford University Press, 1998), 452.

applications also has security implications by facilitating domain awareness through potential registration requirements in Vietnam's contested offshore waters.¹⁷⁵ VAST's 2030 vision includes completion of the Vietnam National Satellite Center (VNSC) at Hoa Lac Hi-Tech Park, now scheduled for 2020.¹⁷⁶ The center is expected to serve as a "launching pad" for a series of larger, increasingly independent satellite projects of the Dragon and Lotus series.

Despite this ambitious investment, Vietnam is aware of several hurdles it faces, including lack of a qualified labor force. Though literate by regional standards and despite earlier efforts to build a technical base, higher technical education is still lacking in Vietnam and qualified space engineers must generally acquire their expertise abroad; the satellite center is seeking to mitigate this deficiency by increasingly training its own personnel. Vietnam hopes the satellite park will allow the country to claim regional leadership in space over Indonesia and Malaysia, which it considers to be the current leaders.¹⁷⁷ These substantial investments, backed by state loans from abroad, are likely to combine with the increasing inertia of Vietnam's economy in general to produce a powerful vector toward a greater role in space for Vietnam.

G. SINGAPORE

Maritime city-state Singapore is truly a "mer-lion" of regional space activities: a relatively recent state-commercial partnership nonetheless leverages its unique capabilities to make a noticeable splash in the local space scene. Singapore's citizenry is among the world's wealthiest and best-educated, and the state-led development model followed by the dominant Lee family's People's Action Party (PAP) has led to close ties between commercial, civil, and military programs and R&D.

Singapore has one of the world's leading telecommunications infrastructures, facilitating its role as a regional—and global—services hub. State-run Singtel dominates

¹⁷⁵ Moltz, *Asia's Space Race*, loc 4129.

¹⁷⁶ "About VAST," Vietnam Academy of Science and Technology," accessed March 16, 2014, <http://www.vast.ac.vn/en/>.

¹⁷⁷ Tia Sang, "Vietnam Dreams of Vietnam Aerospace Center," News VietNamNet, February 27, 2014, <http://english.vietnamnet.vn/fms/science-it/96447/vietnam-dreams-of-the-vietnam-aerospace-center.html>.

this industry, as the country operates two satellite ground stations at Bukit Timah and Sentosa Island.¹⁷⁸ National University of Singapore's Centre for Remote Imaging, Sensing, and Processing is a well-known space service provider; its unique "multi-mission ground station built around the open system concept" is a leader in flexible architecture to facilitate scalable capabilities.¹⁷⁹ It currently receives remote sensing data from a wide range of foreign providers for redistribution and conducts sophisticated research in a wide range of space applications, including ocean and coastal studies, environmental monitoring, and Synthetic Aperture Radar data monitoring.¹⁸⁰ Meanwhile, Nanyang Technological University's Satellite Research Centre coordinated with the Defence Science Organization's National Laboratories to domestically design and build an earth observation and communications satellite, *X-SAT*, launched aboard foreign booster in 2011.¹⁸¹ *X-SAT* has since been followed by a second satellite, *VELOX-PH*, launched by Russia in late 2013.¹⁸²

Unlike other Southeast Asian states, Singapore's strong PAP government has less incentive to rely on its space program as a flagship program of national prestige to build legitimacy. Likewise, the heavy commercial-academic role suggests Singapore's space program is an outgrowth of Singapore's economic wealth and human capital, rather than an intended driver thereof as elsewhere in the region. Nonetheless, its government will likely continue to support such investments as it seeks to build and maintain its competitive advantage in the region. The city-state's military is well-trained and equipped and plays an active role in international security cooperation, so that further defense support for R&D and space technology applications are likely in the future. Singapore's deep pockets, well-established technical expertise backed by a well-educated society, and close ties among its defense, commercial, and civil sectors within its PAP-dominated system means that Singapore easily adds space applications to its list of

¹⁷⁸ Noichim, "ASEAN Space Organization," 103.

¹⁷⁹ "CRISP," National University of Singapore, accessed March 16, 2014, <http://www.crisp.nus.edu.sg>.

¹⁸⁰ Ibid.

¹⁸¹ Moltz, *Asia's Space Race*, loc 3977.

¹⁸² "Satellite Research Centre (SaRC)," Nanyang Technological University, accessed March 17, 2013, <http://www.sarc.eee.ntu.edu.sg/Pages/Home.aspx>.

regional leads despite its late entry. Its geo-economical centricity, manifesting itself through the added dimension of space applications, is likely to reinforce its role as a regional leader and hub well into the future.

H. THE PHILIPPINES

The Philippines is the second-most populous Southeast Asian nation, and as another diverse archipelagic nation it shares with Indonesia similar motivations to pursue space applications for national unity, development, and governance. It also shares similar limitations regarding human capital and a developmental level within the lower-middle income bracket. As a former U.S. colony with close ties to the United States, its experiences and incentives toward developing domestic space technologies differ slightly from other Southeast Asian nations.

The Philippines does not have a formalized space agency to coordinate its space activities, although it has had the Science and Technology Coordinating Council Committee on Space Technology Applications (STCC-COSTA) since 1995. As the lead organization for space affairs it has filled the coordination gap between various government agencies and the private sector on a number of research and space technology applications.¹⁸³ Though applications of space technology permeate Philippine society as much as other regional players, their primary focus has been on remote sensing, astronomical and atmospheric services, and communications via commercial provider.¹⁸⁴ To meet these ends the Philippines operates the National Mapping and Resource Information Authority (NAMRIA) to coordinate with foreign governments for some satellite remote sensing and to conduct coastal surveys.¹⁸⁵ The astronomical and atmospheric services have been coordinated by PAGASA, the Philippine Atmospheric, Geophysical, and Astronomical Services Administration, under the Department of Science and Technology since 1972. Concerned primarily with promoting economic security through meteorology services and natural disaster early warning and mitigation,

¹⁸³ Burleson, *Space Programs*, 214.

¹⁸⁴ Noichim, "ASEAN Space Organization," 98.

¹⁸⁵ *Ibid.*, 99.

PAGASA grew out of the Philippine Meteorological Service that was centered on the Manila Observatory, which itself dates back to 1865 and Spanish colonialism.¹⁸⁶ Meanwhile, the large Philippines telecommunications market—and a wider regional audience—have been serviced by foreign-built satellites purchased through the Mabuhay Satellite Corporation.¹⁸⁷

While most Filipinos do not consider their country “behind” the region in space due to these disaggregated but adequate efforts, some have argued that a single national space agency could better provide a more streamlined, coordinated national agenda and begin expanding the underwhelming domestic space community.¹⁸⁸ Arguments to formalize a national space strategy and acquire national satellite assets have been steadily accumulating louder national security overtones. Events in the South China Sea over the last decade have underlined critical underinvestment in its navy, air force, and domain awareness capabilities and the routing of its national election results through Singapore by the Philippines’ Singtel provider highlighted additional embarrassing vulnerabilities.¹⁸⁹ Despite a few vocal proponents, however, the Philippine Space Act of 2012, on file with the national House since its namesake year, has made little headway in paving the way for a national space agency.¹⁹⁰

Much as in the realm of military modernization, the Philippines, despite its size and archipelagic geography, is still playing catchup in the national space sector. Both may be results of its protection under the U.S. defense umbrella for so long, which provided it with less incentive to invest in building domestic capabilities than others in the region with a postcolonial history of having to fend for themselves. On the other

¹⁸⁶ “About Us,” Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA), accessed March 18, 2014, <http://www.pagasa.dost.gov.ph>.

¹⁸⁷ Moltz, *Asia’s Space Race*, loc 3960.

¹⁸⁸ K.D. Suarez, “Is PH Ready for Liftoff?” *Rappler*, February 28, 2013, <http://www.rappler.com/science-nature/22745-is-ph-ready-for-liftoff>; “View from the Outside: Developing a Filipino Space Program,” NASA, November 29, 2012, <http://www.nasa.gov/offices/oce/divisions/appel/>.

¹⁸⁹ “Reaching for the Stars: Why the Philippines Needs a Space Program,” *GMA News Online*, October 15, 2013, <http://ph.news.yahoo.com/reaching-stars-why-philippines-needs-space-program-114457573.html>.

¹⁹⁰ “HB 6725 Philippine Space Act of 2012,” accessed March 16, 2013, <http://agham.org.ph/house-bill-6725-philippine-space-act-2012/>.

hand, perhaps the Philippines' devolved management of space applications husbands scarce resources by reducing duplication of efforts and its deferment to commercial space service providers will be well adapted to a future of increased space commercialization.

I. MYANMAR

Despite being one of Southeast Asia's larger and more populous countries, Myanmar is one of the region's least-developed countries (LDC) due to decades of autarkic military autocracy. But its recent re-opening to the West and tepid reforms may gather momentum, and there is substantial optimism regarding Myanmar's potential for future market growth and as a source of resources. Though a long way away, shortly after Myanmar's opening a Japanese company began conducting a feasibility study for a satellite to be used by the meteorology and hydrology department of Myanmar's transport ministry.¹⁹¹ The resource-rich country's size presents potential as a growing market for remote sensing, satellite communications, and meteorology. Its politically powerful military, the Tatmadaw, seeking a force multiplier for defense and internal governance, may develop designs in the space sector as well. To that end, Myanmar is reported to have recently set up a five-member committee to oversee satellite development.¹⁹²

J. LAOS

The communist government of the Lao People's Democratic Republic (PDR) presides over one of the region's other LDCs that has often been dominated by the affairs of its larger neighbors. It coordinates its modest space activities through its Department of Space Technology (DST), established in 2008 under the National Authority for Science and Technology (NAST). DST's ambitions are modest; nonetheless, that Laos even operates the DST is a significant development considering its technical and resource base. Its proffered interest is in using space to develop human resources, international

¹⁹¹ "Myanmar Mulling Satellite Launch: Japan Company," *Phys.org*, September 13, 2012, <http://phys.org/news/2012-09-myanmar-mulling-satellite-japan-company.html>.

¹⁹² "Myanmar, Japan to Hold Workshop on Satellite Launching," Xinhua, September 13, 2012, <http://english.peopledaily.com.cn/203691/7940218.html>.

cooperation, and remote sensing utilization, among other projects.¹⁹³ Its first satellite, *Laosat-1*, and an accompanying ground station are currently scheduled to begin operations in mid-2015.¹⁹⁴

K. CAMBODIA

Cambodia, in a race from the bottom with Myanmar, can scarcely afford to meet the threshold for space activities. Its still-recent legacy of Khmer Rouge purges—especially of anything or anyone remotely intellectual—has left a long road to recovery. Aside from attendance at a handful of regional developmental conferences including space applications on the agenda, any interest it has shown toward space applications has been completely reliant on foreign sponsorship. Even in this shell-shocked country, however, awareness of a future in space shines through, with the torch currently carried by a few local rocket clubs.

L. BRUNEI

The small but wealthy petro-sultanate of Brunei meets its space needs through Intelsat earth stations, providing meteorological information to its citizens through foreign contract via the Brunei Meteorological Service (BMS), Department of Civil Aviation (DCA), and Ministry of Communications.¹⁹⁵

M. CONCLUSION

Within Southeast Asia's emerging space programs, there is no natural leader, though several nations contend for that status. Sheer economic size does not overcome shortcomings in human capital; on the other hand, large countries with strong geographic, political, and economic incentives to utilize space can pace the efforts of wealthier

¹⁹³ Singthong Khamone, "The Current Status of Space Technology Activities in LAO PDR," Presentation at APRSAF-18 Communication Satellite Application Working Group, December 7, 2011, http://www.aprsaf.org/data/aprsaf18_data/csa/15_APRSAF-18%20Lao%20PDR%20Country%20Report.pdf.

¹⁹⁴ "LaoSat-1 Program," China Great Wall Industry Corporation," accessed March 16, 2014, <http://www.cgwic.com/In-OrbitDelivery/CommunicationsSatellite/Program/Laos.html>; "LaoSat-1 To Be Launched in Mid-2015," *Satlaunch.net*, accessed February 20, 2014, <http://www.satlaunch.net/2013/06/laosat-1-to-be-launched-in-mid-2015.html>.

¹⁹⁵ Noichim, "ASEAN Space Organization," 77.

counterparts by leveraging their larger aggregate resource bases. While there is clearly a lower-tier of regional space actors, there is also an active cadre of notable regional space actors: Indonesia, Malaysia, Thailand, Singapore, Vietnam, and even the Philippines each demonstrate some areas in which they have a comparative advantage.

With the exception of Indonesia eventually developing independent launch capability, each of the leading nations is likely to work to protect its own rice bowl while seeking to reduce its reliance on others in other sectors of the space economy. Purely prestige projects such as paying for manned spaceflight are likely to remain one-shot national adventures in the near future, as nations focus on their developmental agendas and ulterior security motives. So, while competition exists among the region's space programs, such space nationalism is primarily at the economic development and market services levels; prestige projects play in as a sort of advertisement for a nation's space prowess for both national and international space consumers. While nationalist security dimensions still maintain steady undertones, particularly within the realms of maritime domain awareness and rocketry, insofar as any regional "space race" remains primarily restricted to economic applications, it could remain a positive-sum game by spurring investment in space as an economic multiplier and by building national capacity across a broader range of interconnected sectors (particularly education).

None of these nations reached their current position on the space ladder by themselves, but reaped the benefits of technological diffusion from a wide range of foreign relationships. Despite vast leaps in regional capacities for space applications since the dawn of the space age, the pace of future development is still highly dependent on external forces. Now that the individual national trajectories have been described, further refinement of their current position and future projections must take into account this wide range of external influences on the region's designs in space.

III. EXTRA-REGIONAL COOPERATION AND FOREIGN POLICY IN SOUTHEAST ASIAN SPACE PROGRAMS

A. INTRODUCTION

In an essentially anarchic world where the big powers [have] the capability to define the international system for the smaller states and [are] much more willing to come to terms among themselves than be guided by notions of equality and fair play, small states... [have] to do all they could to ensure their own survival, from diplomacy to balancing.¹⁹⁶

Chapter II outlined Southeast Asian space developments to date, with an emphasis on the basic conditions from which they arose. This chapter explains how domestic politics interact with geopolitics to influence states' cooperative relationships with extra-regional space powers. One could cite Southeast Asia's rapidly increasing wealth and corresponding rise of a middle class with demands for higher standards of living that space technologies facilitate as a means to the developments outlined in chapter II, but these means do not sufficiently explain the motives.¹⁹⁷ Nor is the cycle of technological diffusion referenced in Chapter I an inevitable progression. Rather, governments must each make a deliberate choice to invest in space technologies based on some expected return on investment. While Chapter II explained domestic motivations to access space, responses to external factors can likewise incentivize such investments. Though Southeast Asian states have different developmental levels and government types, they share similarities in the way their domestic politics interact with geopolitics to motivate development of their space programs as perceived tools of internal balancing to facilitate freedom of action and regime legitimacy.

Due to the advanced technologies and expenditures involved, developing countries must cooperate with advanced space powers if they expect a reasonable return on investment. Meanwhile, how governments justify the large domestic expense inherent in any space activity ensures that foreign policies with extra-regional space powers are

¹⁹⁶ Kim Ninh, "Vietnam: Struggle and Cooperation," in *Asian Security Practice: Material and Ideational Influences*, edited by Muthiah Alagappa (Stanford: Stanford University Press, 1998), 448.

¹⁹⁷ "March of the Middle Class," *The Economist*, May 27, 2014, <http://www.economist.com/blogs/graphicdetail/2014/05/daily-chart-16>.

firmly rooted in local politics. Despite efforts to romanticize mankind's journey toward the final frontier, many "of the policies that have driven modern space programs have emanated from a much more complex yet primordial impulse—the improvement and even the survival of the state."¹⁹⁸ The advanced space powers themselves (the United States, Russia, Japan, China, India, and Europe) have their own motives to cooperate with Southeast Asian states in space as outreach to extend "soft power" or create new markets by locking users into proprietary technological systems.¹⁹⁹ They also face unique constraints, such as the MTCR that limits the international transfer of rocket technologies or the United States' current regulation of all satellite components as munitions under its International Traffic in Arms Regulations (ITAR) regime.²⁰⁰ Understanding how a region of states jealously protective of their postcolonial independence manages cooperation with great powers on sensitive technological issues is a useful geopolitical concept.

Before examining individual state cases, it is worth noting some shared philosophical principles in Southeast Asian social and state psyches that argue technologically deterministic, structural explanations for space development. In Southeast Asia as elsewhere, chosen technological paths seem to "embody humanity's choice of its future."²⁰¹ After the region's states chose independence following World War II and sought to increase their capacity for independent action through economic growth and integration following the Cold War, they have almost uniformly created government bureaucracies to independently leverage space applications, especially remote sensing. This structural convergence—a characteristic of technological determinism—can

¹⁹⁸ Such assertions date back to the origins of the first space programs, in which a space race was launched amid fears of *Sputnik* moments and "Red Moons." Despite substantial contemporary space cooperation, continued space race and space control rhetoric worldwide suggests that, at the very least, funding is still likely correlated to such perceptions. While smaller countries' state programs have not exclusively originated in national defense industries in the same way as mankind's first national programs, the broader conception of national security discussed in the introduction will be expanded in this chapter. Harding, *Space Policy in Developing Countries*, ix.

¹⁹⁹ Rob Chambers, "China's Space Program: A New Tool for PRC 'Soft Power' in International Relations?" (Master's thesis, Naval Postgraduate School, 2009).

²⁰⁰ Though new rules will soon take effect in the United States after over a decade of restrictions, institutional memory of the arbitrary ability of great powers to shut off access to advanced technologies will likely persist. Developing states are therefore likely to continue seeking enhanced domestic capabilities and diversified external supply chains to ensure uninterrupted access to the benefits of space technologies in the future.

²⁰¹ Marx and Smith, "Introduction," xiv.

therefore be seen to influence individualistic space nationalism, as regimes seek to build national and regional “resilience” to protect the national resources states had wrested away from colonial powers.²⁰² For Southeast Asian states, space is an opportunity to “exploit cosmic resources” that augment power—it is an increasingly indispensable “force multiplier” for terrestrial capabilities.”²⁰³ Just as resilience expanded regionally once states realized that individual resilience could not be achieved through autarky, they also recognized that attempts at convergence with the great powers could not be achieved without technology and capital transfers from the great powers themselves. Technological determinism’s structuralism and domestic space nationalism, then, provide insufficient explanation regarding Southeast Asian states’ behavior towards space; rather, Southeast Asian space policies are also rooted in global institutionalism and constructivist social interactionism, as the international, regional, and domestic levels of analysis mutually interact.

B. INDONESIA

Indonesia’s extra-regional space cooperation, like all its foreign policy, is determined by its geography; its relative security from external threats subordinates foreign policy to domestic considerations.²⁰⁴ Furthermore, these domestic priorities ensure that Indonesian “security is not primarily regarded as a solely...military problem; rather, it is seen as a political, economic, and social concern connected to nation- and state-building.”²⁰⁵ One contemporary challenge for a democratized Indonesia is rebalancing this domestically-driven foreign policy with more “active” engagement.²⁰⁶ Indonesia’s space program provides an excellent case study of the balancing act between

²⁰² Dewi Fortuna Anwar, “Indonesia: Domestic Priorities Define National Security,” in *Asian Security Practice: Material and Ideational Influences*, ed. by Muthiah Alagappa (Stanford: Stanford University Press, 1998), 489.

²⁰³ Allan Rosas, “The Militarization of Space and International Law,” *Journal of Peace Research* 20 (1983), quoted in Michael Sheehan, *The International Politics of Space* (London: Routledge, 2007), 18.

²⁰⁴ Anwar, “Indonesia: Domestic Priorities,” 478.

²⁰⁵ *Ibid.*

²⁰⁶ Rizal Sukma, “The Evolution of Indonesia’s Foreign Policy: An Indonesian View,” *Asian Survey* 35, no. 3 (1995), 305.

²⁰⁶ *Ibid.*

its foreign and domestic agendas, including the persistence of state-supported developmental policies amidst democratization.

LAPAN's growing budget in the 21st century in a nation already among the regional leaders in space technology has roots spread across the archipelago. Unlike military modernization, space technologies in Indonesia, where an "all-embracing" concept of "national resilience" includes "national identity, national economy, and society as well as military capability," are commonly viewed as both guns and butter.²⁰⁷ LAPAN, which operates across a broad range of constituencies, likely stands to benefit from pork politics more than ever in a democratized Indonesia proliferating with political promises. Though not quite a continuation of Sukarno's autarkic *berdikari* policies, state-subsidized, patronage-driven industrial development policies are alive well after Suharto's New Order.²⁰⁸

Economic recovery and resilience since 1997, culminating in G-20 membership, has improved Indonesia's international image and self-confidence, while its transition to democracy has validated the balance of internal forces in a way that allows it to pursue the "independent and active" policy it long sought but could not achieve under authoritarian rule.²⁰⁹ LAPAN, therefore, represents a dimension of self-strengthening, internal balancing by Indonesia, which increasingly seeks to engage the great powers as an equal while leveraging its demographics as the world's largest Muslim country and third-largest democracy toward a moderating position between Western and Islamic civilizations.²¹⁰ Elements of national prestige, then, play an increased role in Indonesia's use of LAPAN as an agent for international cooperation. Finally, the military dimensions of Indonesia's aerospace program cannot be ignored, as it seeks cooperative endeavors to build domestic capabilities in military industries. While Indonesia's new Space Law reasserts LAPAN's purely peaceful role, it apparently does not preclude it from cooperating with the TNI or foreign countries on endeavors with obvious military

²⁰⁷ Anwar, "Indonesia: Domestic Priorities," 485.

²⁰⁸ Ibid.

²⁰⁹ Ibid., 313.

²¹⁰ Ibid., 132.

applications. Motivations of great power convergence drive such behavior, as Indonesia's aspirations to better control its archipelagic territories and vast maritime domain are viewed as prerequisites for equal treatment. Space technologies, therefore, fulfill an economic, security, and political niche across a foreign to domestic spectrum.

Indonesia's early efforts to build a domestic space architecture began with cooperation with the Netherlands on the *Tropical Earth Resources Technology Satellite*; cooperation with its former colonial master reveals both the legacy of imperial ties and the importance Indonesia placed on space technologies.²¹¹ Alternatively, Indonesia's early cooperation with the United States reflects the early U.S. lead in the international satellite market and that Indonesia, while still non-aligned under Suharto's New Order, had grown closer to the Western orbit than the Soviet one. *Palapa A-1, B-1, B-2, and B-3* were launched by the United States after being purchased through commercial contract from U.S. companies such as Boeing and Hughes.²¹² The *Palapa* telecommunications series was coupled with deals for construction of the accompanying control and receiving stations and an additional contract to receive remote sensing Landsat signals; the receivers' capabilities were broadened by the mid-1990s to include French SPOT and European *ERS-I* capabilities in a bid to diversify Indonesia's remote sensing sources.²¹³ The United States' offer to fly an Indonesian astronaut, though aborted, was the last such offer that Indonesia accepted.²¹⁴

From the beginning, Indonesia sought diversification of its space industry's supply chain. Prior to 1989, China had approached the Indonesian government with an offer to help build an \$800 million commercial launch pad on Gag Island in cooperation with Singapore.²¹⁵ The project never materialized, as Indonesia's aspirations to develop

²¹¹ Mayerchak, "Asia in Space," 97.

²¹² Ibid.

²¹³ James Clay Moltz, *Asia's Space Race: National Motivations, Regional Rivalries, and International Risks* (New York: Columbia University Press, 2012), Kindle edition, loc. 3684; H. Wiryosumarto, "Indonesia's Space Activities," *Proceedings of the Euro-Asia Space Week on Cooperation in Space—'Where East & West Finally Meet,' 23-27 November 1998*, (European Space Agency, 1999).

²¹⁴ Mayerchak, "Asia in Space," 97.

²¹⁵ Ibid.

its own launch capability would have been undermined by a joint venture and relations with China were only normalized in 1989 following a 22-year hiatus after Indonesia blamed China for backing the abortive communist coups of the 1960s. But for Indonesia to even entertain such a prospect with China in the 1980s “suggests a high degree of commitment to developing a space program.”²¹⁶

Indonesia’s approach to space cooperation in the 21st century has been increasingly balanced with a renewed push for building domestic capabilities. Editorials in the *Jakarta Globe* lay out the argument that reliance on foreign providers today is simply a stepping stone to self-reliance in the near future: the space program’s expense in a country with millions below the poverty line and crumbling infrastructure is secondary to the “encouraging” symbolic successes that demonstrate what Indonesia is capable of “given the right policies and capital.”²¹⁷ Such proclamations also reflect the belief, common to most Southeast Asian states, that space architecture *is* infrastructure—an indispensable economic multiplier for a competitive modern economy. The 21st century *LAPAN-A* series beginning with *TubSat* is representative, as its commercial-academic cooperative technology transfer (with Germany) facilitated domestic construction of the subsequent satellites in the series.

Indonesia also leverages its broad geography by hosting a telemetry station for the Indian Space Research Organization (ISRO).²¹⁸ It further diversified its suppliers when PT Telekomunikasi deviated from U.S. commercial providers in favor of a joint contract with Russia’s Reshnetev and French-Italian Thales Alenia Space consortium for its *Telekom-3* satellite.²¹⁹ Moltz notes the impact of U.S. ITAR restrictions on influencing such changes in the developing world’s satellite market: in 2009 Indonesia opted for Thales Alenia’s more costly bid for its *Palapa-D* satellite because it could be launched on

²¹⁶ Ibid.

²¹⁷ “Editorial: Indonesia’s Entry into Space Race,” *Jakarta Globe*, January 7, 2014, <http://www.thejakartaglobe.com/news/jakarta/joko-introduces-30-new-transjakarta-buses/>.

²¹⁸ Moltz, *Asia’s Space Race*, loc. 3699.

²¹⁹ Ibid.

a cheaper Chinese Long March.²²⁰ Problems with orbital insertion by the Chinese booster have since incentivized Indonesian companies to again work with a U.S. company to construct a telecommunications satellite for launch aboard a European Ariane 5 in 2016.²²¹

While Indonesia courts space powers for cooperation, it is courted in return. China, Russia, and India have all actively pursued cooperation with Indonesia, largely due to its equatorial geography, large population, blossoming space market, and growing geopolitical importance. China and India have offered to sell remote sensing data to Indonesia, where officials cite the need to “end that reliance” on European-American sources.²²² ISRO launched *LAPAN-A1* from its space center in Sriharikota in 2007, with *LAPAN-A2* to follow in 2015.²²³ Indian and Indonesian leadership in 2013, seeking to broaden the scope of a 2002 memorandum of understanding, issued a joint statement on increased space and defense cooperation, including: upgrades to the Biak, Papua, ground station; Indonesian access to earth data from India’s *OceanSat* and *ResourceSat*; enhanced training programs for Indonesians at India’s Centre for Space Science Technology Education in Asia and the Pacific (CSSTEAP); and more Indian launches of Indonesian microsatellites.²²⁴ Further afield, Japan and Indonesia collaborated in 2002 on research investigating space-based solar power,²²⁵ and Indonesia recently cited safety concerns and residents’ protests in declining a long-time Russian offer to construct novel-technology air-launch facilities in Biak.²²⁶ This refusal represented the collapse of six

²²⁰ That Chinese booster ultimately failed to reach geostationary orbit, costing five years off the satellite’s service life to correct the mistake. Ibid., loc. 3714.

²²¹ Peter B. de Selding, “Indonesia Taps SS/L, Arianespace to Build, Launch 3500-kilogram Satellite,” *Space News*, April 28, 2014, <http://www.spacenews.com/article/satellite-telecom/40358indonesia-taps-ssl-arianespace-to-build-launch-3500-kilogram>.

²²² Erwida Maulia, “Indonesia’s First Satellite Ready for Takeoff,” *The Jakarta Globe*, January 7, 2014, <http://www.thejakartaglobe.com/news/indonesias-first-satellite-ready-for-take-off/>.

²²³ Maulia, “Indonesia’s First Satellite.”

²²⁴ “India Indonesia to Expand Defence Space Cooperation,” *Security Risks Monitor*, October 12, 2013, <http://www.security-risks.com/security-trends-south-asia/india-defence/india-indonesia-to-expand-defence-space-cooperation-2152.html>.

²²⁵ A. Mostavan, N. Kaya, “A Case Study of SSP in Indonesia,” in 53rd International Astronautical Congress of the International Astronautics Federation (Houston, TX, 2002), ProQuest 27079710.

²²⁶ Maulia, “Indonesia’s First Satellite.”

years of hopeful Russian negotiations in which they offered technologies to help Indonesia become a “prestigious space nation.”²²⁷ Closely tied to the deals’ failure were Russia’s obligations under the MTCR, as Indonesia adamantly sought a deal including launch technology transfer, for which they ultimately turned to the Chinese.

Indonesian cooperation with China on space activities dates back to the early 1990s. In the mid-2000s, it joined nine nations in creating the Asia-Pacific Space Cooperation Organization (APSCO), headquartered in Beijing. Due in part to China’s heavy hand in APSCO, the Indonesian legislature has yet to ratify the treaty. While Indonesia participates in APSCO activities as a signatory nation, it remains an organizational outlier. Interestingly, Indonesia’s balanced position allowed LAPAN to host an Asia-Pacific Regional Space Agency Forum (APRSAF) session in light of the Japanese-led confederation’s looser, more inclusive model, though it has yet to host an annual APSCO summit.²²⁸

Cooperation with China is still significant. China shared with LAPAN information from the *Shenzhou-9* orbital rendezvous with *Tiangong-1*, accompanied by supportive statements that “Indonesia could replicate China’s success.”²²⁹ A Chinese *taikonaut* team toured Indonesia in 2010 to “promote knowledge of Chinese space activities, appealing to the country’s large ethnic-Chinese minority.”²³⁰ China has also offered a manned mission, a goal Indonesia will likely incorporate into LAPAN’s Space Law-mandated 25-year plan, indicating some renewed interest in prestige projects.²³¹ Following ratification of the 2013 Space Law, Indonesia signed a new partnership with China on “development of space technology for commercial and peaceful purposes,” including hopes that China will be “willing to share a bit of rocket science.”²³² Details

²²⁷ Erwida Maulia, “Russia Repeats Offer to RI to Become a ‘Space Nation,’” *The Jakarta Post*, February 15, 2012, <http://www.thejakartapost.com/news/2012/02/15/russia-repeats-offer-ri-become-a-space-nation.html>.

²²⁸ “The 13th Session,” Asia-Pacific Regional Space Agency Forum, accessed June 9, 2014, http://www.aprsaf.org/annual_meetings/aprsaf13/meeting_details.php.

²²⁹ Arfi Bambani Amri and Santi Dewi, “Indonesia: China Ready to Assist with Governments Space Program,” *VIVAnews*, July 31, 2013.

²³⁰ Moltz, *Asia’s Space Race*, loc. 3728.

²³¹ Maulia, “Indonesia’s First Satellite.”

²³² *Ibid.*

on the China agreement are still under negotiation, and they include China's request to construct a ground station next to a LAPAN station in Pare-pare, South Sulawesi.²³³ Indeed, while space technology cooperation proceeds apace, rocket technology in particular is a more sensitive subject, due to its potential to run afoul of the MTCR, though neither China nor any Southeast Asian state participate in that regime. Indonesian officials specifically cite difficulties in the negotiations arising from China's trend toward heavy-handed approaches and fears of becoming too closely aligned to either side in a future Sino-American space arms race.²³⁴ Indonesia and China agreed as early as 2007 to jointly produce guided missiles, including technology transfer and a factory in Indonesia, but progress has been slow, partially due to different domestic laws on both sides regarding such technology transfers; Indonesia, however, is adamant that such transfers are a nonnegotiable part of any deal.²³⁵

As other powers court Indonesia, Agus Hidayat, LAPAN's cooperation and public relations bureau chief, believes the United States is "silently" keeping a "close watch" on these proposals.²³⁶ The United States has continued to close its cooperation gap with Indonesia across a broad front that includes space partnerships: a 2012 Space Cooperation Agreement between the United States and Indonesia facilitates NASA's Southeast Asia Composition, Cloud, Climate Coupling Regional Study (SEAC⁴RS) study of Asian emissions' effects on the monsoon climate.²³⁷ Jakarta's increased international advocacy of human rights and democracy complement Washington's international priorities and the Obama administration's desire to use science and technology for Muslim outreach programs. The two democracies have upgraded their Comprehensive

²³³ Ibid.

²³⁴ Ibid.

²³⁵ "Indonesia, China Talks on Joint Development of Missile, Technology Transfer Stall," *Open Source Center*, January 18, 2014, https://www.opensource.gov/portal/server.pt/gateway/PTARGS_0_0_200_203_121123_43/content/Display/SER2014012112068760#index=16&searchKey=152900%E2%80%A6.

²³⁶ Maulia, "Indonesia's First Satellite."

²³⁷ U.S. Department of State, "Space Cooperation: Agreement between the United States of America and Indonesia," *Treaties and Other International Acts Series* (Washington and Jakarta, 2012).

Partnership, which lays the groundwork for increased space cooperation among other things.²³⁸

In the realm of international space treaties, Indonesia has moved away from its part in the odd 1976 Bogota Declaration by developing equatorial states that challenged the 1967 Outer Space Treaty's assertion banning "national appropriation" of anything in space.²³⁹ It has since ratified the Outer Space Treaty, Rescue Agreement, Liability Convention, and Registration Convention, the four primary United Nations treaties governing space activities.²⁴⁰

C. MALAYSIA

Malaysia's geography at the nexus of global shipping lanes ties its economy to freedom of the seas and cooperation with many nations, a policy it appears to translate into the space commons. President Obama's stop in Malaysia during his 2014 Asia tour indicated "recognition of Malaysia as a strategic pivot" in the region, as it was the only U.S. non-treaty ally on the agenda.²⁴¹ As one of the wealthiest countries in Southeast Asia, Malaysia seeks to punch above its weight with widely dispersed international cooperative projects and an outsized international profile. Historically, Malaysia's postcolonial existence was challenged, so it pursued a developmental path and cooperative arrangements that would facilitate its regional security. Rapid growth also appeased its multi-ethnic Malay, Chinese, and Indian constituencies, which it sought to keep in harmony while improving the relative position of indigenous Malays under the

²³⁸ The Comprehensive Partnership includes a \$600 million compact through the Millennium Challenge Corporation for investments in modernization of energy, governance, and prosperity engines and statements concerning increased defense cooperation across the areas of maritime security, humanitarian assistance and disaster relief, and reform and professionalization. All could benefit from cooperation in space technologies. Murray Hiebert, "Comprehensive Partnership Nudges U.S.-Indonesia Relations to New Levels of Cooperation," *Center for Strategic and International Studies*, September 28, 2012, <http://csis.org/publication/comprehensive-partnership-nudges-us-indonesia-relations-new-levels-cooperation>.

²³⁹ Dan St. John, "The Bogota Declaration and the Curious Case of Geostationary Orbit," *Denver Journal of International Law and Policy*, January 31, 2013, <http://djilp.org/3494/the-bogota-declaration-and-the-curious-case-of-geostationary-orbit/>.

²⁴⁰ "Status of International Agreements relating to Activities in Outer Space as at 1 January 2014," *United Nations Office for Outer Space Affairs*, accessed June 4, 2014, <http://www.oosa.unvienna.org/oosa/en/SpaceLaw/treatystatus/index.html>.

²⁴¹ "President Obama in Malaysia: The Substance of Symbolism," East-West Center, in *Asia Pacific Bulletin* no. 261 (2014).

contentious New Economic Policy. Malaysia's long-time policy since independence, accelerated under the longtime leadership of Dr. Mahathir Mohamed, was that foreign policy and trade are inseparable from domestic policies.²⁴² Leaders since have only sought to enhance foreign policy by providing "depth" through thickening relationships.²⁴³ Furthermore, the goal of Mahathir's open economic policy, continued under Najib Razak, was "to promote resilience and collective self-reliance among the developing" countries in a way that counter-balanced the West; spreading cooperation around rather than relying on one partner supports these ends by fostering a more rapid convergence in relative standards.²⁴⁴

Yet while rhetorically practicing an "open policy" of space cooperation, Malaysia notably focused that cooperation on more distant space powers such as Russia, Europe, and the United States, while minimizing close bilateral space cooperation with China and India that may strengthen the economic advantages and external ties of those corresponding domestic minorities.²⁴⁵ Change is foreshadowed, however, as leveraging space technology as technological bootstraps to lift Malaysia out of the middle-income trap is likely to feature in Najib's New Economic Model launched in 2010.²⁴⁶ This may require more truly open cooperative policies (more open to neighbors China and India) as Malaysia seeks to leverage the potential of all available partners. A decreased mandate for the Barisan Nasional, which has ruled since independence but is increasingly challenged by a viable opposition, may lead to increased democratization or instability that either way also alters foreign policy.

Malaysia's early satellites *Measat-1* and *-2* were U.S.-built and launched via Ariane rocket.²⁴⁷ Malaysia branched out afterward, looking to build domestic capacity by contracting with the United Kingdom's Surrey Satellite for a joint microsatellite

²⁴² Khadija M. Khalid, "Malaysia's Foreign Policy Under Najib," *Asian Survey* 51, no. 3 (2011): 437.

²⁴³ *Ibid.*, 438.

²⁴⁴ *Ibid.*, 439.

²⁴⁵ Noichim, "ASEAN Space Organization," 93.

²⁴⁶ Khalid, "Malaysia's Foreign Policy," 440.

²⁴⁷ Moltz, *Asia's Space Race*, loc. 3740.

project that was launched in 2000 aboard a Russian Dnepr rocket.²⁴⁸ Work with the Russians continued in their 2006 launch of Malaysia's American-built *Measat-3*. The relationship between Malaysia's defense and space industries as well as between national capabilities and international prestige was indicated by its decision in 2005 to augment its Russian Sukhoi-30 fighter jet purchase with the training and launch of its first astronaut in 2007.²⁴⁹ It reached out to growing middle-level space powers while continuing to build its domestic industry by cooperating on another joint project, *RazakSat*, with South Korea, that also boosted ANGKASA's international image when equatorial countries across three continents expressed interest in *RazakSat*'s up-to-date, high resolution meteorological images.²⁵⁰ Malaysia's international image was damaged, however, by its limited capability to manage the search for missing Malaysia flight MH370 in early 2014; it was forced to admit huge lapses in airspace domain awareness as well as reliance on external space powers for satellite and other reconnaissance assets. Kuala Lumpur was quick to point out, though, that its contributions in remote-sensing satellites, while not up to task in searching for MH370 due to resolution restrictions, were on par with the contributions of China and most other countries, with the exception of the United States and Russia (with their superior reconnaissance satellite technology).²⁵¹

Malaysia's elevation in 2014 to Comprehensive Partnership with the United States in conjunction with Trans-Pacific Partnership free trade area negotiations indicates close commercial ties.²⁵² Simultaneous attempts to decouple the Malaysian economy from overreliance on the United States have not been as successful. "To compensate for the decline in American private investment" that has left Malaysia in economic doldrums, "Malaysia is now relying more on strategic alliances through 'non-economic'

²⁴⁸ Ibid., 3748.

²⁴⁹ Ibid., 3764.

²⁵⁰ Ibid., 3764.

²⁵¹ "Malaysian Expert Clarifies Satellite Capabilities of Countries Searching for Missing MH370 Plane," *Utusan Online*, in *Open Source Center*, March 15, 2014.

²⁵² "President Obama in Malaysia."

investments in the defense and aerospace industries.”²⁵³ Yet again these industries feature prominently in state plans for economic growth in the 21st century.

Malaysia co-hosted an APRSAF session in 2001 and hosted in 2012.²⁵⁴ It has also broadened its participation through several cooperative projects with the Japanese Aerospace Exploration Agency (JAXA), such as a program soliciting Malaysian experiments for parabolic flights simulating microgravity.²⁵⁵ Despite its increased international profile with Dr. Mazlan Othman heading UNOOSA for nearly a decade²⁵⁶, Malaysia is nonetheless signatory to only the Outer Space Treaty and Rescue Agreement and a handful of tangential agreements.²⁵⁷

D. THAILAND

Thailand has long utilized its central position on the Asian mainland to focus on regional leadership and economic growth by leveraging its space services sector. Its relationships further afield have supported this regional-domestic agenda as Thailand coordinated extensive international cooperation with domestic efforts to institutionalize space technologies within a vibrant economy encompassing academic and commercial ventures.²⁵⁸ Thailand balanced early cooperation with the United States with a cozy Chinese connection, later adding Japan and other international projects.

Thailand’s democratic instability in the 20th and 21st centuries has owed much to exploitation of foreign policy issues as domestic political weapons, such as the Shinawatra family’s sale of Shin Corporation shares to Singapore becoming a pretext for the 2006 coup discussed in chapter II.²⁵⁹ Deep socio-political rifts, crystallized around the Shinawatra “red shirt” faction’s supposedly populist foreign and domestic policies

²⁵³ Khalid, “Malaysia’s Foreign Policy,” 450.

²⁵⁴ “The 9th Session,” Asia-Pacific Regional Space Agency Forum, accessed June 9, 2014, http://www.aprsaf.org/annual_meetings/aprsaf9/meeting_details.php.

²⁵⁵ “Parabolic Flight Program 2014,” ANGKASA, January 21, 2014, www.angkasa.gov.my.

²⁵⁶ Moltz, *Asia’s Space Race*, loc. 3771.

²⁵⁷ “International Agreements,” UNOOSA.

²⁵⁸ Moltz, *Asia’s Space Race*, loc. 4053.

²⁵⁹ Pavin Chachavalpongpun, “Diplomacy under Siege Thailand’s Political Crisis and the Impact on Foreign Policy,” *Contemporary Southeast Asia* 26, no. 3 (2009): 447.

and the conservative, nationalistic policies of the royalist “yellow shirts,” created conditions for another coup in 2014 that leaves questions regarding the consistency of Thailand’s future foreign arrangements.²⁶⁰

Thailand’s early cooperation with NASA on receiving Landsat’s remote-sensing data grew out of its close Cold War security relationship with the United States.²⁶¹ After the Vietnam War, Thailand sought to create a regional economic niche by transitioning to a space services hub, which has guided many of its policies since and required extensive cooperation with extra-regional space powers. Its Lad Krabang distribution hub soon leveraged additional French and European data.²⁶² The *Thaicom* series was produced and launched alternately by U.S. and French companies and rockets, including the largest geostationary satellite to date, *Thaicom-4* or *iPSat*, produced by Space Systems/Loral, which provides broadband across the Asia-Pacific region.²⁶³ Thailand has worked extensively on technology transfer programs; in addition to its university-based one with the UK,²⁶⁴ it is working with the United States and Canada.²⁶⁵ Thailand also tapped France for its *THEOS* satellite construction and training contract, despite attempted inroads by China into Thailand’s space industry.²⁶⁶

Thailand has been willing to tightly link itself to China’s space program since that space power’s emergence from the dark ages of the Cultural Revolution. As early as 1992, Thailand jointly proposed (with China and Pakistan) an Asia-Pacific Workshop on Multilateral Cooperation in Space Technology and Applications (AP-MCSTA), which included 16 participant nations and a Small Multi-Mission Satellite (SMMS) joint

²⁶⁰ Ibid., 463.

²⁶¹ “Profile,” Geo-Informatics and Space Technology Development Agency (GISTDA), accessed March 16, 2014, www.gistda.or.th.

²⁶² “Profile,” GISTDA.

²⁶³ “Company Profile,” Thaicom Public Company Limited, accessed March 16, 2014, www.thaicom.net; Moltz, *Asia’s Space Race*, 4064-4080.

²⁶⁴ “Thai-Paht,” Surrey Satellite Technology Limited, accessed March 16, 2014, <http://www.sstl.co.uk/Missions/Thai-Paht--Launched-1998/Thai-Paht/Thai-Paht--TMSat---The-Mission>; Noichim, “ASEAN Space Organization,” 110.

²⁶⁵ “Profile,” GISTDA.

²⁶⁶ Moltz, *Asia’s Space Race*, loc. 4095.

project.²⁶⁷ The SMMS ground receiving station opened at Kasetsart University in Bangkok in 2008; construction and joint training was completed by the Chinese Centre for Resource Satellite Data and Application (CRESDA) under the auspices of the Chinese government.²⁶⁸ Thailand was one of the breakout states that formalized their APSCO membership in 2005.²⁶⁹ Thailand has hosted more APSCO meetings than any other state besides China and is an outspoken actor in the organization, also hosting an international symposium for Space Cooperation for the Asia-Pacific Region in 2009 and a research center for space law, among multiple other projects with an international profile.²⁷⁰ Thailand's space assets are also part of APSCO's Asia-Pacific Ground-based Optical Satellite Observation System (APOSOS), a Low Earth Orbit (LEO) space tracking system intended to provide an alternative to U.S. domination in space object tracking and verification.²⁷¹ To not wholly commit itself to Chinese orbit, Thailand also co-hosted APRSAF-15 and hosted APRSAF-16 in 2008 and 2010.²⁷² Thailand has only ratified the Outer Space Treaty and Rescue Agreement.

E. VIETNAM

Vietnam, while like Indonesia seeking a balanced foreign policy of space cooperation that supports increased domestic capabilities, nonetheless follows patterns much more defined by its historic opposition to China. Amidst the changing geopolitical landscape near the end of the Cold War, the Vietnamese Communist Party (VCP) adopted the *doi moi* (renovation) policy in 1986.²⁷³ The foreign policy aspect of *doi moi* sought to “diversify” and “multilateralise” external relationships, “especially with major

²⁶⁷ Asia-Pacific Space Cooperation Organization, accessed June 6, 2014, www.apsco.int.

²⁶⁸ Ibid.

²⁶⁹ In doing so, it demonstrated a willingness to link itself with China, Indonesia, Mongolia, Pakistan, Iran, Turkey, and Peru to create APSCO as a much more institutionalized regional space cooperative than Japanese-led APRSAF. Ibid.

²⁷⁰ Ibid.

²⁷¹ Ibid.

²⁷² “The 16th Session,” Asia-Pacific Regional Space Agency Forum, accessed June 9, 2014, http://www.aprsaf.org/annual_meetings/aprsaf16/meeting_details.php.

²⁷³ Le Hong Hiep, “Vietnam’s Domestic-Foreign Policy Nexus: Doi Moi, Foreign Policy Reform, and Sino-Vietnamese Normalization,” *Asian Politics & Policy* 5, no. 3 (2013), 392.

powers and international institutions.”²⁷⁴ Desiring “to create a peaceful external environment and facilitate the use of foreign resources, such as capital, markets, and technology, for Vietnam’s domestic and economic reform,” Vietnam normalized relations in the 1990s not only with its ASEAN neighbors but also with China (1991) and the United States (1995).²⁷⁵ To self-strengthen the state, the VCP sought to balance the “two aspects of cooperation and struggle in order to develop and protect the economy, to defend national security, and to preserve and develop the national cultural traditions and characteristics.”²⁷⁶ Le Hong Hiep, in explaining the domestic-foreign policy nexus in Vietnam, notes that the authoritarian VCP’s foreign policy lends greater weight to domestic political conditions and economic interests; both of these stand to gain from boosts to national pride, economic competitiveness, and disaster recovery capability supported by the Vietnamese space program.²⁷⁷ A combination of realist space nationalism with external cooperation reflects this “struggle-cooperation” strategy’s “flexible approach” to Vietnamese security, prosperity, and regime legitimacy in a “changing era”²⁷⁸ in which the VCP believes “the strength of a country is measured mainly by its economic strength and cultural values.”²⁷⁹ Vietnam’s space policy is therefore similar to Indonesia’s in another way: as a government stimulus project that strengthens economic competitiveness, space then pays for more government projects (including armaments and more modernization)—a virtuous cycle for the regime.

Though economic integration with China since Vietnam normalized relations has resulted in deeply interdependent supply chains, Vietnam has sought to balance this devil’s bargain. Indeed, this proves prudent policy, as 2014 tensions in the South China Sea threaten to ripple across regional supply chains.²⁸⁰ Vietnamese success in attracting

²⁷⁴ Le Hong Hiep, “Vietnam’s Strategic Trajectory: From Internal Development to External Engagement,” *Strategic Insights* 59 (2012), 2-3.

²⁷⁵ *Ibid.*, 3.

²⁷⁶ Ninh, “Struggle and Cooperation,” 445.

²⁷⁷ Hiep, “Domestic-Foreign Policy Nexus,” 392.

²⁷⁸ Ninh, “Struggle and Cooperation,” 446.

²⁷⁹ *Ibid.*, 456.

²⁸⁰ “Nikkei: China Vietnam Faceoff Could Throw Wrench Into Supply Chains,” in Open Source Center, *Nikkei Telecom* 21, May 19, 2014,

Western and Japanese investment helps to offset the flood of Chinese consumer goods that undermined Vietnam's domestic economy.²⁸¹ Because Vietnam cannot hope to compete with China alone, close cooperation with Japan and the United States is necessary to balance its northern neighbor. Here, Vietnam's policies of space cooperation reflect broader policies. Space development shares a focus on modernization and indigenous development within the broader Vietnamese defense industry; Vietnam's 21st century military modernization "has been buttressed not only by arms imports but also the development of its own defense industry through co-production and technology transfers."²⁸² Indeed, its move to break its reliance on Thai satellite services through the *Vinasat-1* launch may have been further motivated by Thailand's close space cooperation with China. Vietnam's close ties with Japan in space have acted as a backdoor for the increased cooperation with Washington desired by Hanoi but deterred by Washington's continued concerns about the VCP's human rights record.

Japan has actively supported Vietnamese space ambitions, particularly through training programs and official development assistance (ODA) directly from Japan and through APRSAF.²⁸³ Funding for the VNSC at Hoa Lac Hi-Tech Park is a joint project including \$400 million in Japanese ODA.²⁸⁴ The ground-breaking was attended by not only high-level VCP dignitaries, but also the Japanese Ambassador and representatives from the Japanese Ministry of Economy, Trade, and Industry, JAXA, and NASA, indicating its importance in Pacific Rim relations.²⁸⁵ Touted as "one of the biggest investment projects in science and technology in Vietnam in... 35 years," VNSC is also hailed as only "the beginning of the strategic cooperation between Vietnam and Japan in space technology."²⁸⁶ The 2013 launch of VAST's *Pico Dragon* CubeSat from the

²⁸¹ Ninh, "Struggle and Cooperation," 461.

²⁸² Hiep, "Vietnam's Strategic Trajectory," 10.

²⁸³ Moltz, *Asia's Space Race*, loc. 4129.

²⁸⁴ Ibid., 4161.

²⁸⁵ Bùi Nam Dưong, "Ground Breaking Ceremony of Vietnam Space Center Project," *Vietnam National Satellite Center*, September 27, 2012, <http://vnsc.org.vn/en/news/News-Events/Ground-Breaking-Ceremony-of-Vietnam-Space-Center-Project-13/>.

²⁸⁶ Ibid.

Japanese *Kibo* module aboard *ISS* (along with several U.S. microsatellites) was the second Vietnamese CubeSat to be so launched, following the *F-I* microsatellite in 2012.²⁸⁷ Ground stations at both VNSC and Japanese universities received *Pico Dragon*'s ensuing signals.²⁸⁸ This Japanese national-commercial model of launching small satellites from the *ISS* for other countries may play an increased role throughout Southeast Asia in the future, as the market for cheap micro- and nano-satellite explodes, benefiting developing states (and secondary schools) on a tight budget.

Despite little cooperation with Russia since Vietnam's cosmonaut flight, closer cooperation may be on the horizon as Russia realigns its space policies and seeks to invigorate its space industry amid a changing geopolitical context. Ninety percent of Vietnam's arms acquisitions since 2002 have been Russian, making it the fifth largest consumer of Russian military hardware (behind China, India, Venezuela, and Indonesia).²⁸⁹ It also cooperates with Russia on other sensitive technological issues such as nuclear power generation and offshore drilling in the South China Sea.²⁹⁰ In 2012 Vietnam upgraded its strategic partnership with Russia, hinting at increased "strategic collaboration," as Russia talks of including Vietnam in its new Eurasian Economic Union.²⁹¹ Regardless, little in the way of space cooperation has been announced to date. When Vietnam finally re-launched its space projects in the 21st century it chose Ariane boosters operated by its former colonizer, France, to launch both *Vinasats*. It has also cooperated with the ESA and commercial and academic entities in the United States, South Korea, and Malaysia.²⁹² Vietnam hosted APRSAF sessions in 2008 and 2013.²⁹³

²⁸⁷ "Vietnam Launched CubeSat from the ISS," *Malaysian Flying Herald*, August 20, 2013, <http://malaysiaflyingherald.wordpress.com/2013/08/20/vietnam-launched-cubesat-from-the-iss/>.

²⁸⁸ "PicoDragon Micro Satellite Active in Space for Month," Science and Technology News, *Vietnam Academy of Science and Technology*, January 20, 2014, <http://pdg.vnsc.org.vn/>.

²⁸⁹ "Vietnam and Russia: Friends in Need," *The Economist*, April 17, 2014, <http://www.economist.com/blogs/banyan/2014/04/vietnam-and-russia>.

²⁹⁰ Ibid.

²⁹¹ Ibid.

²⁹² Moltz, *Asia's Space Race*, loc. 4129.

²⁹³ "The 15th Session," Asia-Pacific Regional Space Agency Forum, accessed June 9, 2014, http://www.aprsaf.org/annual_meetings/aprsaf15/meeting_details.php.

It has ratified the Outer Space Treaty and signed the Rescue Agreement but not the Liability or Registration Conventions.²⁹⁴

Ultimately, VCP governance follows the “successful model of the one-party authoritarian state...in Asia, liberal in economic growth but conservative in political and social change, insistent on an independent national organizing ideology.”²⁹⁵ The VCP is willing to cooperate despite a strong realist perspective, but usually with few strings attached and in ways that strengthen the regime’s “performance-based legitimacy.”²⁹⁶ Its tensions with China may only drive it closer to Japan and its U.S. patron and invigorate its desire to build its own technological-industrial capacity. Concurrently, Japan’s constitutional flexing under Shinzo Abe—itself largely in response to China—may permit more overt Japanese defense cooperation in the future. Vietnam, however, walks a fine line in balancing its relationships with China and the United States. Its space cooperation with middle powers such as Japan indicate a compromise position, but may eventually pull Vietnam toward one side of an emerging geopolitical rift as the facts on the ground change and the VCP becomes entrenched in cooperative security and economic agendas favoring one side over the other.

Kim Ninh’s summary of Vietnam’s balancing situation is revealing:

[While] not a zero-sum view of security...the elaboration of a cooperation-struggle strategy reveals a strong attachment to national independence and a perception that even though the current trend is toward economic interdependence and cooperation...[this may not] always be the case. Power can be utilized in conjunction with cooperation...to garner the best possible outcome. It is a view of power and international relations from the perspective of a small state, aware of its limitations but also determined to maximize its possibilities.²⁹⁷

²⁹⁴ “International Agreements,” UNOOSA.

²⁹⁵ Ninh, “Struggle and Cooperation,” 476.

²⁹⁶ Hiep, “Domestic-Foreign Policy Nexus,” 392.

²⁹⁷ Ninh, “Struggle and Cooperation,” 458.

F. SINGAPORE AND THE PHILIPPINES

Singapore and the Philippines, representing the richest and strongest and one of the poorest and weakest states in Southeast Asia, nonetheless share similarities in their commercial-academic space program models that lack a unifying space agency to coordinate foreign cooperative endeavors.

Singapore's constellation of space activities conducted by state-sponsored universities and commercial-academic enterprises, while operating substantial commercial assets, is reminiscent of Moltz's description of Australia's "loose amalgam of academic-, private-, and government funded space-related activities, some of which were quite sophisticated, but together lacked a sense of integration and national vision."²⁹⁸ As an entrepôt city under single-party rule, Singapore's government-backed commercial space model, which operates a range of commercial contracts spanning half the globe, is its foreign policy in space. Though largely ethnically Chinese, Singapore's anti-communist postcolonial history kept it much closer to a Western orbit, reflected today in its cooperative space projects. Its first satellite, *ST-1*, was purchased from British-French Matra Marconi and launched via Ariane.²⁹⁹ *X-Sat*, after being constructed at home, was launched from India, and Japan's Mitsubishi Electric Company was selected to construct a much larger communications satellite.³⁰⁰ Singapore also outsources to the United States for training large numbers of civilian and military personnel in engineering and space operations.³⁰¹ This last point highlights one of the Singapore's differences with the Philippines: much of the government backing for its commercial-academic model occurs through appreciable interaction with Singapore's modern and active defense ministry. This phenomenon also opens the door to future international cooperation in the defense space sector. Singapore hosted APRSAF-18 in 2011; befitting its internationalist profile, it has ratified or signed all four major space

²⁹⁸ Moltz, *Asia's Space Race*, loc. 3621.

²⁹⁹ Ibid., loc. 3973.

³⁰⁰ Ibid., loc. 3973.

³⁰¹ Ibid., loc. 3990.

treaties.³⁰² Despite the absence of a singular space authority, Singapore's small size and permeation of government throughout society nonetheless ensure a successful state-backed space policy.

The Philippines uses a similar disaggregated bureaucratic model that also relies heavily on private commercial endeavors. In the Philippines, "the political system is personality-driven, with no institutionalized or program-focused political parties;" rather, its national policies are adrift in a sea of "patron-client relationships" and "competition among local elites for access to government patronage."³⁰³ Therefore, it is no surprise that lucrative contracts for the Philippines' large domestic telecommunications industry and other licenses for foreign technology remain largely in private hands. Private entities such as Mabuhay Satellite Corporation operate more than a half dozen telecommunications satellites acquired via U.S. corporate contract, purchase of old Korean assets, or joint ventures with Indonesian and Chinese companies.³⁰⁴ One of the first government activities that did occur under the Philippines' balkanized national space agencies was the use of Landsat and SPOT imagery to fully map the Philippines.³⁰⁵ A cooperative remote sensing project with Australia followed shortly.³⁰⁶ Politics continues to preoccupy government uses of PAGASA and NAMRIA, such as the 2012 requirement to rename the South China Sea the West Philippine Sea on all government maps and documents. STCC-COSTA does coordinate activities with NASA and JAXA, but the compartmentalized bureaucracy and fiscal constraints limit achievements here, too.³⁰⁷

The Philippines has substantial incentive to build up its maritime domain awareness, to prevent further surprises such as the 1995 Mischief Reef incident or standoffs such as Scarborough Shoal in 2012. Its patronage by the United States, with

³⁰² "International Agreements," UNOOSA.

³⁰³ Aileen S.P. Baviera, "The Influence of Domestic Politics on Philippine Foreign Policy: The Case of Philippine-China Relations since 2004" (RSIS Working Paper 241, S. Rajaratnam School of International Studies, Nanyang Technological University, Singapore, 2012), 8, <https://www.rsis.edu.sg/publications/rsis-publications/rsis-publications-working-papers/>.

³⁰⁴ Moltz, *Asia's Space Race*, loc. 3960.

³⁰⁵ Ibid.

³⁰⁶ Ibid.

³⁰⁷ Burleson, *Space Programs*, 214.

whom it enjoys a mutual defense agreement, counteracts incentives to establish a single space agency and build a national space architecture. As long as it can rely on the United States to fill gaps in its own capabilities, the Philippines is unlikely to spend the political and fiscal capital to develop its own assets. Such external factors are still secondary to the political constraints imposed by its fractious domestic politics. Despite these weak state space policies, the Philippines has nonetheless signed the major space treaties except the Registration Convention, including—uniquely to the region—the globally unpopular Moon Treaty.³⁰⁸

G. MYANMAR, LAOS, CAMBODIA, AND BRUNEI

Evidence suggests that as developmental levels increase, the LDCs of Myanmar, Laos, and Cambodia will increase investments in space technologies, facilitated primarily by space policies that grow from larger national domestic and foreign priorities. Structural factors such as technological diffusion suggest that, for better or worse, these LDCs may be tempted to emulate other regional space policies because the costs of *not* doing so increase as national space assets proliferate.

Myanmar's still-dominant Tatmadaw, as it seeks a more balanced foreign policy but lacks the capacity for a national space program, would likely pursue an elitist, commercialized model similar to the Philippines, because the Tatmadaw is still heavily involved in the economy. Once the wealthiest country in the region, Myanmar is likely to look around and see other countries leveraging space technology to build internal capacity and balancing capability. Because Myanmar's junta seeks to balance China's outsized influence, it is likely to remain supportive of Japanese overtures for space cooperation so that it can get its foot on the first rung of the space ladder and not be left too far behind. Japan's quick work to make inroads in Myanmar to balance China's traditional influence is a win-win for both the Japanese and Burmese. Shortly after forgiving billions in Burmese debt, Japan held workshops with Myanmar on using satellite technology to bolster its telecommunications and information sectors and provide

³⁰⁸ "International Agreements," UNOOSA.

small-scale earth survey satellites for a variety of uses, while helping Myanmar craft a space strategy and training personnel at Japanese universities.³⁰⁹

Laos, with its strong communist authoritarianism, and near-Finlandized Cambodia enjoy close ties with China; to that end, most space applications launched from those countries in the near future, such as *Laosat-1*, are likely to be heavily subsidized by the Chinese as Beijing seeks to tighten the ties that constrain those governments' foreign policy options.³¹⁰ Indeed, in 2013 a state-sanctioned group from Cambodia visited the China Aerospace Science and Technology Corporation to discuss a future *Cambodia Satellite-1* to support that country's rapidly growing telecommunications industry.³¹¹ Brunei hosts an Indian ground station.³¹²

H. CONCLUSION

Like the substantial arms acquisition and modernization programs throughout the region (even by countries without sensationalized territorial disputes),³¹³ some combination of domestic and external factors must have motivated the concurrent increases in space budgets. Economic growth alone is insufficient to explain such policies, while the requirement for capital and technological support means foreign policy implications must be justifiably balanced against domestic priorities. Overall, historic alignments, such as Vietnam with the Soviets or Thailand with the United States, have shifted with the global order as new forces—more economic and geostrategic than

³⁰⁹ "Myanmar, Japan to Hold Workshop on Satellite Launching," *Xinhua*, September 13, 2012, <http://english.peopledaily.com.cn/203691/7940218.html>.

³¹⁰ "LaoSat-1 Program," China Great Wall Industry Corporation," accessed March 16, 2014, <http://www.cgwic.com/In-OrbitDelivery/CommunicationsSatellite/Program/Laos.html>; "LaoSat-1 To Be Launched in Mid-2015," *Satlaunch.net*, accessed February 20, 2014, <http://www.satlaunch.net/2013/06/laosat-1-to-be-launched-in-mid-2015.html>.

³¹¹ "Cambodia's Conglomerate in Talks to Buy Communications Satellite from China: Minister," *Xinhua*, April 10, 2013, <http://english.people.com.cn/90778/8202558.html>.

³¹² "India-ASEAN Heads of Space Agencies Meeting Held at Bangalore," *Space India*, Indian Space Research Organisation (ISRO), accessed January 20, 2014, <http://www.isro.gov.in/newsletters/contents/spaceindia/jan2012-jun2012/back1.htm>.

³¹³ Southeast Asian defense budgets have increased by one-third in the last decade. The United States, China, Russia, and India increased theirs over the same period, while European defense budgets declined. Since 2000, Indonesian arms imports increased by 84 percent, Singaporean imports by 146 percent, and Malaysian imports by 722 percent. Robert D. Kaplan, *Asia's Cauldron: The South China Sea and the End of a Stable Pacific* (New York: Random House, 2014), Kindle edition, loc. 380.

ideological—increase in relative importance.³¹⁴ Democratic Thailand has shifted toward China, while communist Vietnam has moved toward democratic Japan. Indonesia and Malaysia balance multiple extra-regional space partnerships in pursuit of independent foreign policies, though the domestic origins of such policies differ. The Burmese junta reopened its border and loosened its authoritarian autarky partially to avoid Chinese domination and appears likely to follow policies similar to other regional states in the future. Laos and Cambodia so far lack the state power to attempt the same. Offshore balancers such as the United States remain appealing despite China's heavy gravitational pull on the region's economic and security paradigms.

What does this all mean vis-à-vis Southeast Asian space programs and policies? Southeast Asian states seek to leverage multiple cooperative arrangements to facilitate technology transfer and domestic capacity-building in a way that facilitates internal balancing, economic growth, and convergence with existing space powers. Doing so not only protects their postcolonial independence but strengthens their domestic legitimacy. Regardless of government type, Southeast Asian domestic incentives regarding space technology drive thematically similar space foreign policies.

Southeast Asian states seek to balance their cooperative arrangements with foreign powers to maintain domestic stability and regional independence; where their neighbors perceive insufficient balancing they seek to counterbalance. For example, if Vietnam sees Thailand moving too close to China, it will adjust its own external balancing toward Japan in response. While this maintains balance in the short term, it emphasizes the importance of domestic policies in maintaining regional balance—regional action-reaction responses absent internal controls could result in two opposing spheres of influence, one China-led and the other based around a U.S.-Japanese confederation. Not only would this undermine the international cooperative regime in space, but such a divide in space cooperation would likely lock the space sector into a broader geopolitical rift. Ironically, Southeast Asian states would find their foreign policies constrained after all as they align on opposite sides of a Pacific Rim space race.

³¹⁴ Kaplan, *Asia's Cauldron*.

The “missing middle” to maintaining stability is regional cooperation within Southeast Asia.³¹⁵ As Southeast Asia seeks to build an ASEAN Community, there is room for a regional cooperative space architecture that touches upon all three pillars.

³¹⁵ Moltz, *Asia's Space Race*, 33.

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IV. COOPERATION AMONG SOUTHEAST ASIAN SPACE PROGRAMS

A. INTRODUCTION

Chapter II revealed domestic motives for space investments in Southeast Asia. Chapter III discussed the interaction between domestic and foreign policies in influencing extra-regional space cooperation. This chapter discusses space cooperation among Southeast Asian countries, particularly within the ASEAN framework. The previous two chapters' focus on space nationalism, technological determinism, and divergent external alignments indicate a host of centrifugal forces working within the regional space sector, but these are partially counteracted by a variety of centripetal forces working toward regional cooperation and integration. While space cooperation among Southeast Asian states is constrained by competitive motives, external alignments, and resource scarcity, ASEAN member states nonetheless pursue modest regional space cooperation characterized by moves toward bureaucratic (and, to a lesser extent, epistemic) space S&T communities that fit within the integrative ASEAN agenda.

Though this space cooperation is more rhetorical than substantive, it is important because it reflects a broader hedging strategy that seeks to limit the influence of the large blocs tugging at the region. If the security of ASEAN member states is even partially interdependent, those states are more vulnerable to larger powers so long as intramural competition outweighs cooperation; to some degree, they must cooperate with each other to balance larger powers and maintain regional stability. Thus, techno-national jockeying, as most nations seek to expand their competitive advantages, results in a net positive experience for the regional space S&T sector as broader regional capacity is achieved. The role national and regional elites play in supporting a cosmopolitan bureaucratic agenda in the face of substantial popular disinterest and the persistence of primordial nationalism is also relevant to the pursuit of such shared regional interests, as the balance between those two competing forces will influence ASEAN's collective ability to leverage those individual national achievements.

Underlying these various regional forces is a changing international paradigm as the current space arena is transformed by a blooming number of participants. Past assumptions regarding space relationships, developed in a period of limited actors, are shifting as “space... is becoming increasingly congested, contested, and competitive.”³¹⁶ To such perspectives should also be added “cooperative.”³¹⁷ Concentrating on the first three characteristics and neglecting the fourth, as many small countries enter space amidst cooperative political architectures and resource constraints that preclude unbridled competition, reflects how states in the 21st century space age have “grappled with how to incorporate the realm of space into their understanding and interpretation of territoriality, international law, and national security.”³¹⁸ Thomas Kuhn’s *The Structure of Scientific Revolutions* offers a perspective of scientific progress as a “kind of punctuated equilibrium,” with predominantly slow evolution interrupted by environmental disruptions that provoke a “paradigm crisis” in which there is “no longer a basis for comparability between previously held notions of reality and current developments.”³¹⁹ Perhaps the trajectory of international space cooperation, across its various levels of interaction, is crossing such an event horizon. If so, a theory of space interaction that sheds light on the complex relationships among Southeast Asian nations on this technological frontier must not only be firmly rooted in earthly concepts of international relations developed over the history of human experience, but also integrate novel phenomena that uniquely color the condition of the modern world system.³²⁰ As such, the earlier chapters’ emphasis on space nationalism and technological determinism—which revealed the connections between cooperative and competitive behaviors—can now be

³¹⁶ Defense Department and Office of the Director of National Intelligence, National Security Space Strategy (Unclassified Summary), January 2011, http://www.defense.gov/home/features/2011/0111_nsss/docs/NationalSecuritySpaceStrategyUnclassifiedSummary_Jan2011.pdf.

³¹⁷ James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests*, 2nd ed. (Stanford, CA: Stanford University Press, 2011), Kindle edition, 23.

³¹⁸ Harding, *Space Policy in Developing Countries*, 18.

³¹⁹ Kuhn’s work is cited in both: Freeman Dyson, *The Scientist as Rebel* (New York: New York Review of Books, 2006), 207; Harding, *Space Policy in Developing Countries*, 19.

³²⁰ As previously mentioned, the human dimension cannot be removed as the primary factor in international relations. However, the potentially transformative effects of the decline of traditional measures of state power in the face of greater transnational flows of people, goods, information, and money cannot be discounted.

more fully augmented by global institutionalist and social interactionist insights in a more holistic understanding of Southeast Asian space motives and relationships.

B. OVERLAPPING INTERNATIONAL ARENAS FOR COOPERATION

Chapter III already revealed a number of fora hosted by space powers, including APSCO and APRSAF, which include a number of Southeast Asian nations. Chapter III also notes that half of ASEAN member states have hosted an APRSAF; with the loosest structure of the multiple organizations, it is also the most inclusive.³²¹ Another is the UN-affiliated CSSTEAP, regionally headquartered in India, which includes Indonesia, Thailand, Myanmar, and Malaysia. CSSTEAP's goals include creation of an "integrated programme of space applications for regional development," so that "no country in the region will have to look abroad for expertise in space science and technology application."³²² The membership rolls of APSCO, APRSAF, and CSSTEAP overlap but are not all-inclusive within Southeast Asia and also indicate competing visions of Asian space leadership by great powers in which Southeast Asian regional interests are likely to remain secondary. Also important, then, are regional efforts to replicate or complement these larger international efforts.

C. ASEAN SPACE SCIENCE AND TECHNOLOGY COOPERATION

1. The ASEAN Community as Context

Southeast Asian states' rapid growth over the last few decades has been matched by substantial growth in their ties to the global economy. At the same time, following its expansion after the Cold War, ASEAN's early focus on its security environment has diminished relative to finding common socioeconomic ground among its constituents to hedge against the persistent influence of great powers. Complementing their small-state views of security as encompassing both national and regional resilience across a broad range of political, economic, and social aspects, the ASEAN states have broadened ASEAN's mandate to include establishment of an ASEAN Community built on three

³²¹ Indonesia, Vietnam, Malaysia, Singapore, and Thailand have each hosted at least one APRSAF.

³²² "Vision," Centre for Space Science and Technology Education in Asia and the Pacific, accessed July 27, 2014, www.cssteap.org.

pillars that reflect these dimensions: the ASEAN Political-Security Community (APSC), ASEAN Economic Community (AEC), and ASEAN Socio-Cultural Community (ASCC).

The APSC officially “promotes political development in adherence to the principles of democracy, the rule of law and good governance, and respect for...human rights and fundamental freedoms” while seeking to ensure that “the peoples and member states of ASEAN live in peace with one another and with the world at large.”³²³ To this end ASEAN has expanded membership in its Treaty of Amity and Cooperation in Southeast Asia that acts as a “code of conduct of inter-state relations,” established an ASEAN Institute for Peace and Reconciliation to foster conflict resolution, adopted the ASEAN Human Rights Declaration, and sought to further practical security cooperation through proposals by the annual ASEAN Defense Ministers’ Meeting (ADMM).³²⁴ Among the most successful programs is the ASEAN Regional Forum (ARF), which has been an important international effort in security cooperation across the Asia-Pacific region for over twenty years. Yet, a litany of ongoing issues challenge the efficacy of these efforts. To date, ASEAN has proved ineffective in conclusively mediating a number of border disputes and transnational issues such as piracy and human trafficking. Functional democracy and respect for human rights are certainly not universally appreciated throughout the region. The APSC clearly illustrates gaps between ASEAN rhetoric and reality.

The AEC’s goal has been phased “regional economic integration” by 2015, including a “single market and production base, competitive economic region, equitable economic development, [and] integration into the global economy.” The AEC has established a series of successive benchmarks that have moved all ten member states—though at different paces—toward that end. While some of the AEC Blueprint’s metrics are ambiguous, unclear, or behind timeline, real achievements have been made. By April 2013, 78% of the AEC’s Blueprint measures had already been implemented, regional

³²³ “Fact Sheet: ASEAN Political-Security Community (APSC),” Association of Southeast Asian Nations, 2013, 2, <http://www.asean.org/resources/fact-sheets>.

³²⁴ Ibid.

annual per capita income had increased from \$2267 to \$3759, and total ASEAN trade had grown 16.8% from 2010 to 2011 to exceed \$2.4 trillion.³²⁵ Of that last amount, intra-ASEAN trade had increased 23% to nearly \$600 billion.³²⁶ Tariff rates on nearly 100% of items in ASEAN's Common Effective Preferential Tariff scheme have been near zero in the ASEAN-6 (Singapore, Malaysia, Thailand, Indonesia, The Philippines, and Brunei) since 2010, with the CMLV (Cambodia, Myanmar, Laos, and Vietnam) nations' tariffs down to less than a 2% average by 2012 (from 8% in 2000) on nearly 70% of items.³²⁷ Aside from broadening transportation infrastructure, ASEAN has established the ASEAN Single Window System to allow single-entry of traded goods into a region-wide accountability system, begun establishment of the ASEAN Single Aviation Market, and implemented Mutual Recognition Arrangements for several professions.³²⁸ ASEAN has signed five major international free trade agreements (FTA) since 2000.³²⁹ Yet progress has been slow on implementing even key enabling mechanisms necessary to meet the 2015 deadline. For example, visa-free travel between member states has still not been fully implemented, and significant economic protections remain in place, particularly in some of the countries with large domestic markets to protect (Indonesia and the Philippines).

Multiple critiques contend that ASEAN makes "process, not progress,"³³⁰ citing an annual litany of issues not satisfactorily addressed over the previous year and the "creeping, hesitant economic integration" as ASEAN's primary (overrated)

³²⁵ "Fact Sheet: ASEAN Economic Community (AEC)," Association of Southeast Asian Nations, 2013, 2, <http://www.asean.org/resources/fact-sheets>.

³²⁶ Ibid.

³²⁷ "ACIF 2012: ASEAN Community in Figures," Association of Southeast Asian Nations, 01 March 2012, 33-34, <http://www.asean.org/resources/publications/asean-publications/item/asean-community-in-figures-2012>.

³²⁸ ASEAN Economic Community Scorecard: Charting Progress Toward Regional Economic Integration, Phase I (2008-2009) and Phase II (2010-2011), 5, <http://www.asean.org/resources/publications/asean-publications/item/asean-economic-community-scorecard-3>.

³²⁹ The five FTAs vary in scope and comprehensiveness. They include agreements with China, Japan, the Republic of Korea, India, and Australia and New Zealand. A sixth, with the European Union, is expected to move forward after 2015. "ASEAN Economic Community Factbook," Association of Southeast Asian Nations (Jakarta: ASEAN Secretariat, 2011), 81-90; http://www.aseansec.org/wp-content/uploads/2013/07/ASEAN_AECFactBook.pdf.

³³⁰ Jones and Smith, "Making Process, Not Progress," 149.

achievement.³³¹ Though not wholly unjustified in their frustration, such views fail to acknowledge the real achievements over the organization's lifetime, including greater internal and regional stability, several instances of collective bargaining with extra-regional powers (such as the FTAs), and substantial integration of regional supply chains.³³² Such criticisms neglect to acknowledge that shortcomings in meeting the often ambitious timelines merely indicate a work in progress rather than failure or regression. Regardless of its magnitude, the vector toward integration has maintained consistent direction. Underlying divergent viewpoints on whether ASEAN is "powerful" are competing realist and constructivist perceptions that "draw different empirically-based conclusions about ASEAN's efficacy."³³³ Realists consider ASEAN a talk shop "peripheral to great power politicking," and would cite the disconnect between regional space cooperation and national space agendas as evidence.³³⁴ Social interactionism offers a different context in which power is not always negative-sum and identity-building through iterative interaction builds new consensual norms that allow collective action on *specific* issues.³³⁵ Thus, to focus on the APSC's and AEC's tempered successes at the expense of the equally relevant but more intangible third pillar, the ASCC, is a mistake.

2. Building Bureaucratic and Epistemic Communities

Despite its nebulous nature, the ASCC is particularly relevant to the discussion of regional space programs as the creation of stronger regional scientific bureaucracies, epistemic communities, and public excitement regarding space investments is one way in

³³¹ Donald E. Weatherbee, "Southeast Asia and ASEAN: Running in Place." *Southeast Asian Affairs* no. 1 (2012): 3.

³³² ASEAN's relative decrease in perceived conventional security challenges among member states, shift in primary achievements toward the socioeconomic realm, and integration of regional supply chains amidst increased individual capacities in space technologies following the various technological transfer schemes point toward an increased likelihood for a collaborative space project in the future, however modest. Likely candidates under the auspices of SCOSA are discussed below.

³³³ Sarah Eaton and Richard Stubbs, "Is ASEAN Powerful? Neo-realist Versus Constructivist Approaches to Power in Southeast Asia," *The Pacific Review* 19, no. 2 (2006) 135-136, doi: 10.1080/09512740500473148.

³³⁴ Ibid.

³³⁵ Ibid., 135-136 and 151.

which these diverse nations can construct a regional identity.³³⁶ The ASCC Blueprint seeks to “forge a common identity” to “bring out the human dimension of ASEAN cooperation” and “lift the quality of life for its people,” providing strategic direction in areas concerning human development, environmental sustainability, narrowing the development gap, disaster resilience, and education.³³⁷ It is important to note that, in the ASEAN Annual Report, the ASEAN Ministerial Meeting on Science and Technology (AMMST) is listed under the AEC section due to its recognizable applicability to economics, though it could also be considered relevant to numerous ASCC functions such as the ASEAN Education Ministers’ Meeting, ASEAN Ministerial Meeting on Disaster Management, ASEAN Ministerial Meeting on the Environment, Conference on the Parties to the ASEAN Agreement on Transboundary Haze Pollution, ASEAN Ministers’ Meeting on Rural Development and Poverty Eradication, and ASEAN Ministerial Meeting on Social Welfare and Development, among others.³³⁸

a. Building Bureaucratic Communities: COST and SCOSA

ASEAN’s founding Bangkok Declaration referenced S&T cooperation among its motivations in 1967, establishing the ASEAN Committee on Science and Technology (COST) in 1978.³³⁹ Since inception, COST’s focus has remained on strengthening ASEAN’s S&T organizational structure rather than actual joint projects.³⁴⁰ Meanwhile, a substantial portion of COST’s funding has been historically sourced from dialogue partners rather than from within ASEAN itself.³⁴¹

Like the rest of ASEAN, COST’s agenda has changed and grown with the organization itself. Its millennium plan of action includes the following goals:

³³⁶ To be clear, this is not one of the ASCC’s elaborated functions; rather, it is a theoretical application that falls within its conceptual framework.

³³⁷ “Fact Sheet: ASEAN Socio-Cultural Community (ASCC),” Association of Southeast Asian Nations, 2013, 2, <http://www.asean.org/resources/fact-sheets>.

³³⁸ “On Track to ASEAN Community 2015: ASEAN Annual Report 2012-2013,” Association of Southeast Asian Nations (Jakarta: ASEAN Secretariat, 2013), iv.

³³⁹ Anuwar Ali, “Science and Technology Collaboration at the Regional Level: Lessons from ASEAN,” in *The Emerging Technological Trajectory of the Pacific Rim*, ed. Denis Fred Simon (Armonk, NY: East Gate, 1995), 135.

³⁴⁰ Ibid.

³⁴¹ Ibid., 143.

- a. to intensify cooperation on science and technology development and R&D between the public and private sector that has a strong thematic focus and is interdisciplinary and cross-sectoral;
- b. to expand [the] scope of regional programmes leveraging on national experiences and resources and ASEAN-help-ASEAN initiatives that will enable the newer ASEAN members to move up the learning curve and become economically competitive;
- c. to establish a highly mobile and intelligent S&T community that thrives on knowledge creation and application, and is creative;
- d. to create a system of rewards and incentives in order to encourage innovation and technology commercialization and attract talent to a life-long career in science and technology; i.e., to ascertain a means of seeding and sustaining science and technology programmes through innovative ways of investing in S&T endeavors and generating revenue; and
- e. to enhance a system of management of the future S&T enterprise that is innovative, bold and entrepreneurial.³⁴²

COST's mission now covers functional areas including public and private cooperation, commercial development, wealth distribution, education, and community-building.

Of COST's ten program areas, two—Meteorology and Geophysics (SCMG) as well as Space Technology and Applications—are overtly relevant to space.³⁴³ Others with secondary relevance to space technologies include the Sub-Committee on Marine Science (SCMS) and the Sub-Committee on S&T Infrastructure and Resources Development (SCIRD) which operates the ASEAN Experts Group on Remote Sensing (AEGRS).³⁴⁴ Working groups under the ASEAN Senior Officials on Environment (ASOEN) and the Committee on Culture and Information (COCI) have also overseen activities involving space technologies.³⁴⁵

³⁴² Plan of Action on Science and Technology: ASEAN Secretariat, 2003, quoted in: Chukeat Noichim, "The ASEAN Space Organization: Legal Aspects and Feasibility" (PhD diss., Leiden University, 2008), 67.

³⁴³ ASTNET.org: The ASEAN Science and Technology Network, ASEAN Committee on Science and Technology, accessed August 5, 2014, <http://astnet.asean.org>.

³⁴⁴ Linda S. Posadas, "ASEAN Cooperation in Space Technology Applications," *Proceedings of the Euro-Asia Space Week on Cooperation in Space—'Where East & West Finally Meet,'* 23-27 November 1998, (Singapore: ESA SP-430, February 1999).

³⁴⁵ Ibid.

The organizational disunity among these various institutions may be more a result of space's utility across a broad range of fields than institutional failure to create an overarching space activities framework. Within COST, the Sub-Committee on Space Technology and Applications (SCOSA) meets twice a year and is funded collaboratively (though not equally) by ASEAN member states and dialogue partners.³⁴⁶ Its cooperative regional agenda includes the following:

- Formulate and coordinate collaborative and cooperative programmes and projects on space technology and its applications, in particular, remote sensing, satellite meteorology, communication and satellite technology applications for environmental and natural resource management, and development planning;
- Review the status and capability of space technology in the region and promote this technology for natural resource and environment management and sustainable development;
- Recommend mechanisms to involve government agencies, industries and academe in promoting and sustaining regional cooperation in space technology and its applications;
- Exchange information on national policies, programmes and planning in all areas of space technology and its applications among member countries;
- Facilitate and accelerate the transfer of space technology and its applications to the ASEAN region;
- Promote collaborative activities and projects on space technology and its applications with relevant international organizations;
- Advise COST on matters relating to space technology and its applications.
- Assist in securing financial support and seek funding sources for ASEAN activities and projects relating to space technology and its applications.³⁴⁷

³⁴⁶ The allowance of unequal funding is notable as it facilitates more rapid increases in financial capacity given the member states' diverse levels of development and economic growth. In contrast, despite a ballooning number of requirements, budget increases for the ASEAN Secretariat are currently limited by the ASEAN Charter's stipulation that all members contribute equally to reduce inordinate influence by wealthier member states. If regional space projects were to follow a similar pattern, SCOSA projects may suffer as wealthier states with shared problems to address opted not to wait for less-capable members to be able to support a region-wide project and chose to cooperate between themselves at the sub-regional level. ASTNET.org, <http://astnet.asean.org>.

³⁴⁷ Ibid.

SCOSA is largely a vehicle for bringing cooperative enterprises together across industrial, academic, bureaucratic, and international lines in pursuit of knowledge sharing and technology transfer.

SCOSA's grand ambitions remain resource-constrained and its practical achievements have been relatively subdued. Many projects remain pending or on-going through substantial delays. SCOSA has, however, brought ASEAN member states together in working on several satellite application training workshops and a few earth observation programs.³⁴⁸ Such cooperation goes back to utilization of the early Indonesian *Palapa* telecommunications satellite series by (then) ASEAN members Singapore, Malaysia, the Philippines, and Thailand.³⁴⁹ Priority Integration Sectors (PIS) led by specific countries have included using remote sensing to monitor rubber (Thailand) and rice (Vietnam) production, for supporting cultural and eco-tourism (Cambodia), and for influenza prevention and response (Indonesia).³⁵⁰ By 2011, SCOSA was handling 11 projects, though only two were ongoing with the remainder pending or proposed, in the fields of biodiversity, disaster management, land cover and climate change, and an *ASEAN Earth Observation Satellite (ASEAN-EOS)*.³⁵¹ Though a 2013 Thailand-led workshop to reassess the feasibility of an *ASEAN-EOS* determined that "development of ASEAN-EOS may not be achievable at the moment," the meeting agreed to "exhaust other options that can equally address the objectives of ASEAN-EOS," such as the integration of a "virtual constellation of the existing satellites among ASEAN member states."³⁵² Building a virtual constellation would provide valuable and ongoing collaborative experience and represent substantial progress in bureaucratic cooperation. Another of SCOSA's projects, dating back to 1991, was the 2001 release of

³⁴⁸ "SCOSA: The ASEAN Subcommittee on Space Technology and Application," Asia-Pacific Regional Space Agency Forum, accessed August 5, 2014, http://www.aprsaf.org/data/malaysia_tecshop_data/malaysia_presen_day1/am/5_asean_bambang.pdf.

³⁴⁹ Mayerchak, "Asia in Space," 96.

³⁵⁰ Monemany Nhoibouakong, "ASEAN-SCOSA" Asia-Pacific Regional Space Agency Forum-14, accessed August 5, 2014, https://www.aprsaf.org/data/aprsaf14_data/day2/P14_ASEAN-SCOSA_APRSAF14.pdf.

³⁵¹ Nyunt Soe, "ASEAN-SCOSA APRSAF-18," Asia-Pacific Regional Space Agency Forum, December 9, 2011, https://www.aprsaf.org/annual_meetings/aprsaf18/pdf/program/day3/19_ASEAN-SCOSA-APRSAF-18.pdf.

³⁵² "Workshop on ASEAN Earth Observation Satellite," Geo-Informatics and Space Technology Development Agency (GISTDA)," accessed August 5, 2014, www.gistda.org.

ASEAN from Space, a collaborative collection of satellite remote sensing imagery of the region, compiled from regional and international sources and published by GISTDA. While circulation was limited to 2000 copies, such a compilation of regional views from outer space can uniquely provoke collective identification, as *Apollo 8*'s "Earthrise" photograph did for humanity and the environmental movement in 1968.³⁵³ A second volume is planned.

Notably, many of SCOSA's achievements occur through ASEAN cooperation with extra-regional partners.³⁵⁴ SCOSA has cooperated with China and India on remote sensing, JAXA and the Asia Institute of Technology on disaster monitoring, and the EU on ASEAN uses of the Galileo navigation system, among others.³⁵⁵ In 2012, the ARF hosted a Space Security Workshop in Vietnam, whose conclusions described the importance of "stronger regional and broader international cooperation...to enhance the security, safety, and sustainability of space" and that "there should be a continuing role for the ARF on space issues."³⁵⁶ Also in 2012, India hosted the heads of all of Southeast Asia's space agencies in Bangalore, facilitated by the active involvement of the ASEAN Secretariat. This meeting was notable as a multi-scalar opportunity for regional, multilateral, in bilateral coordination among member states' space programs and ISRO;

³⁵³ There is little evidence of *ASEAN from Space* having this effect on any significant number of people, yet it is impossible to discount this possibility regarding individuals. In the foreword, the SCOSA chairman praises the project's facilitation of "closer networking, established among professionals, not only among member but also non-ASEAN members from advanced countries." The preface by the GISTDA director lists the promotion of "awareness of the remote sensing and related technologies for the average laymen of ASEAN member countries" and remote sensing's relevance to the "common interest of the group" foremost among the purposes of the project. The editorial board included members from all ASEAN member states except Myanmar and Laos. ASEAN Committee on Science and Technology Sub-Committee on Space Technology and Applications, *ASEAN from Space*, Geo-Informatics and Space Technology Development Agency (Bangkok, Thailand: GISTDA, 2001), ii-iv.

³⁵⁴ This is a typical cooperative pattern for ASEAN: one ASEAN state and one non-ASEAN state co-chair working groups. In this way, ASEAN can overcome relative shortcomings in resources and expertise, though it inevitably surrenders some control over agenda-setting. As ASEAN's capacity increases (however slowly) as a result of growth among its member states, it is likely that it would seek to increase its own domain of independent action.

³⁵⁵ "SCOSA: The ASEAN Subcommittee on Space Technology and Application," Asia-Pacific Regional Space Agency Forum, accessed August 5, 2014, http://www.aprsaf.org/data/malaysia_tecshop_data/malaysia_presen_day1/am/5_asean_bambang.pdf.

³⁵⁶ "ASEAN Regional Forum Space Security Workshop Co-Chairs' Summary Report," ASEAN Regional Forum, Association of Southeast Asian Nations, December 7, 2012, <http://aseanregionalforum.asean.org>. The United States and Japan have expressed substantial interest in continuing this dialogue: "U.S. Engagement in the 2013 ASEAN Regional Forum," U.S. Department of State, July 2, 2013, <http://www.state.gov/r/pa/prs/ps/2013/07/211467.htm>.

its areas of focus included greater cooperation on satellite ground stations and personnel training, among other topics.³⁵⁷ Outside the narrower purview of SCOSA, cooperative projects on S&T among multiple institutions are still dominated by extra-regional cooperation, and certainly activities in supporting shared S&T objectives have been limited. Events such as the ASEAN-EU and ASEAN-China Years of Science and Technology Cooperation (2012) and annual ASEAN Science and Technology Weeks do not even specifically highlight space awareness.³⁵⁸ Extra-regional cooperation is based on the realities of finite resources at ASEAN's disposal, though the choice to cooperate through ASEAN at all is an example of a conceptual perception of ASEAN as a medium for cooperation that collectively amplifies individual interests. The success of these examples and SCOSA's stated goal of facilitating technology transfer to and through the entire region means such events are likely to continue in the future.

In 2012, the AMMST revealed plans to restructure COST and its subcommittees in the future to design more "appropriate clusters," though plans have been delayed pending further studies on optimal reorganization.³⁵⁹ Additionally, the AMMST acknowledged that the 80 percent of earnings from the ASEAN Science Fund (ASF) were insufficient to support most S&T activities, and proposed establishing an augmentary ASEAN Innovation Fund (AInF) and partnering more actively with dialogue partners.³⁶⁰ Such changes could result in more collaborative efforts within certain sectors such as space that are currently relevant to a number of disaggregated fields and subcommittees and thus potentially suffer from bureaucratic stove-piping.

³⁵⁷ "India-ASEAN Heads of Space Agencies Meeting Held at Bangalore," *Space India*, Indian Space Research Organisation (ISRO), accessed January 20, 2014, <http://www.isro.gov.in/newsletters/contents/spaceindia/jan2012-jun2012/back1.htm>.

³⁵⁸ "On Track to ASEAN Community 2015: ASEAN Annual Report 2012-2013," Association of Southeast Asian Nations (Jakarta: ASEAN Secretariat, 2013), 49-50.

³⁵⁹ *Ibid.*, 49.

³⁶⁰ *Ibid.*

b. Building Bureaucratic Communities: Proposals for a Regional Space Program

ASEAN romantics who often tout the EU as a model for regional integration (despite substantial differences in conditions and motives) similarly tout ESA as a functional model for an ASEAN Space Organization (ASO) that would both benefit—and benefit from—greater ASEAN unity.³⁶¹ In such proposals, a more robust regional space architecture would unify the national space programs of member states under a single space policy to pool resources as a “necessary scheme” toward building a stronger ASEAN Community.³⁶² One refrain is that an ASO would “assure equal rights to space benefits,” so that returns are not limited to the “first beneficiary” but will “spread out to other cooperating countries equally” in line with the references to fair distribution of benefits in the UN space treaties.³⁶³ Notable in such ambition is the equal importance placed on the ASO’s ability “to serve as a focal point for broader international cooperation for the exploration and utilization of outer space.”³⁶⁴ Not to be outdone, other proposals include merging APSCO and APRSAF into an Asian space agency that would also include the Southeast Asian space programs.³⁶⁵ Aside from the unrealistic expectations of such continental ambitions, the inclusion of large space powers in such an organization would diminish the stature of ASEAN and its constituents and therefore be undesirable for a region of smaller states.

Parallel attempts by a 2012 working group to establish a road map toward an African Space Agency are conceptually relevant to the proposals that include Southeast Asia. The champions of an African Space Agency posit that developing regional space agencies could follow the ESA example to benefit from increased *competition*, synergy,

³⁶¹ Others, challenging ESA-style obligated payments models as impractical, propose a more corporate model of shareholder investment such as the Arab League’s ARABSAT program. But this model may also be impractical if the goals are to share benefits equally within consensus-based ASEAN.

³⁶² Noichim, “ASEAN Space Organization,” 72.

³⁶³ Chukeat Noichim, “Promoting ASEAN Space Cooperation,” *Space Policy* 24, no. 1 (2008), 10-12.

³⁶⁴ Noichim, “ASEAN Space Organization,” 167.

³⁶⁵ For several such proposals, see: Minoru Suzuki, “Toward the Establishment of Asia and the Pacific Space Agency,” *Journal of Policy Studies* no. 34 (2010), 57-62, <http://hdl.handle.net/10236/4813>; Doo Hwan Kim, “The Possibility of Establishing an Asian Space Agency,” *Singapore Journal of International and Comparative Law* no. 5 (2001): 214-226.

industrial development and capacity building. Detractors counter that many of these same achievements can be better accomplished by “strengthening nascent national space programmes, fostering intra-regional competition, and raising the profile of space activities in...national and regional political structures.”³⁶⁶ Important to note are the two viewpoints’ divergent perspectives on the relative value of cooperation and competition in motivating and financing developing country achievements in outer space. As we have seen in previous chapters, many increased investments in space programs in the last decade have indeed been incentivized by (peaceful) techno-national rivalry, with SCOSA’s activities as a smaller complement. This competition-cooperation duality is important as both play a role in facilitating Southeast Asian advancements in space; it prioritizes national interests but facilitates regional cooperation in areas of shared interest.

Of more practical interest than a true regional space organization are proposals for more frequent and inclusive project-based committees that seek to leverage overlapping priorities of the various Asian organizations within the “regional space regime complex” (APRSAF, APSCO, CSSTEAP, and ASEAN, etc.) as “building blocks” for consolidating space governance.³⁶⁷ Such a scheme would essentially constitute business as usual, with interested partners choosing to partner where interested. These multi-scalar constructs allow states to leverage project-specific advantages appropriately. For example, APSCO’s broad geography (stretching from Turkey to Peru) has been useful in working toward a “unified space observation network based on optical trackers” for which global reach is advantageous; it has been less useful for satellite slot-sharing schemes as single slots are rarely useful for more than a few partners.³⁶⁸ In contrast, ASEAN’s tightly clustered, equatorial geography has already been useful for virtual slot-sharing schemes,

³⁶⁶ Peter Martinez, “Is There a Need for an African Space Agency?” *Space Policy* no. 28 (2012), 142-145: <http://dx.doi.org/10.1016/j.spacepol.2012.06.011>; Timiebi Aganaba-Jeanty, “Precursor to an African Space Agency: Commentary on Dr. Peter Martinez ‘Is There a Need for an African Space Agency,’” *Space Policy* no. 29 (2013): 168-174, <http://dx.doi.org/10.1016/j.spacepol.2013.06.009>.

³⁶⁷ Xavier L. W. Liao, “Consolidate the Global Space Governance with Regional Cooperation Mechanisms as Building Blocks,” Beijing Space Sustainability Conference, Secure World Foundation, November 9, 2012, <http://www.swfound.org/events/2012/2012-beijing-space-sustainability-conference/>.

³⁶⁸ Asia-Pacific Space Cooperation Organization (APSCO), accessed June 6, 2014, www.apsco.int.

insofar as transnational purchases of commercialized data from regionally-oriented satellites can be considered sharing of a single space asset.

Other newsworthy ASEAN issues potentially benefitting from space applications include environmental issues and domain awareness. While disaster prevention and response is a key motivation for many a space investment, most projects, such as Indonesia's *Sahadev* or Vietnam's *VNREDSat*, have been national or received interest as multilateral projects for the larger Asia-Pacific region.³⁶⁹ In 1997, the Singapore *Straits Times* published a series of color satellite images for the first time that escalated cross-border tensions by facilitating finger-pointing at Indonesia for the annual transboundary haze problem. Yet, additional photos since, particularly in 2014, have revealed fires in Malaysian Borneo, and many of the companies responsible for swidden land-clearing are active across national borders. Multilateral solutions in the future are likely to include some measure of satellite verification. Similar problems of land use and pollution throughout the Mekong basin could also benefit. Regarding domain awareness, maritime registry efforts using satellite-enabled technologies could facilitate increased awareness with attendant effects on territorial disputes, piracy, and human trafficking. The above issues highlight, however, the *sub-regional* nature of many of ASEAN's international issues, which are particularly split between mainland and maritime clusters. The nature of these issues suggests that investments in specific space assets to address them will likely reflect the sub-regional nature of the problem.³⁷⁰

Given the salience of techno-national security motives for the various Southeast Asian space programs and the sub-regional nature of ASEAN's most pressing issues, it seems unlikely that a robust collaborative space architecture will emerge in the near future, although space investments—some of them cooperative—will increase. While

³⁶⁹ United Nations Economic and Social Commission for Asia and the Pacific, *Asia-Pacific Plan of Action for Applications of Space Technology and Geographic Information Systems for Disaster Risk Reduction and Sustainable Development, 2012-2017* (Bangkok, Thailand: 2012), <http://www.unescap.org/events/intergovernmental-meeting-asia-pacific-years-action-applications-space-technology-and>.

³⁷⁰ For example, wealthier maritime Southeast Asian nations with similar problems in environmental monitoring or maritime domain awareness may choose to invest in space technologies that specifically address these specific problems. Incentives for such breakout cooperation would likely be increased as relatively wealthier nations seek to ensure the dividends of their financial contributions to such projects primarily benefit themselves.

cooperation will continue, so will national rivalry; however, the relatively peaceful nature of competition due to the subordination of security interests within a broader developmental paradigm implies that both ASEAN and its individual member states will benefit from the increased technological and economic capacity such cooperative competition spurs. Furthermore, there is a role for ASEAN's COST-SCOSA to operate as an added ambassador for international S&T cooperation that provides a stronger collective posture from which to arrange cooperative international projects.

c. *Building Epistemic Communities*

In assessing the status and prospects for S&T development in Southeast Asia, Roger Posadas concludes that the techno-national strategies of Southeast Asian states to converge with great powers must now operate “amidst the challenges and opportunities of *technoglobalism*,” which is characterized by: (1) the internationalization of R&D and scientific communities; (2) the “integration of technological complementarities through strategic alliances”; and (3) “the international diffusion of technologies at much earlier stages of the life-cycle.”³⁷¹ In light of such findings, he recommends that ASEAN increase its competitiveness through pursuit of “technoregionalism,” which would build regional resilience better than through individual techno-national strategies.³⁷² A 2001 RAND study of S&T collaboration between countries with different levels of scientific capacity emphasizes the importance of technology transfer and also suggests that existing gaps in such collaboration are extremely detrimental toward shrinking the development gap.³⁷³ ASEAN states, therefore, while continuing to maximize the benefits of technology transfer from developed countries, would also be well served by complementing these schemes with more effective cooperation with each other in space S&T, to reduce individual investments in duplicative efforts and to unlock regional synergies. Importantly, such regional cooperation would result in expansion of the

³⁷¹ Roger Posadas, “The Development of Science and Technology in South-East Asia: Status and Prospects,” *Science, Technology & Society* 4, no. 1 (1999), 128, doi: 10.1177/097172189900400109.

³⁷² *Ibid.*, 129

³⁷³ Caroline S. Wagner, et al, *Science and Technology Collaboration: Building Capability in Developing Countries*, No. RAND/MR-1357.0-WB, RAND Corp, Santa Monica CA, 2001.

ASEAN space S&T epistemic community, as relevant personnel and sectors increased not only dialogue but also practical cooperation. This exchange would benefit the region's space S&T sector as technologies transferred from outside were forwarded throughout the region's interconnected economies, and it would also support construction of the broader ASCC by standardizing a regional cadre of scientific bureaucrats and elites and thickening backward linkages to other relevant sectors.

Ernst Haas et al. explored the role of S&T epistemic communities, suggesting that scientists within international organizations play an increasingly important role in transforming cognitive mindsets from purely competitive nationalism toward a better leveraging of specialized knowledge to address socioeconomic development and political problems.³⁷⁴ It is within such a framework that the ASCC can complement the AEC and APSC. Currently, despite decades of achievements, one of ASEAN's challenges is its lack of regional identity. ASEAN is often accused of being too ambitious, elitist, and "lacking [in] serious efforts to solicit public opinion."³⁷⁵ In one 2008 survey, only 60.7% of even elite university students were familiar with ASEAN; among the general populace, awareness is doubtless much lower.³⁷⁶ Many cite "low educational levels, economic disparities, differences in political and legal systems, and uneven information technology acquisition as major obstacles for an ASEAN Community initiative," yet these issues are precisely what could be addressed through the cooperative process of building regional virtual constellations to knit together the developmental aims of the various national space programs.³⁷⁷

Currently, many technicians and engineers within ASEAN's space industries must still be educated overseas; though international university partnerships seek to address this, the underfunding of public education throughout the region (outside Singapore) will

³⁷⁴ Haas et al., *Scientists and World Order*, 8-9.

³⁷⁵ Ravichandran Moorthy and Guido Benny, "Is an 'ASEAN Community' Achievable?: A Public Perception Analysis in Indonesia, Malaysia, and Singapore on the Perceived Obstacles to Regional Community," *Asian Survey* 52, no 6 (2012), 1043.

³⁷⁶ Mario Masaya, "ASEAN and EU Regional Identity Building: What Went Wrong?" *The Jakarta Post*, 16 February 2013, <http://www.thejakartapost.com/news/2013/02/16/asean-and-eu-regional-identity-building-what-went-wrong.html>.

³⁷⁷ Moorthy and Guido, "'ASEAN Community' Achievable?" 1065.

continue to stymie such efforts. Regardless, an increasing number of universities in Singapore, Malaysia, Thailand, and elsewhere are engaging in collaborative space S&T projects with foreign universities as well as teaching curricula in English (the working language of ASEAN), establishing media for a common academe. Other national attempts to engage the ASEAN public in the S&T fields are augmented by nascent region-wide efforts supported by the ASCC and AEC, as technology use within society is increasingly associated with higher standards of living.³⁷⁸ In one example of knowledge-sharing, in 2009 LAPAN launched an online aerospace library, billed the largest of its kind in ASEAN, in an effort to incite greater public interest and tap into the broader ASEAN community (particularly those disadvantaged by location) to LAPAN's own advantage.³⁷⁹

Haas also points out that the technical agendas of broad socioeconomic development compete with national priorities of "maintaining social stability and traditional values" due to the former's potential disruption of the latter.³⁸⁰ Furthermore, the persistence of "national pride...achieved by dint of efforts to develop an indigenous scientific elite and technological capability" counteracts the professed goal of regional equality in a way that "delay[s] the optimization of aggregate economic growth."³⁸¹ This phenomenon is certainly at work among ASEAN's member states, where cooperative rhetoric does not wholly subsume the space nationalism apparent in attempts to broaden sectorial competitive advantages that result in some regional duplications of effort at great expense. These competing priorities indicate that ASEAN is most likely in the near future to, at best, sustain suboptimal "incremental growth" as it adapts to meet new challenges, rather than reassess its values so that it operates under a more positive-sum regime of "managed interdependence."³⁸² SCOSA (indeed, ASEAN) is unlikely to be

³⁷⁸ "Greater Technology Use Linked to Higher Per Capita Income," Pew Research Global Attitudes Project, Pew Research Center, Spring 2013 survey, [Emerging Nations Embrace Internet, Mobile Technology](#), February 13, 2014.

³⁷⁹ "LAPAN Launches Online Library, Space Community," TMCnet.com, July 30, 2009, <http://technews.tmcnet.com/ip-pbx/news/2009/07/30/4299017.htm>.

³⁸⁰ Haas et al, *Scientists and World Order*, 233.

³⁸¹ Ibid.

³⁸² Ernst B. Haas, *When Knowledge is Power: Three Models of Change in International Organizations* (Berkeley: University of California Press, 1990), 4

adopted soon as an end in itself, rather than simply a means to achieve national ends.³⁸³ The result should be tempered expectations. ASEAN's primary reaction to major "ideational challenges" has been "localization," in which imported ideas of institutionalism are reconstructed to better match the local identity, and "inertia," which is "most likely if domestic conditions facilitate resistance" to "transformation."³⁸⁴ It is usually such transformation, the "construction of a new collective identity" that is required to counter new challenges.³⁸⁵ The challenge for the idea of greater ASEAN space cooperation, then, is to better balance the strong techno-national perceptions of space S&T's utility with increased appreciation of its own value. SCOSA, within the larger ASEAN Community-building agenda, has provided a foundation upon which to build a regional space architecture, but has yet to substantively bridge the independent national space programs. ASEAN space cooperation will likely plod ahead, and even receive greater attention, but it will remain a much smaller priority than national prestige projects in the near future.

At the same time, "there is powerful evidence that the subordination of science to cultural diversity is a thing of the past."³⁸⁶ The very similarity of Southeast Asia's scientific bureaucracies despite vast socio-cultural differences within the region is evidence of a prevailing consensus on the value of modernization and the role of space investments as a means to that end. Acceptance of this creed among scientific practitioners and some elites indicates that there will likely be a growing regional epistemic community that subscribes to such values and that the space community is an exciting growth field within the larger ASEAN Community.

³⁸³ Haas, *When Knowledge is Power*, 15.

³⁸⁴ Anja Jetschke and Jürgen Rüland, "Decoupling Rhetoric and Practice: The Cultural Limits of ASEAN Cooperation," *The Pacific Review* 22, no. 2 (2009): 179 and 194, doi: 10.1080/09512740902815326.

³⁸⁵ Ibid.

³⁸⁶ Haas et al, *Scientists and World Order*, 354.

D. IMPLICATIONS OF REGIONAL SPACE COOPERATION

ASEAN's cooperative behavior on space S&T supports the perception of ASEAN as an instrument of "hedging utility."³⁸⁷ Viewing ASEAN space cooperation and national space programs in this light "captures the sovereignty-centered and power-sensitive dimensions of ASEAN behavior quite well without ignoring the cooperative achievements of the grouping" that favor a "rather shallow multilateralism characterized by contingent, flexible, low-cost, thematically broad and only moderately accountable institutions" such as COST and SCOSA.³⁸⁸ Just as with economic integration, achievements by individual member states as they compete for comparative advantage is likely to have numerous positive-sum effects, as long as they are at least tied together by even the loose architecture of SCOSA (and APRSAF), to say nothing of their collective partnerships with other extra-regional space powers.³⁸⁹ As individual space capabilities are built, the capacity for meaningful cooperation increases accordingly.

One distinct revelation in ASEAN's space cooperation patterns is that the lines of interaction are not neat: rather, there exists an overlapping, multi-scalar network of iterative interactions. While space programs may have their origins in domestic politics, they connect nations, epistemic communities, and organizations in an ever-thickening web of relationships. These networks can not only facilitate increased opportunities to modularly pool resources for cooperation between interested parties, but also structurally define the boundaries of responsible behavior in space, as new norms are established and

³⁸⁷ This approach borrows from Jürgen Rüländ's exposition on the subject. Though his application applies generally to ASEAN as an instrument of broader "international institution-building," it is adapted here to highlight ASEAN's state-centric form of regionalism that exhibits strong protectionist characteristics while still retaining some utility as an intermediate vehicle for both regional and international cooperation. This "hedging utility" focuses more on "instrumental and pragmatic objectives than the explicitly normative agenda inherent in the essentially liberal properties of the 'multilateral utility' concept." Jürgen Rüländ, "Southeast Asian Regionalism and Global Governance: 'Multilateral Utility' or 'Hedging Utility'?" *Contemporary Southeast Asia: A Journal of International Strategic Affairs* 33, no. 1 (2011), 86 and 107.

³⁸⁸ Ibid.

³⁸⁹ John Ravenhill has extensively and quantitatively analyzed the positive-sum balance of economic integration within ASEAN and with extra-regional powers such as China (through the China-ASEAN Free Trade Area—CAFTA). See: John Ravenhill, "China's 'Peaceful Development' and Southeast Asia: A Positive Sum Game?" in *China's Rise and the Balance of Influence in Asia*, ed. William K. Keller and Thomas G. Rawski (Pittsburgh: University of Pittsburgh Press, 2007), 162; John Ravenhill, "Is China an Economic Threat to Southeast Asia?" *Asian Survey* 46, no. 5 (2006): 653-674; John Ravenhill, "Fighting Irrelevance: An Economic Community 'With ASEAN Characteristics,'" *The Pacific Review* 21, no. 4 (2008) 469-88, <http://dx.doi.org/10.1080/09512740802294697>.

the numbers of stakeholders increased. Global institutionalist and social interactionist theories thus lend credence to softer theories of technological determinism, in which the effects of new technologies are less influential in structurally constraining society than the human element is in guiding how technology is utilized. Therefore, previous dynamics of international interaction regarding the space environment are fundamentally changed as a global majority enters space. As more nations crowd into orbit, previous monopolies on capabilities are eroded and undesirable unilateral actions can be met by a louder chorus of stakeholders: Goliaths begin to look like Gullivers, still giant but vulnerable to entrapment by collective action.

E. CONCLUSION

Chapter IV has shown that even though space cooperation among Southeast Asian states is constrained by competitive motives, external alignments, and resource constraints, notable opportunities for regional space cooperation exist. One important result of such cooperation is the growth of bureaucratic and epistemic communities amid an ever-thickening web of international cooperation across multiple levels. In light of competitive motives that build capacity discussed in earlier chapters, this reveals that cooperation and competition are not mutually exclusive; rather, they are two sides of the same coin in the currency of international statecraft. To a large degree, both competitive and cooperative agendas complement—rather than contradict—each other in a positive-sum game, in which a quorum of regional actors is made better off due to the substantially peaceful nature of the process. Even so, the sub-regional nature of interests and the influence of external space powers is notably salient, so while such positive-sum interaction may be beneficial in the near future, if emerging divisions are not sufficiently bridged within a regional architecture then problems may emerge over the horizon.

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V. CONCLUSION

A. SUMMARY

The data indicate increasing expenditures by Southeast Asian countries in developing space capabilities and building national space bureaucracies. Given the longevity of existing investments and their symbolic importance in a developing region, such trends seem likely to be sustained in the future. This thesis described the conditions under which ASEAN member states choose to invest national resources in space programs as vehicles for cooperation and competition with each other and within the international system.

Chapter I emphasized the importance of national space programs as a component of national security and development policies due to dual-use perceptions and broad range of applications across a number of sectors. The chapter also provided a regional context in which to analyze Southeast Asian space developments based on schools of thought built on theories of international relations: space nationalism (realism), technological determinism (structural realism), global institutionalism, and social interactionism.

Chapter II examined national space programs, including domestic motivations for space investments. Realist principles of space nationalism and the structural influences of technological determinism helped identify that Southeast Asian space investments are viewed as a techno-national means of building national resilience. The small postcolonial states of Southeast Asia seem driven by an imperative to work toward convergence with developed nations to reduce their vulnerability amid a shared consensus (with constructivist elements) that space technology is an indispensable socioeconomic multiplier in the modern global economy. Critics who challenge the expense of space investments in developing countries fail to appreciate the *utility* with which such programs are viewed (measured in more than just dollars); for most Southeast Asian states, climbing the space ladder is an essential means of internal balancing. Furthermore, while the focus is predominantly on peaceful applications of space technology for

socioeconomic development, broad perceptions of national power aggregation ensure that security considerations are certainly present.

Chapter III explained domestic forces driving foreign policy regarding Southeast Asian states' partnerships with extra-regional space powers. External sources of finance and technical capacity remain indispensable for Southeast Asian countries emerging space programs due to the complexities of space technologies and the relative lack of local capacity. While space powers actively court Southeast Asian states for space cooperation, to a large degree reception to such partnerships are determined by states' priorities. Additionally, Southeast Asian states are pulled in different directions by their competing space policies and domestic priorities, such that external balancing plays a large role in who states choose to partner with. While nearly all Southeast Asian states seek to maintain an independent balance among foreign providers of space services, a seam is forming between mainland and maritime states due to different priorities within the larger geopolitical context. While such rifts are certainly not exclusive to space cooperation, again, it is an indicative field, and the degree to which such rifts are allowed to open may add to strong centrifugal forces pulling against the ASEAN community-building agenda.

While realist perspectives of competition dominate the first two chapters, chapter IV's insights of global institutionalism and social interactionism reveal how incentives toward cooperation work to balance the competitive side of the equation describing Southeast Asian space programs. Despite economic competition within the region and disparate external alignments, ASEAN's member states can also cooperate with each other in order to collectively hedge against the influence of large global power blocs. A broad agenda for identity-building within the ASEAN Community and the very real "security complex" within the region ensure that some centripetal forces continue to oppose the centrifugal ones at work. Therefore, while states use their space programs to build their own independent space capabilities and competitive advantages, the result is largely a positive-sum game that enhances regional resilience. Against the backdrop of official bureaucratic community-building, the role of elites in setting an international, cosmopolitan agenda contributes toward building a regional S&T epistemic community

that has a real chance to evolve and benefit a stronger regional identity in the future. Nonetheless, these centripetal forces are still weak compared to centrifugal forces of techno-nationalism and external alignments, though increasing human capital and an integrated economy will build greater S&T capacity for regionally-sourced joint projects in the future.

In summary, security considerations for space development in Southeast Asia are present as elsewhere, just subordinated within a developmental agenda (chapter II). ASEAN member states balance their cooperative endeavors in space technologies among a number of space powers and offshore balancers based on domestic perceptions of security and independence (chapter III). A nascent regional space S&T community could provide a vehicle for ASEAN cooperation in the future, particularly through identity-building within an international epistemic community (chapter IV). Cooperative and competitive forces among these smaller states actually complement each other within a multi-scalar international network, perhaps uniquely when compared to the strong competitive forces that characterize the great powers in space. Patterns of space cooperation and competition among Southeast Asian space programs balance these two activities, as well as regional centrifugal and centripetal forces, in a relatively peaceful, positive-sum game for national and regional space development.

B. LOOKING AHEAD

The cross-domain functions of space technologies and the geopolitical dynamism of Southeast Asia make the region's space programs a useful weathervane to indicate active vectors within the world system. Technological diffusion and policies of national empowerment indicate a wealthier future with increased actors in a multi-scalar, multipolar world with an increasingly interconnected economic and security complex. Enhanced national capabilities indicated by space savviness could increase the potential for conflict, as more connections mean more potential for a rupture that cascades through the complex system. However, space also offers unique opportunities for cooperation, as an increasing number of international stakeholders are confronted by the challenges of the unique physics, fragile environment, and expensive barriers to entry of the

increasingly crowded commons of the final frontier. Within ASEAN, increased capacity is likely to facilitate increased regional cooperation, though this will likely begin first with sub-regional bilateral and multilateral breakout groups cooperating on specific projects before spreading to formalized organizational efforts.

Within the global international arena, along the lines of their Zone of Freedom, Peace, and Neutrality and Nuclear Weapons Free Zone the small states of Southeast Asia are likely to oppose any weaponization of space that threatens their increased reliance on space-based technologies. Those space investments represent an even larger relative expense within their more limited budgets, and they are acutely conscious of their inability to compete with space powers seeking to actively establish or undermine space control through greater militarization of space. Southeast Asian states will likely continue to support policies of space sanctuary and equitable access to space-derived benefits in the future.

C. IMPLICATIONS FOR U.S. POLICY

Southeast Asian states will continue to require extra-regional partnerships for space S&T development well into the future, creating opportunities for the U.S. as a potential market and a high-profile avenue for international outreach to a strategically important region. While China is an indispensable nation in Southeast Asia, the region is hungry for offshore balancers, and the United States commands a premium lead in the space sector. Prospective partnerships should be explored and exploited.

Regarding space, the United States must avoid focusing on only key players while missing the growing chessboard of actors, all of whom play a specific role in the game. The United States should engage not only longtime strategic partners, but the region collectively, so that rifts do not develop within the region that threaten to unravel the currently peaceful “security complex.” Assistance in developing an *ASEAN-EOS* or similar virtual constellation is one such opportunity. Additionally, the example of Vietnam demonstrates the value of Japan as a back door to regional cooperation in areas in which it may otherwise be limited.

The peaceful prescriptions of the region's space programs open opportunities for cooperation on developmentally-relevant projects. Technical assistance and space technology transfer can facilitate development of epistemic communities that build human capital and enhance regional development in a larger positive-sum exchange. The relative political innocuousness of scientific communities provides an opportunity to consistently maintain open channels to international elites despite political developments that may preclude greater official cooperation and assistance. Isaac Asimov wrote, "Never let your sense of morals prevent you from doing what is right."³⁹⁰ The United States must not trip over its own sense of justice nor succumb too eagerly to space protectionism in an increasingly interconnected international paradigm of its own making. The United States should maintain its commitment to removing most commercial satellite technologies from ITAR restrictions in the future in order to reestablish and maintain its market dominance in this sector.³⁹¹ It must remain consistently open and not retreat behind such protectionist walls again. In the vein of technological determinist arguments, the United States should not let fear of technology's worst potential uses drive state policy; rather, technology should be socially constructed as a tool (for soft power and otherwise) to achieve national policies.

Due to small states' unique perceptions of power, they can often be more prone to cooperate through international institutions because they provide an opportunity for a louder collective voice. As the international regime in space changes due to a dramatic increase in national stakeholders, the United States should work to maintain a favorable global institutional regime from a position of leadership. Withdrawal from and failure to ratify key treaties due to notions of self-interested exceptionalism are counter-productive in the current international order and noted by states of all sizes. Finally, the increasingly

³⁹⁰ Isaac Asimov, *Foundation* (New York: Bantam, 1991), 173.

³⁹¹ Though the United States has certainly remained a consistent provider for the Southeast Asian space market, its early dominance has clearly decreased. Though some of this was likely inevitable as the number of national providers competing in the market increased, the onerous permitting process imposed by ITAR has certainly not helped. That some states would choose to pay more for ITAR-free satellites that can then be launched on cheaper foreign boosters indicates that U.S. protectionist policy has at least somewhat limited its profits from the 21st century's developing country space boom.

“crowded orbits”³⁹² of LEO are a uniquely fragile commons. Space control rhetoric aside, the United States cannot control everything that accesses outer space; as an increasing number of national players enter space and cheap, small, disposable satellites penetrate the market, efforts to register and mitigate space debris must be at the forefront of national policy. Active engagement with an active region in an active sector is paramount.

³⁹² Moltz, *Crowded Orbits*.

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