



C H I N A A E R O S P A C E
S T U D I E S I N S T I T U T E

China's Space Program Through The Lens of Irregular Warfare Theory

COL William Stephens

Printed in the United States of America
by the China Aerospace Studies Institute

To request additional copies, please direct inquiries to
Director, China Aerospace Studies Institute,
Air University, 55 Lemay Plaza, Montgomery, AL 36112

All photos licensed under the Creative Commons Attribution-Share Alike 4.0
International license, or under the Fair Use Doctrine under Section 107 of the Copyright
Act for nonprofit educational and noncommercial use.

All other graphics created by or for China Aerospace Studies Institute

E-mail: Director@CASI-Research.ORG

Web: <http://www.airuniversity.af.mil/CASI>

[@CASI_Research](https://twitter.com/CASI_Research)

<https://www.facebook.com/CASI.Research.Org>

<https://www.linkedin.com/company/11049011>

Disclaimer

The views expressed in this academic research paper are those of the authors and do not necessarily reflect the official policy or position of the U.S. Government or the Department of

Defense. In accordance with Air Force Instruction 51-303, *Intellectual Property, Patents, Patent Related Matters, Trademarks and Copyrights*; this work is the property of the US Government.

Limited Print and Electronic Distribution Rights

Reproduction and printing is subject to the Copyright Act of 1976 and applicable treaties of the United States. This document and trademark(s) contained herein are protected by law. This publication is provided for noncommercial use only. Unauthorized posting of this publication online is prohibited. Permission is given to duplicate this document for personal, academic, or governmental use only, as long as it is unaltered and complete however, it is requested that reproductions credit the author and China Aerospace Studies Institute (CASI). Permission is required from the China Aerospace Studies Institute to reproduce, or reuse in another form, any of its research documents for commercial use. For information on reprint and linking permissions, please contact the China Aerospace Studies Institute.

Cleared for Public Release, Distribution unlimited.

China Aerospace Studies Institute

CASI's mission is to advance the understanding of the strategy, doctrine, operating concepts, capabilities, personnel, training, organization, of China's aerospace forces and the civilian and commercial infrastructure that supports them.

CASI supports the Secretary, Chief of Staff of the Air Force, the Chief of Space Operations, and other senior Air and Space leaders. CASI provides expert research and analysis supporting decision and policy makers in the Department of Defense and across the U.S. government. CASI can support the full range of units and organizations across the USAF, USSF, and the DoD. CASI accomplishes its mission through conducting the following activities:

- CASI primarily conducts open-source native-language research supporting its five main topic areas.
- CASI conducts conferences, workshops, roundtables, subject matter expert panels, and senior leader discussions to further its mission. CASI personnel attend such events, government, academic, and public, in support of its research and outreach efforts.
- CASI publishes research findings and papers, journal articles, monographs, and edited volumes for both public and government-only distribution as appropriate.
- CASI establishes and maintains institutional relationships with organizations and institutions in the PLA, the PRC writ large, and with partners and allies involved in the region.
- CASI maintains the ability to support senior leaders and policy decision makers across the full spectrum of topics and projects at all levels, related to Chinese aerospace.

CASI supports the U.S. Defense Department and the China research community writ-large by providing high quality, unclassified research on Chinese aerospace developments in the context of U.S. strategic imperatives in the Asia-Pacific region. Primarily focused on China's Military Air, Space, and Missile Forces, CASI capitalizes on publicly available native language resources to gain insights as to how the Chinese speak to and among one another on these topics.

This article¹ examines the question of whether the PRC is using its space program as a method of irregular warfare with the goal of neutralizing the United States as a threat to its goal of achieving global hegemony. For purposes of this paper, a campaign of irregular warfare is defined as a “struggle to influence populations and affect legitimacy.”² After examination of Chinese actions in Africa, specifically in the emerging satellite technology sector, the inevitable conclusion must be a resounding yes.

Before examination and analysis of how it is part of an irregular warfare campaign, it is useful to examine the goals, the core tenants, and the history of China’s space program. China has explicitly stated one of the end goals of its space program is to surpass the United States and become a “strong space power (□ □ □ □)” and achieve “the great dream” by 2045, before the 100-year anniversary of the founding of the Communist Party in 2049.³ China’s aerospace industry follows “three key spirits” which could be considered guiding tenants in the pursuit of these goals. The three spirits are: “the traditional” spirit, the “two bombs-one satellite” spirit, and the “crewed space” spirit.”⁴ These “spirits” are considered the soul of the program and provide a deep connection to the country’s history and underlying virtues, a connection and remembrance to the beginning roots of the space industry in China, including the struggle of the Chinese people during that period, and they embody the virtues which will continue to propel the Chinese towards space domination.⁵ The first spirit, the “traditional spirit” consists of the spirit of Chinese ancient traditions and underlying values, primarily related to Confucius’ teachings, including balance, community, family, righteousness, and loyalty to the State.⁶ The second spirit is the “two bombs-one satellite” and refers to the origins of the Chinese aeronautical programs when, using extremely limited resources during a period of national strife in the 1960s and earlier, it was still able to develop the atomic bomb in 1964, and an intercontinental ballistic missile program, as well as develop and launch a satellite, the Dongfanghong, in 1970.⁷ The third spirit refers to the current era, specifically, the achievement in 2003 of crewed space flight despite not yet being one of the global space powers at that time.⁸ These “three spirits” permeate the culture of the Chinese aerospace industry.

As to the origins of the space program, as described in the “two bombs – one satellite” spirit, the Chinese have been developing ground control (otherwise known as telemetry, tracking, and control stations) technology since the 1950s with the help of the then-Soviet Union, a major space power at the inception of the space race.⁹ In the 1970s, instead of the Soviets assisting the Chinese, it was the United States. During this period, the U.S. and China were cooperating in tracking U.S. satellites, using technology and equipment provided by the U.S., and it was the developments made during this period that allowed China to successfully launch its first satellite, the Dongfanghong 2 in 1984.¹⁰

Historically, China’s aerospace sector was almost exclusively dominated by the State. More mixed ownership corporations have entered the market after 2014 due to commercial lending policy changes, however, the sector is still heavily influenced by the State. Two of China’s government aerospace organizations are the China National Space Administration (CNSA)¹¹ and the Chinese Aerospace Science and Technology Center (known as CASC).^{12,13} As per the CNSA, it is:

[T]he government agency of the People's Republic of China responsible for civil space management and international space cooperation, and it performs the

corresponding management responsibilities of the government.¹⁴ ...On behalf of the Chinese government, organize or lead activities such as foreign exchanges and cooperation in the aerospace field.¹⁵

The CASC is a state owned enterprise which originated from China's military unit, the Fifth Research Institute of the Ministry of Defence, but now consist of "8 large R&D and production complexes, 11 specialized companies, 13 listed companies and a number of directly affiliated units."¹⁶ While there has been a high level of state-sponsored research and civil/military fusion over the last 60 years, there has also been a rapid increase in private companies entering the space sector.¹⁷ As of July 2020, there were over 100 aerospace companies¹⁸ with approximately 30 percent of these companies still being State-funded, in whole or in part.¹⁹ This is mainly due to the State Counsel's release of Guo Fa [2014] No. 60,²⁰ which was a declaration that private loans and funding could be used "[t]o encourage the private capital's participation in China's construction of civilian space infrastructure," including construction of, launching, and operating various satellite systems."²¹ This declaration provided the intended effect, resulting in opening lines of capital for new, private or semi-private, aerospace companies, with over 80 companies being started since 2014.²²

Since 2015, the People's Liberation Army Strategic Support Force (PLASSF) has the primary responsibility for coordinating the methods of electronic warfare, including space and cyber warfare.^{23,24} The PLA Space Systems Department (SSD) [□ □ □ 统部] a service of the PLA's Strategic Support Force [□ □ 军战略支援部队], has been the main entity in charge of data to establish information dominance.²⁵ Much but not all ground control infrastructure is under a separate entity, the China Satellite Launch and Tracking Systems Department [□ □ 卫星发射测控系统部].²⁶ Amongst other things, this entity helps other countries build ground control and launching stations.

There is a significant amount of literature regarding China's space program and how it is being used as a means of military strength, economic expansion, and global influence. In addition, there is a broad consensus that absent any counterbalancing actions by the U.S. or other space agencies, such as the European Space Agency, China is on a trajectory to potentially dominate outer space technology. In reviewing the literature, while there is a large amount of research and consensus on China's military capabilities that utilize the technology developed in the aerospace industry, there is a gap as to how the space program is part of an irregular warfare strategy for the PRC.

One of the earliest discussions as to how China began to reorient its military towards space applications is "China's Military Role in Space," by Dean Cheng.²⁷ This article was written in 2012 and provided excellent insight as to how China was using its economy to grow the space programs and military might especially as it was written before the 2015 reorganization of the space programs in the People's Liberation Army when the Strategic Support Forces (SSF) was formed and is now responsible for most technology used in military responses.²⁸ At the time the article was written, it was presumed that China would continue to develop its space technology as a means of conducting tactical and operational warfare against other countries which had a large reliance on space capabilities, such as the United States' use of Global Positioning Satellite (GPS) for precision-guided bombs.²⁹ Further, from a tactical perspective, it was illustrated that China would use space-based technology, in combination with a large

geographically dispersed network of robust supporting ground infrastructure, to provide it with informational strategic advantages without the same vulnerabilities as other countries with large, more centralized satellite observation networks.³⁰ The article accurately predicted that satellite technology and a large ground infrastructure support system would allow greater capabilities for offensive and defensive operations in space, information dominance, and help ensure space deterrence.³¹

There is a contrary argument in the literature that China is not, and will not, engage in a space race for dominance nor will it engage in attacks against United States satellites or systems as these attacks would provide limited strategic value or benefits.³² In a well-researched paper, Jaganath Sankaran argues that while the U.S. must continue to advance its space and satellite capabilities, China would gain little military advantage if it elected to attack the U.S. in the space domain.³³ The paper also proposes that since neither side would gain a large tactical advantage by using anti-satellite (ASAT) offensive operations, that the U.S. could instead focus on cooperation versus competition with China and the “U.S. should use all available diplomatic leverage to partner with China and share [space situational awareness] data to make it a part of the global space community.”³⁴ The paper also proposes ground rules for space operations, similar to arms control agreements, which have been traditionally rejected by the U.S., and asserts that the U.S. failure to cooperate is “short-sighted and flawed,” as failure to engage feeds into the belief that the U.S. is a threat to China.³⁵ This article, written in 2014, is in direct contrast to the earlier article written in 2012 which indicated the U.S. is in danger of failing to take the Chinese space program as a serious threat to U.S. national security.

Since both of those articles were written, China has continued to develop its space programs, and the programs have become additional means of influence, while the economy became its own line of effort in the competition with the United States. “China’s Space Power & Military Strategy - The Role of the Yaogan Satellites,” by S. Chandrasheker and N. Ramani, published in 2018, demonstrates the evolution of the Chinese space program from 2014 to 2018 and how, as of 2018, China was fully capable of engaging the United States in space.³⁶ This article reflects how one satellite program is illustrative of Chinese ambitions to replace the United States as the pre-eminent space power and makes the compelling argument that China is using the satellite program as a method of warfare to “fight and win local wars under informationization conditions.”³⁷ The article masterfully demonstrates how the capabilities of the Yaogan satellite system, along with the reorganization of the PLA to flatten command and control of information and assets, provides military commanders exceptional operational and strategic capabilities, giving China major tactical advantages during any engagement. While this article illustrates the tactical advantages of the satellite program, it was limited in scope to military tactics versus China’s overall strategy.

Two recent reports, both by the China Aerospace Studies Institute, a division of the United States Air Force’s Air University, are critical to understanding the current capabilities of China, as well as the importance of the narrative of the Chinese space programs. A report published in 2021, “China’s Ground Segment: Building the Pillars of a Great Space Power” extensively discusses the history of the Chinese space ground segment, the development of large infrastructure in support of space technology, and the reorganization of the PLA to maximize the military effectiveness of the military space program,³⁸ as was foretold in the 2012 article by Dean Cheng. This report conducts a full

review of source documents and speeches to crystalize China's ambitions for space, which are driven by building an infrastructure that is both geographically dispersed and decentralized. Further, it provides insight into how China is using its influence with multiple partners across the world to build ground stations in other countries, providing it with a means of soft power projection. As early as 2015, the Chinese Ministry of Finance was jointly supporting the space program as it would help "build a technologically advanced, highly efficient civil infrastructure system with global coverage that supports economic and social development domestically and globally," including building a mega infrastructure project with "coverage wherever [China has] national interests."³⁹

An earlier report by the same organization, issued in October 2020, entitled "China's Space Narrative, Examining the Portrayal of the U.S.-China Space Relationship in Chinese Sources and its Implications for the United States" examines the evidence in concluding the "Chinese space program presents military, economic, and political challenges to the United States."⁴⁰ In the report, the China Aerospace Studies Institute(CASI) examines the role of the CCP and how the advances in the space sector support the CCP's "political, economic, and military interests," as well as the CCP's goals to make "China rich, strong, and proud."⁴¹ The authors make the critical point that China is seeking to become the "enlightened, benevolent hegemon whose power and legitimacy derive from its ability to fulfill other countries' security and economic needs - in exchange for their acquiescence to Chinese leadership."⁴²

The United States Congress is actively tracking the capabilities and potential threats posed by the Chinese space programs. In a March 2020 report, *China's Space and Counterspace Capabilities and Activities*, the U.S.-China Economic and Security Review Commission concludes that China's investments in the space program will have a "significant influence on U.S. interests, both militarily and strategically."⁴³ The report reviews the development of the satellite program, dual-use technology, most notably the expansion through the BeiDou⁴⁴ company, and concludes these programs may allow China to increase domination of the outer space atmosphere as well as to increase influence through partnership programs.⁴⁵ For example, the expansion of China's GPS allows it to use this data in multiple civilian sectors while simultaneously severing other countries' reliance on American GPS systems. These actions further cement reliance on China, including reliance on weapons produced in China and sold to other countries, which increases Chinese influence in those locations, while these same international partnerships allow China to take advantage of improvements in its own technology.⁴⁶ In summary, the report finds that "the preservation of the CCP's monopoly on power as an overriding goal, a growing space presence consolidates the Party's domestic and international legitimacy."⁴⁷

The prevailing literature and reports on Chinese capabilities typically discuss the space program's military strengths and weaknesses, the ends-ways-means, economic efforts, etc. However, missing from the prevailing literature is an analysis that ties together each line of effort and provides a viewpoint as to how the space program aligns for one cohesive strategy, specifically, how China is using these programs as a strategy in conducting irregular warfare. Several reports touch on the concept of China building legitimacy through space program, however, they fail to tie this pursuit of legitimacy to a campaign of irregular warfare.

For purposes of this paper, a campaign of irregular warfare is defined as a “struggle to influence populations and affect legitimacy” and it will be demonstrated that the Chinese are using the space program as a method of irregular warfare.⁴⁸ To understand how the Chinese are using the space program as a method of irregular warfare, it is important to understand the analysis and methodology of irregular warfare, including the strategic analysis and the strategic response framework.⁴⁹ As part of the initial strategic analysis for an irregular warfare campaign, the following questions of the actor/actions must be engaged:

1. What is the threat group doing politically?
2. How is the group exploiting domestic alliances to better reach its objective?
3. How is violence used in support of its political project?
4. How is non-violence used?
5. What is the role of the internationalization of the group’s struggle?⁵⁰

As part of the strategic estimate and framework, the “problem” must be determined, the “roots” of the problem examined; the “frame and narrative” by the antagonistic must be understood; the “threat strategy”, including the ends-ways-means and the center of gravity by the antagonist must be examined; and finally, the “present response” by the party facing the aggression must be fully understood.⁵¹ Once these questions are examined during an initial analysis focusing on the malign actor, a strategic response may be formulated by utilizing a similar framework and the same questions from the perspective of the actor/actions responding to the original antagonist. As part of a strategic response, the following framework should be utilized: concept of response, legal authority, assumptions, implementation, and risk assessment & mitigation. Each of these aspects of a response must be reviewed and formulated to provide an effective response.⁵² Although the strategic estimate is provided in this paper, the strategic response is not. The framework for the response is included for completeness of analysis, however, this paper will only the strategic estimate.

Using the IW framework provides the only satisfactory analysis of the various actions by China regarding its space programs and will provide a basic framework for crafting an appropriate response. This framework will be utilized herein using countries in Africa to illustrate the IW campaign. However, China is using the same IW campaign in multiple regions of the world, including in the Pacific and Central America.⁵³ A full analysis of each of these regions is outside the scope of this paper. However, regardless of the region discussed, the same framework and analysis will result in the same conclusion – that China is using its space programs as a method of engaging in irregular warfare against the United States.

STRATEGIC ESTIMATE

The irregular warfare analysis framework begins with a discussion of the problem. In this instance, the problem is that the United States faces increased global competition from the PRC as the latter pursues its goal of displacing the United States as the global hegemon.

China is rapidly developing its space and satellite program in combination with partner countries and these programs are an extension of Chinese influence through soft power, especially in Africa. While Africa is not the only region of the World in which China is engaged in partnerships, the countries around the Equator are attractive partners for launching satellites, as this geographic band allows space payloads to break free from the Earth's gravitational pull more quickly due to the higher speed of the Earth's rotation at the Equator. In other words, it is easier to get into orbit faster, using less fuel, all while carrying a heavier payload.⁵⁴ Currently, as of July 2020, there are 20 African countries that have some type of space program and China has known space-related engagements with 18 of these countries. Activities include launching satellites, collaborative research projects, and developing components for the Chinese Chang'E lunar program.⁵⁵

The roots of the symbiotic partnership with African countries are based upon a balance between fear and need and the space programs are an extension of this dynamic. China fears that it will not be able to compete with the United States in great power competition. Further, it needs additional resources and markets to continue economic growth, which will ensure the CCP remains in power. African countries need economic growth and global power equity and fear not being able to achieve either at present without international partners.

In the past, before its rise in power and influence, China has traditionally feared that if it is not able to compete with the other great powers, it risks being subjugated by these countries again, similar to the age of imperialism in the 1800s. The CCP fears being replaced by a Western form of government, such as an American-style republic/democracy. Democracy itself is an existential threat as it values the individual over the party/government. This is the opposite of China's perceived priorities which put the Party/State over personal interest.

Economically, China needs continued resources to feed its economy and markets to export Chinese products to. Africa has the resources to feed this insatiable need for resources and markets. The Belt and Road Initiative, including the Digital Belt and Road Initiative as well as the Space Silk Road Initiative, will allow China to build a physical and electronic supply route through multiple countries with multiple allies, each with independent resources. Xi Jinping, the President of China, has stated many times in speeches that the biggest bottleneck to Africa's success is its insufficient infrastructure and infrastructure is the leading priority when these countries request assistance.⁵⁶ Infrastructure can be the building of main supply routes such as roads, bridges, shipping terminals, and train networks. However, equally important is the building of reliable power grids, communication networks, and internet connectivity.

This expansion of infrastructure and cementing of relationships will fulfill China's need for additional partners in the future in the event there is a larger conflict and gain partners for so-called mutually beneficial economic relationships. African countries are

willing to engage in these partnerships based upon the need for technology, a desire for a greater role internationally, and the fear of not being perceived as legitimate global partners which can provide equitable consideration in a partnership. African countries need partnerships to assure growth and gain global stature, as most are currently not major global players politically or economically. The only way to gain power rapidly is through collective partnerships and economic influence. These countries are cognizant of their respective tremendous potential, such as being rich in resources and human capital, and seek opportunities to capitalize on these resources. Partnerships with China are a natural expansion of pre-existing long-term relationships and commonality of history.

China frames the narrative of U.S. domination as one built on oppression and China offers African countries an alternative redemptive path. China claims that Western powers, as represented by the United States, engage in exploitation and oppress the world through capitalism, which is an extension of democracy. This message has resonance as both China and several African nations suffered under Western colonialism or economic imperialism. China frames its narrative to illustrate that it has cast off the oppression, leading to economic superiority, and as such, it is a country to emulate. China's vision is that this alternative path towards independence is possible through mutual acceptance, partnership, and mutual collaboration.

The "America First" rhetoric plays right into this diagnostic frame. Where China says partnership – America says, "America first!" China apportions the blame for some of the discord around the world and in Africa on the United States' engagement of a capitalistic regime of oppression across the world, including oppressing countries that are struggling to achieve global influence and trying to meddle in private and internal affairs of state. China can claim that African countries that are struggling to be part of the technological revolution are prohibited from doing so due to the inherent racism of the United States, which only views other countries as a resource to control as capitalism is the new colonialism.

The Chinese Communist Party's (CCP) goal is to remain in power, and it can accomplish this by illustrating the legitimacy of the political regime which currently exists.⁵⁷ The political regime has produced remarkable economic prosperity and growth, thus illustrating the legitimacy of the Party. As the Party has produced immense prosperity in the past, it must remain in power for the future so this growth can continue. If it remains in power, the past, which was often characterized by oppression and poverty, will be overcome, and tomorrow's future will be even greater than the past or the present.⁵⁸ China offers a chance for select countries to help develop its space program, climb the ladder of technology associated with the program, and build a stronger, more prosperous economy.

Throwing off the shackles of servitude and oppression by every African citizen is central to the prognostic framing of China in Africa. China can suggest that the United States' capitalistic system is an extension of that oppression and it is trying to control the rise of African nations as these nations seek to increase their technology base and space programs. The reliance on the American GPS technology is an example of a shackle of capitalism that serves only to keep African countries bound in subservience. The African countries should seek other partners, including willing partners like China. By throwing off American repression and joining China, there will be economic prosperity and growth in African countries, especially in the area of outer space emerging technologies. In the

new world order, Africans will be at the forefront of technology innovations with China, as an equal partner. The only costs which these countries must pay is to join China and other partners in the Belt and Road Initiative so that all citizens may enjoy mutual acceptance, economic prosperity, and freedom from Western influence.

There are multiple reasons why a country in Africa should be inspired to join China in its space exploration missions; however, the most important is equality, both political and economic. China's message is that it is only interested in being a full and equitable partner and it is willing to provide any partner with the technology to help all of humanity. For the African partners, this is a welcome motivation as each realizes that China's assistance will potentially encourage economic growth and wealth, which in turn will produce domestic and international power and influence. China stresses that the advances are "open, equal, mutually beneficial, and inclusive" especially for countries in need or just entering the space sector.⁵⁹ The very logo of the Chinese Aerospace Science and Technology Corporation (CASC) is a testament to the motivational framing of China to any partner.⁶⁰



"China Aerospace Science and Technology Corporation's logo is composed of straight lines, circles, alphabets and an arrow. The arrow symbolizes the soaring launch vehicles, the energetic aerospace staff and the thriving aerospace cause. It also looks like the mandarin Chinese character "ren", an example of our company's business concept—people-oriented and working together. The three concentric circles are symbols of the first, second and third cosmic velocities, which indicate the features of [the] aerospace industry. As the lines of the circles become thicker from inside out, they can also show a momentum of development and growth."

The narrative is that by joining China in pursuit of a better life and society through technology, a country will receive this technology for free, which can then be used for humanitarian purposes, to improve the quality of life for the people of the country, and to build a country based upon an economy without Western reliance or interference. China's implied promise with this technology is that the people in that country will never be hungry or thirsty again.⁶¹

The promise of free technology that can alleviate human suffering, hunger, and thirst has a powerful appeal. For countries not blessed with abundant accessible natural resources, it is a promise of hope and great riches in the future. This is reflected in the African Union (AU) Science, Technology, and Innovation Strategy for Africa 2024:

The AU Science, Technology and Innovation Strategy for Africa (STISA) places science, technology, and innovation at the epicentre of Africa's socio-economic development and growth and emphasises the impact the sciences can have across critical sectors such as agriculture, energy, environment, health, infrastructure development, mining, security and water among others. The strategy envisions an Africa whose transformation is led by innovation and which will create a *Knowledge-based Economy*. STISA is anchored on six (6) priority areas namely:

- i. Eradication of Hunger and Achieving Food Security
- ii. Prevention and Control of Diseases
- iii. Communication (Physical and Intellectual Mobility)
- iv. Protection of our Space

- v. Living together in peace and harmony to build the society
- vi. Wealth Creation⁶²

Once the technology is developed, it can generate significant returns on that investment, but the African countries acknowledge that investment is required both financially and politically before these programs come to fruition. Again, referencing the STISA framework, “Conducive political and financial environment is a requirement for strengthening creativity and technological innovation that brings about entrepreneurship in new technological frontiers such as nanotechnology.”⁶³ Financially, China has indicated that it will provide the capital to fund technology growth and train personnel and it will do all of this because of the mutual respect for partners versus any global power leadership ambitions.⁶⁴ Politically, China offers a vision of the world where African countries are equal global partners versus being relegated to the role of a “third world country” to be ignored on the global stage. Further, China has indicated that it “respects the legitimate interests and values of nations, regardless of their social systems or their level of development.”⁶⁵ This can be a powerful incentive to countries that are newly formed, which have been marginalized in the past or have been exploited/subjugated by colonial powers.

China’s development of its aerospace program in conjunction with African partners does help these partners achieve greater advancements in technology, especially through data collection and collaboration, but it is not done solely for altruistic reasons. This mutual development provides China with greater soft power influence and it mutually benefits China by enabling even greater technological breakthroughs in China’s aerospace industry which will also enable advances in its military.⁶⁶ For example, if a country develops a new type of satellite or artificial intelligence for guidance of an existing satellite in conjunction with a Chinese corporation or using Chinese venture capital, China will immediately have access to this leading-edge innovative technology and can immediately use this technology in improving its own civilian and/or military programs, such as in conjunction with its highly developed missile system, or market this technology to others, increasing its economic prosperity.⁶⁷

China freely acknowledges its use of aerospace technology for military purposes. According to the China Aerospace Science and Technology Center (CASIC), its corporate mandate is to “secure peace with aerospace technology” and ensure “military–civilian integration development” to empower the military with the latest technology.⁶⁸ For China’s partners, the message is even more clear: “your security–our responsibility.”⁶⁹

As of 2018, 45 countries in Africa had signed bilateral agreements with China’s State Administration for Science, Technology, and Industry for National Defense (SASTIND) to share defense-related technology and build partner military capacity.⁷⁰ China believes that military/civilian dual-use programs should be fostered as these will develop an industrial base in multiple countries, which will then launch new economic opportunities through emerging technologies.⁷¹ This shared technology and increased partner capacity provides greater military strength to China by giving it increased technologies as well as multiple locations China can utilize if necessary. While China has not engaged in direct military conflict against the United States via its space program nor has it engaged in military conflict against African countries/citizens to ensure cooperation

with the satellite programs, the increased capabilities provide China with a stronger military and an ability to engage in military actions using these various platforms and locations should the need arise in the future, as part of its active defense.⁷²

Militarily, the PRC can easily bring defense forces into strategic locations to ensure cooperation. The military base in Djibouti is often cited as the first Chinese base on the continent, however, it is arguably the second military base built by China in Africa. The first base China built is located in the city of Swakopmund, Namibia. The China Space Tracking, Telemetry and Command Station is a tracking facility completed in July 2001 in a strategic harbor location and is a dual-use asset operated by the Xi'an Satellite Control Centre (XSCC), also known by the military designation of Base 26 by the Peoples Liberation Army Strategic Support Force.⁷³ This satellite tracking facility is a small but strategically important center and could easily provide ground orientation guidance for multiple civilian and military purposes.

In 2019, Liu Yang, a Chinese Taikonaut, otherwise known as an astronaut in the United States, and the first Chinese woman in space on the Shenzhou 9 mission, visited Namibia and this visit was highly publicized by the Chinese official news outlet. A quote from this article illustrates how effective this visit was in winning hearts and minds. One young girl is quoted as saying, "I like Liu Yang. As a woman, she can match any man. She shows what she can do, which means we can make it, too."⁷⁴ Further, according to the local ambassador, "China and Namibia continue to cooperate in the fields of aerospace based on equality and mutual benefit. China's aerospace development cannot be separated from the support of Namibia. The visit will further strengthen the friendship between the two countries and two peoples."^{75,76} These examples illustrate the effectiveness of the narrative which China is disseminating via media propaganda.

Building on the propaganda, the PRC is willing to train partner country citizens as a strategy of soft power projection and pursuing non-violent means of influence.⁷⁷ African countries engaged in the space program with China are assured that the technology transfer and training programs on how to use this technology in the future is the bedrock of the agreement and they will be able to continue to build a space program on this stable foundation. As per one working paper, "International satellite partnerships undertaken on the part of African space programs proceed with the express understanding that the transfer of know-how and technology is a cornerstone of the agreement" and is sometimes used as a "Learning by Doing" approach.⁷⁸ Under this approach, the country which is contracting for a product will send experts, including scientists and engineers, to the contractor's location and these individuals will work at that location during all of the phases of the contract, starting with the initial design of the satellite and will continue to work on all additional phases, including the final launch⁷⁹

In addition to providing technology and training, the PRC is engaged in a multi-faceted effort to build allies across multiple countries which are not necessarily part of the elected government but nonetheless hold power and influence in their particular region.⁸⁰ An example of building a connected regional network of allies across multiple countries, in multiple regions, including the remote regions in Africa, is the Square Kilometer Array (SKA) telescope project. China is one of the main proponents in building the SKA telescope, with collection sites spanning thousands of miles in remote regions in South Africa.⁸¹ This telescope will be so advanced and gather so much data that "entirely new computer technologies will need to be invented to process it all."⁸²

China will be the main processor of this data using the second-fastest supercomputer in the world, Tianhe-2.⁸³ Each of the regions where these telescopes are installed will benefit as they will require new infrastructure to support these arrays of telescopes - including new roads in remote areas, electricity to power the equipment (which can also be used to bring power to remote areas), and internet cable/infrastructure for data transfer. Also, presuming that the agreements obligate local residents to be employed versus Chinese nationals, each region will have new jobs for each phase of construction and jobs for continued maintenance at each site location.⁸⁴ This initiative will increase the goodwill towards China and gain allies in almost every remote region as well as nationally.

China is building additional goodwill not just through building projects in remote locations, but also through humanitarian projects, such as using its partnership with the Belt and Road countries to provide data that can increase crop yields significantly. The Gaofen high-resolution (GF-1) satellite, primarily used for agricultural monitoring, provides data on multiple factors which influence crop yields and using data obtained from observations, analysts can more accurately predict crop growth and estimate crop yield for an area. The satellite observations and data collections can assist for the entire growth cycle by observing the region for optimum moisture conditions to plant (which alone can increase/decrease plant mortality rates by 25-35%), determine moisture conditions in targeted communities to allow for precision irrigation, monitor vegetative growth, and monitor which crops will require targeted fertilizer use and/or blight monitoring.⁸⁵ Further, with constant monitoring, the farmers in that region can engage in precision harvesting as crops in different areas have different peak growth rates and constant monitoring by the satellite allows for harvesting at peak growth.⁸⁶ This information is relevant and useful and has resulted in a drop in the agricultural land needed to produce crops while the population has increased.⁸⁷ This means more people can be fed using less land.

The PRC's efforts to build goodwill are not limited to regional allies, it is also engaging in cooperation with private or public entities and is willing to fund and support organizations via official channels or the Chinese aerospace commercial entities. As per the official CASIC site, it "actively implements the concept of the "Belt and Road Initiative" and cooperates with international partners...to contribute our space intelligence and strength to promote the global economic development and the building of a community of common destiny for mankind."⁸⁸ China is willing to train respective partners on any of the technologies used in the aerospace industry as each of these trainees is a diplomat for the Chinese upon returning home. China confirms that it is a willing partner with the African countries and in 2018, committed to providing over 50,000 training opportunities to various leaders and technical experts, as well as over 50,000 scholarships and degree program opportunities in STEM fields, including in the aerospace industry.⁸⁹ According to one source, over 80,000 students from Africa participate in international studies in China per year, including 57 Namibian students in 2019.⁹⁰

From the African partners' perspective, there is an understanding that this training is a necessary requirement for building generational advancement due to the immense labor pool, especially of the youth, which can help build greater technological development in the future. As per STISA:

Africa's greatest hope for continental development is its vibrant human resources. However, to accelerate Africa's transition to an Innovation-led, Knowledge-based Economy, our Human Resources must be empowered with the necessary skills and greater emphasis must be placed on innovation and appropriate adaptation of technology and existing research results. It is necessary to promote creativity and innovative technologies to locally process the continent's abundant natural resources and to create more wealth and jobs for the youth on the continent. This priority will develop internal capacities; spur the co-creation, development, and marketing of new or improved products and services through engagement with end-user communities. This will create new opportunities for value-added employment by adapting and commercializing the outputs of national and regional Innovation across Africa.⁹¹

As of January 2020, fourteen African countries have launched forty-two satellites (including nine by Egypt alone) and U.S. private companies have assisted in only eight of these programs as a contractor versus as a mutual partner.⁹² The United States has issued a clear line in the sand by limiting certain business technology transactions and ownership with Chinese corporations, especially in the area of technology devoted to the space industry and these prohibitions extend to partners.⁹³ The original order was in the Wolfe Amendment which prohibits agreements which would enhance China's missile or space program.⁹⁴ This amendment has prohibited various companies from collaborating on technical projects with any entity which will also work with China to prevent the technology being used to enhance China's space capabilities. This prohibition was further expanded by Executive Order 13959 issued on November 12, 2020, which blocks any American companies or individuals from owning shares of any companies that aid in the modernization of the Chinese military.⁹⁵ As the Chinese aerospace industry is expressly engaged in modernizing the military, this prohibition would include companies working directly with African partners collaborating with China on joint aerospace projects. The PRC can point to these restrictions to illustrate that the U.S. is not interested in technology transfer or collaboration/teaching the next generation of upcoming scientists and aerospace engineers, including those in African countries. The U.S. is failing to counter this narrative.

On an international level, U.S. actions are being portrayed as attempting to militarize space and to use it for commercial purposes, feeding directly into the narrative that the U.S. is interested solely in profit. For example, the U.S. State Department's 2018 Joint Regional Strategy amplified the wrong message by stating, "We will also foster trade linkages to enable greater levels of two-way trade, boost economic diversification and sustainable growth, actively support U.S. private sector engagement in Africa, and create broader markets for U.S. goods and services."⁹⁶ This message feeds into the narrative by the Chinese that the U.S. is only interested in partnerships for profit. In contrast, the PRC is strategically positioning itself as the legitimate leader in international organizations based on humanitarian considerations. For example, China has positioned itself in support of the G77 group of emerging space powers in the UN Office for Outer Space Affairs (UNOOSA).⁹⁷

CONCLUSION

The PRC is using the space programs as instruments of irregular warfare (IW) to gain legitimacy. These programs further have the dual capability to build a strong base of power and influence with multiple partners as part of China's soft power projection. China is engaging in multiple lines of effort across multiple instruments of national influence in the space industry to challenge the U.S. in this sector, and thereby is seeking to counter the U.S. through implementation of this portion of its overall campaign. If it wins in this campaign effort, China will be the leader in the next generation of military technology, the leader in the international aerospace and space industry, and the country with the strongest and most influential economy in the world.

ENDNOTES

¹ This is a condensed version of William Stephen's U.S. National Defense University, International Regional Defense Fellowship Program Thesis, "To Infinity and Beyond: China's Space Program as a Method of Irregular Warfare," 2022. COL Stephens currently is with the Near East South Asia Center, Center for Strategic Studies, as an advisor to the Saudi Armed Forces National Defense University, Strategic Initiatives Office in Riyadh, Saudi Arabia.

² Marks, Thomas A., and Ucko, David. *Violence in Context: Mapping the Strategies and Operational Art of Irregular Warfare*, pgs. 206-233, February 2018.; Ucko, David, "Crafting Strategy for Irregular Warfare: A Framework for Analysis and Action, p 26.

³ China's Space Narrative, p. 16.

⁴ Silk, Molly. "China Is Evolving a Distinct Space Culture." *TheDiplomat.Com*, 21 2021, <https://thediplomat.com/2021/03/china-is-evolving-a-distinct-space-culture/>.

⁵ "党史学习教育专题." *SpaceChina.com*, 7 Apr. 2021, <http://zhuanti.spacechina.com/n3151488/n3151628/c3174638/content.html>.

⁶ Silk, Molly, "China Is Evolving a Distinct Space Culture."

⁷ Id.

⁸ As per the China Aerospace Science and Technology Corporation's English translated webpage, "The three big spirits of aerospace are the concrete manifestation, inheritance and development of aerospace culture in different historical periods. It is the product of the combination of the great national spirit and the aerospace practice. It is the soul of China's aerospace industry and the soul of China's aerospace corporate culture." "航天三大精神_中国航天科技集团有限公司." *SpaceChina.com*, <http://www.spacechina.com/n25/n142/n154/n178/index.html>. Accessed 11 Apr. 2021.

⁹ Wood, Peter; Stone, Alex; Lee, Taylor A., *China's Ground Segment, Building the Pillars of a Great Space Power*, ISBN 9798719347652, China Aerospace Studies Institute, March 1, 2021.

https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Space/2021-03-01%20Chinas%20Ground%20Segment.pdf?ver=z4ogY_MrxaDurwVt-R9J6w%3d%3d pg 15;

<https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Military%20Space-Institutions%20and%20Capabilities-%20Raji.pdf?ver=2PhK-I9TwUQIIZScikGxgw%3D%3D>, 15.

¹⁰ Id., 15.

¹¹ "China National Space Administration." *CNSA.Gov.Cn/English*, 24 May 2018, <http://www.cnsa.gov.cn/english/n6465645/n6465650/c6768437/content.html>.

¹² "Company Profile." *English.Spacechina.Com*, <http://english.spacechina.com/n16421/n17138/n17229/index.html>. Accessed 11 Apr. 2021.

¹³ , Rajeswari Rajagopalan. *China's Growing Military Space Prowess: Institutions and Capabilities*. Chinese Aerospace Studies Institute, Sept. 2020, p. 17,

<https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Military%20Space-Institutions%20and%20Capabilities-%20Raji.pdf?ver=2PhK-I9TwUQIIZScikGxgw%3D%3D>. citing: S. Chandrashekar and N. Ramani, "China's Space Power & Military Strategy – the role of the Yaogan Satellites," International Strategic & Security Studies Program (ISSSP), National Institute of Advanced Studies (NIAS), July 2018, http://issp.in/wp-content/uploads/2018/07/Chinas-Space-Policy_July2018.pdf

¹⁴ <http://www.cnsa.gov.cn/english/n6465645/n6465650/c6768437/content.html>

¹⁵ "机构简介." *CNSA.gov.cn*, <http://www.cnsa.gov.cn/n6758821/index.html>. Accessed 11 Apr. 2021.

As per its website, the CNSA also encompasses additional organizations including: The National Space Administration's Lunar Exploration and Space Engineering Center, established in 2004 ("responsible for the overall technology and management of lunar exploration projects; responsible for engineering technology, overall design and implementation; drafting overall plans and development procedures, formulating overall development requirements and overall technical documents"); The National Space Administration Earth Observation and Data Center, established in 2010("responsible for the implementation, organization and management of the major scientific and technological project of high-resolution Earth observation system"), Space Remote Sensing Demonstration Center of the National Space Administration, established 2004 ("direct development of civil aerospace, facing the needs of national economic development and the direction of international aerospace-related scientific and technological development); The Space Law Center of the National Space Administration, established 2017, ("the overall support organization for the rule of law and space work of the National Space Administration"); China Space Law Society ("a national academic organization composed of relevant state departments, space law research institutions, space science and technology research and application institutions, and space law and policy research experts and scholars.")

¹⁶ China Aerospace Science and Technology Corporation (spacechina.com), As per its website: “As the leading force of China’s space industry and one of China’s first innovative enterprises, CASC has 8 large R&D and production complexes, 11 specialized companies, 13 listed companies and a number of directly affiliated units. CASC is mainly engaged in the research, design, manufacture, test and launch of space products such as launch vehicle, satellite, manned spaceship, cargo spaceship, deep space explorer and space station as well as strategic and tactical missile systems.” See:

english.spacechina.com/n16421/n17138/n17229/index.html

¹⁷ The importance of the Chinese civil/military fusion cannot be overstated as it is not merely a collaboration, such as what exists in the United States. For an excellent analysis of how the civilian sector and the military sector are mutually symbiotic, intertwined, and integrated, see China’s Aerospace Studies Institute publication: China’s Military and Civil Fusion Strategy, found at the following url:

https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Other-Topics/CASI_China_Military_Civil_Fusion_Strategy.pdf

¹⁸ Xin, Guan, and Jin Yang. “New Money: China’s Private Space Start-Ups Lift Off.” *CGTN*, 10 July 2020, <https://news.cgtn.com/news/2020-07-10/New-Money-China-s-private-space-start-ups-lift-off-S0jCrO1Yzu/index.html>; CASI, China’s Space Narrative, p. 29,

<https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Space%20Narrative.pdf?ver=FGoQ8Wm2DypB4FaZDWuNTQ%3d%3d>

¹⁹ Xin, Guan, and Jin Yang. “New Money: China’s Private Space Start-Ups Lift Off.” *CGTN*, 10 July 2020, <https://news.cgtn.com/news/2020-07-10/New-Money-China-s-private-space-start-ups-lift-off-S0jCrO1Yzu/index.html>

²⁰ China Public Private Partnerships Center. *Guiding Opinions of the State Council on Innovating the Investment and Financing Mechanisms in Key Areas and Encouraging Social Investment*. China Public Private Partnership Council, 16 Nov. 2014, <http://www.cpppc.org/en/zy/994006.jhtml>.

²¹ China Public Private Partnerships Center. *Guiding Opinions of the State Council on Innovating the Investment and Financing Mechanisms in Key Areas and Encouraging Social Investment*. China Public Private Partnership Council, 16 Nov. 2014, <http://www.cpppc.org/en/zy/994006.jhtml>.

²² Xin, Guan, and Jin Yang. “New Money: China’s Private Space Start-Ups Lift Off.” *CGTN*, 10 July 2020, <https://news.cgtn.com/news/2020-07-10/New-Money-China-s-private-space-start-ups-lift-off-S0jCrO1Yzu/index.html>; CASI, China’s Space Narrative, p. 29,

<https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Space%20Narrative.pdf?ver=FGoQ8Wm2DypB4FaZDWuNTQ%3d%3d>

²³ China Space Institutions and Capabilities, pg 2, Sept. 2020

<https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Military%20Space-Institutions%20and%20Capabilities-%20Raji.pdf?ver=2PhK-19TwUQIIZScikGxgw%3D%3D>

²⁴ S. Chandrashekar and N. Ramani, “China’s Space Power & Military Strategy – the role of the Yaogan Satellites,” International Strategic & Security Studies Program (ISSSP), National Institute of Advanced Studies (NIAS), July 2018, http://isspp.in/wp-content/uploads/2018/07/Chinas-Space-Policy_July2018.pdf P. 23 f

²⁵ CASI - Chinas Gound Segment (3-1-21), pg 20, 21

²⁶ Wood, Peter; Stone, Alex; Lee, Taylor A., *China’s Ground Segment, Building the Pillars of a Great Space Power*, ISBN 9798719347652, China Aerospace Studies Institute, March 1, 2021.

https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Space/2021-03-01%20Chinas%20Ground%20Segment.pdf?ver=z4ogY_MrxaDurwVt-R9J6w%3d%3d, pg 22, 23

²⁷ Cheng, Dean. “China’s Military Role in Space.” *Strategic Studies Quarterly* 6, no. 1 (2012): 55-77.

²⁸ Bowe, Alexander. *China’s Pursuit of Space Power Status and Implications for the United States*. US-China Economic and Security Review Commission, 2019.

²⁹ Cheng, Dean. “China’s Military Role in Space.” 71.

³⁰ Id.

³¹ Id.

³² Sankaran, Jaganath. “Limits of the Chinese antisatellite threat to the United States.” *Strategic Studies Quarterly* 8, no. 4 (2014): 19-46. Antisatellite actions are actions taken to destroy or disable a satellite.

³³ Id.

³⁴ Sankaran, Jaganath. “Limits of the Chinese antisatellite threat to the United States.”, pg 36.

³⁵ Id, at 37.

³⁶ S. Chandrashekar and N.Ramani, “China’s Space Power & Military Strategy – the role of the Yaogan Satellites,” ISSSP Report No. 02-2018. Bangalore: International Strategic and Security Studies Programme, National Institute of Advanced Studies, July 2018.

³⁷ Ibid, 4.

³⁸ Wood, Peter; Stone, Alex; Lee, Taylor A., *China's Ground Segment, Building the Pillars of a Great Space Power*, ISBN 9798719347652, China Aerospace Studies Institute, March 1, 2021.

https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/Space/2021-03-01%20Chinas%20Ground%20Segment.pdf?ver=z4ogY_MrxaDurwVt-R9J6w%3d%3d

³⁹ Ibid, 10, 11.

⁴⁰ Pollpeter, Kevin, Timothy Ditter, Anthony Miller, and Brian Waidelich. "China's Space Narrative." China Aerospace Studies Institute, (2020). Preface & p. 7.

⁴¹ Pollpeter, Kevin, et. al, "China's Space Narrative." Preface & p. 9

⁴² ⁴² Pollpeter, Kevin, et. al, "China's Space Narrative." Preface p. 10, citing Yan Xuetong, "The Age of Uneasy Peace, Chinese Power in a Divided World," *Foreign Affairs* (2019), <https://www.foreignaffairs.com/articles/china/2018-12-11/age-uneasy-peace>.

⁴³ Gabriel Alvarado, Mark Stokes, Emily Weinstein, and Ian Easton. "China's Space and Counterspace Capabilities and Activities." The U.S.-China Economic and Security Review Commission, March 30, 2020. https://www.uscc.gov/sites/default/files/2020-05/China_Space_and_Counterspace_Activities.pdf

⁴⁴ "BeiDou (BěiDǒu 北斗, named after the Big Dipper) Navigation Satellite System (BDS)" see: Belt and Road Initiative - China's Space Silk Road, cited previously, www.beltrroad-initiative.com

⁴⁵ Gabriel Alvarado, Mark Stokes, Emily Weinstein, and Ian Easton. "China's Space and Counterspace Capabilities and Activities."88.

⁴⁶ Ibid, 88, 101.

⁴⁷ Ibid, 101.

⁴⁸ Marks, Thomas A., and Ucko, David. "Gray zone in red: China revisits the past." (2021): 1-24.

⁴⁹ Marks, Thomas A., and Ucko, David. "Violence in Context: Mapping the Strategies and Operational Art of Irregular Warfare," pgs. 206-233, February 2018.; Ucko, David, "Crafting Strategy for Irregular Warfare: A Framework for Analysis and Action, p 26, 27.

⁵⁰ Ibid.

⁵¹ Ucko, Crafting Strategy for Irregular Warfare: A Framework for Analysis and Action. 36.

⁵² Ucko, "Crafting Strategy for Irregular Warfare: A Framework for Analysis and Action," 36.

⁵³ As illustrated by the joint Chinese and Venezuelan satellite programs in which China developed and launched sensing satellites for Venezuela Clark, Stephen. *China Successfully Launches Earth-Imaging Satellite for Venezuela – Spaceflight Now*. <https://spaceflightnow.com/2017/10/09/china-successfully-launches-earth-imaging-satellite-for-venezuela/>. Accessed 10 Apr. 2021. China has similar programs with four other Latin-American countries, including a major collaborative effort with Brazil in the China-Brazil Resources Satellite program. Klinger, Julie Michelle. "A brief history of outer space cooperation between Latin America and China." *Journal of Latin American Geography* 17, no. 2 (2018): 46-83.

⁵⁴ "Basics of Space Flight - Solar System Exploration: NASA Science." *NASA Solar System Exploration*, <https://solarsystem.nasa.gov/basics/chapter14-1/>. Accessed 9 Apr. 2021. Note that this does location is not as equally advantageous for missions to other planets.

⁵⁵ Space in Africa, *African Space Industry Now Generating Over USD 7 Billion Annually, To Exceed 10 Billion by 2024.*, Space in Africa, June 11, 2019; Klinger, Julie. *China, Africa, and the Rest: Recent Trends in Space Science, Technology, and Satellite Development*. 38, Johns Hopkins School of Advanced International Studies, p. 26,

<https://static1.squarespace.com/static/5652847de4b033f56d2bdc29/t/5ecdb4ab6dad0e25fa0feb06/1590539437793/WP+38+-+Klinger+-+China+Africa+Space+Satellites.pdf>. These 20 countries include: Algeria, Angola, Botswana, Burkina Faso, Egypt, Ethiopia, Gabon, Ghana, Ivory Coast, Kenya, Libya, Mauritius, Morocco, Nigeria, Rwanda, South Africa, Sudan, Tunisia, Uganda, Zimbabwe, [List of Space Agencies in Africa - Space in Africa \(africanews.space\)](http://africanews.space)

⁵⁶ Reuters. "China Is Not Funding 'vanity Projects' in Africa, Chinese President Xi Jinping Says." *CNBC*, 3 Sept. 2018, <https://www.cnbc.com/2018/09/03/chinas-president-xi-jinping-on-belt-and-road-initiative-in-africa.html>.; Shepard, Wade. "What China Is Really Up To In Africa." *Forbes*, 3 Oct. 2019, <https://www.forbes.com/sites/wadeshepard/2019/10/03/what-china-is-really-up-to-in-africa/>.

⁵⁷ Syk, Marcus. *If You Want to Get Rich, First Build a Road, A Study on Chinese Trade Network Building in Eurasia*. Lund University, May 2018,

<http://lup.lub.lu.se/luur/download?func=downloadFile&recordId=8947664&fileId=8947665>. 12

⁵⁸ Ibid.

⁵⁹ China's Space Narrative, p. 20, citing Shi Zhongjun, "Chinese Space Cooperation: Build a Common Destiny for Humankind - A Presentation by Permanent Mission of the People's Republic of China to the United Nations and Other International Organizations in Vienna," (Zhongguo de hangtian hezuo: goujian mingyun gongtongti he zao fuquan renlei - Zhongguo zai wei ye na lianheguo juban hangtian hezuo zhuti chuan jiehui; 中国的航天合作: 构建命运共同体和造福全人类 ——中国在维也纳联合国举办航天合

作主题宣介会), Permanent Mission of the People's Republic of China to the United Nations and Other International Organizations in Vienna, June 21, 2018, <http://www.chinesemission-vienna.at/chn/hyyfy/t1570725.htm>.

⁶⁰ China Aerospace Science and Technology Corporation. "Our Logo." *English.Spacechina.Com*, <http://english.spacechina.com/n16421/n17138/n2357695/index.html>.

⁶¹ These are all real technologies that can be utilized, as is more fully explained in further sections of the paper. Qing-bo ZHOU, Qiang-yi YU, Jia LIU, Wen-bin WU, Hua-jun TANG. "Perspective of Chinese GF-1 High-Resolution Satellite Data in agricultural Remote Sensing Monitoring." *Journal of Integrative Agriculture*, vol. 16, no. 2, 2017, pp. 242–51, <https://www.sciencedirect.com/journal/journal-of-integrative-agriculture/vol/16/issue/2>.

⁶² *Education, Science & Technology | African Union*. <https://au.int/en/education-science-technology>. Last Accessed 12 Dec. 2020. (Alternative spellings in the original.)

⁶³ African Union Commission. "Science, Technology and Innovation Strategy for Africa 2024." *Science, Technology and Innovation Strategy 2024*, 2019, p. 52, https://au.int/sites/default/files/documents/38756-doc-stisa_science_tech_innovation_strategy.pdf. , 23

⁶⁴ Nantulya, Paul. "Chinese Hard Power Supports Its Growing Strategic Interests in Africa." *Africa Center for Strategic Studies*, 17 Jan. 2019, <https://africacenter.org/spotlight/chinese-hard-power-supports-its-growing-strategic-interests-in-africa/>.

⁶⁵ China's Space Narrative, p. 20, citing Ambassador Fu Ying, Fu Ying, "China's Vision for the World: A Community of Shared Future," *The Diplomat*, June 22, 2017, <https://thediplomat.com/2017/06/chinasvision-for-the-world-a-community-of-shared-future/>

⁶⁶ "The aim of the [Digital Belt and Road Program] program is to improve environmental monitoring, promote data sharing, and support policymaking using big data on Earth observations. The program involves more than making Chinese data available to others; it also aims to address the digital divide, raise awareness of the potential benefits of Earth observations, and increase international collaboration." Borowitz, Mariel. "Earth Observing Satellites and Open Data Sharing in China." *China Research Center*, 5 Feb. 2020, https://www.chinacenter.net/2020/china_currents/19-1/earth-observing-satellites-and-open-data-sharing-in-china/., quoting Xinming, T. (2018). *International Service and Application: China's Ziyuan and Surveying and Mapping Satellites*. GEO Week 2018: Asia-Oceania Day. Kyoto, Japan.

⁶⁷ Brown, Michael, and Pavneet Singh. "China's technology transfer strategy." *Silicon Valley, CA: Defense Innovation Unit Experimental Report* (2018)., 2018, 8, 10, 12, 13, [https://admin.govexec.com/media/diux_chinatechnologytransferstudy_jan_2018_\(1\).pdf](https://admin.govexec.com/media/diux_chinatechnologytransferstudy_jan_2018_(1).pdf)

⁶⁸ China Aerospace Science and Technology Center. "ABOUT US - Introduction of CASIC." *CASIC-English*, <http://www.casic.com/n189298/n189314/index.html#:~:text=CASIC%20takes%20%22empowering%20the%20army%20with%20science%20and,always%20adhered%20to%20%22national%20interest%20above%20all%20else%22>. Accessed 14 Dec. 2020

⁶⁹ Id.

⁷⁰ Nantulya, Paul. "Chinese Hard Power Supports Its Growing Strategic Interests in Africa." In addition, an appendix of the agencies and engagements can be found at: Klinger, Julie. *China, Africa, and the Rest: Recent Trends in Space Science, Technology, and Satellite Development*. 38, Johns Hopkins School of Advanced International Studies, p. 10-13, <https://static1.squarespace.com/static/5652847de4b033f56d2bdc29/t/5ecdb4ab6dad0e25fa0feb06/1590539437793/WP+38+-+Klinger+-+China+Africa+Space+Satellites.pdf>

⁷¹ China Aerospace Science and Technology Corporation, "Space Technology Applications." <http://english.spacechina.com/n16421/n17215/n2003172/index.html>

⁷² Fravel, M. Taylor. *Active Defense: China's Military Strategy Since 1949*. Princeton University Press, 2019.

⁷³ US-China Economic and Security Review Commission, *China's Strategic Aims in Africa*, May 8, 2020. <https://www.uscc.gov/hearings/chinas-strategic-aims-africa.135>: Dreher, A., Fuchs, A., Parks, B.C., Strange, A. M., & Tierney, M. J. (2017). *Aid, China, and Growth: Evidence from a New Global Development Finance Dataset*. AidData Working Paper #46. Williamsburg, VA: AidData. <https://china.aiddata.org/projects/1336>

⁷⁴ □ □ , Xin Hua. "Visiting Astronauts Inspire Namibian Youngsters." *ChinaDaily.Com.Cn*, 9 Aug. 2019, <https://www.chinadaily.com.cn/a/201908/28/WS5d65d5a2a310cf3e355683f0.html>.

⁷⁵ Id. For an interesting read, pursue the Chinese space race to put a woman in space. The story of Liu Yang is fascinating in itself. She was the first female taikonaut in space and she was sent to space on June 16, 2012, which was the anniversary date the first female cosmonaut was sent into space – a clear reference that China has assumed the mantle of space dominance from the Russians. More information on both of these fascinating individuals can be found here: https://cpcchina.chinadaily.com.cn/2012-12/03/content_15981597.htm; <https://www.britannica.com/biography/Valentina-Tereshkova>

⁷⁶ This was the second visit by Chinese Taikonauts. Yang Liwei, (the first Chinese Taikonaut) visited Namibia in 2010. XinHua. "Visiting Astronauts Inspire Namibian Youngsters." *ChinaDaily.Com.Cn*, 9

Aug. 2019.

⁷⁷ Eleanor Albert, “China’s Big Bet on Soft Power,” Council on Foreign Relations, Backgrounder, February 9, 2018. <https://www.cfr.org/backgrounder/chinas-big-bet-soft-power>.

⁷⁸ Klinger, Julie. *China, Africa, and the Rest: Recent Trends in Space Science, Technology, and Satellite Development*. 38, Johns Hopkins School of Advanced International Studies, p. 26, <https://static1.squarespace.com/static/5652847de4b033f56d2bdc29/t/5ecdb4ab6dad0e25fa0feb06/1590539437793/WP+38+-+Klinger+-+China+Africa+Space+Satellites.pdf>, 10.

⁷⁹ Ibid, 10.

⁸⁰ Ibid.

⁸¹ Versfeld, Allen. “SKA Africa: What The World’s Biggest Telescope Means For Africa’s Development.” *Space in Africa*, 17 Dec. 2019, <https://africanews.space/ska-africa-what-the-worlds-biggest-telescope-means-for-africas-development/>.

⁸² Ibid.

⁸³ Africa, Space in. “China Set To Build Regional Data Centre To Crunch Data From the SKA Telescope.” *Space in Africa*, 26 Aug. 2019, <https://africanews.space/china-set-to-build-regional-data-centre-to-crunch-data-from-the-ska-telescope/>.

⁸⁴ Versfeld, Allen. “SKA Africa: What The World’s Biggest Telescope Means For Africa’s Development.” *Space in Africa*, 17 Dec. 2019, <https://africanews.space/ska-africa-what-the-worlds-biggest-telescope-means-for-africas-development/>.

⁸⁵ “How Many Seeds Does It Really Take to Get 100,000 Plants per Acre at Harvest? | Integrated Crop Management.” *Iowa State University*, 9 Apr. 2007, <https://crops.extension.iastate.edu/encyclopedia/how-many-seeds-does-it-really-take-get-100000-plants-acre-harvest>.; Qing-bo ZHOU, Qiang-yi YU, Jia LIU, Wen-bin WU, Hua-jun TANG. “Perspective of Chinese GF-1 High-Resolution Satellite Data in agricultural Remote Sensing Monitoring.” *Journal of Integrative Agriculture*, vol. 16, no. 2, 2017, pp. 242–51, <https://www.sciencedirect.com/journal/journal-of-integrative-agriculture/vol/16/issue/2>.

⁸⁶ Qing-bo ZHOU, Qiang-yi YU, Jia LIU, Wen-bin WU, Hua-jun TANG. “Perspective of Chinese GF-1 High-Resolution Satellite Data in agricultural Remote Sensing Monitoring.” *Journal of Integrative Agriculture*, vol. 16, no. 2, 2017, pp. 242–51, <https://www.sciencedirect.com/journal/journal-of-integrative-agriculture/vol/16/issue/2>.

⁸⁷ Ritchie, Hannah, and Max Roser. “Land Use.” *Our World in Data*, Nov. 2013, <https://ourworldindata.org/land-use>. The dual capability to use this information as a method of warfare is as simple as denying any country the data, which would result in a dramatic loss of crop yield as they will no longer be able to produce the same number of crops as with the data. If crop yield is approximately 100% using this data technology, even a modest reduction of 20% to an 80% yield could have dramatic impacts on a country that relies on a full harvest. It would be equivalent to the old method of burning the crops and poisoning the wells to starve the population.

⁸⁸ See footnote 12, CASIC-English - ABOUT US - Introduction of CASIC.

⁸⁹ US-China Economic and Security Review Commission, *China’s Strategic Aims in Africa*, May 8, 2020, https://www.uscc.gov/sites/default/files/2020-06/May_8_2020_Hearing_Transcript.pdf, 30

⁹⁰ Klinger, “China, Africa, and the Rest: Recent Trends in Space Science, Technology, and Satellite Development.”, 10, Space In Africa, “China-Namibia Relationship On Space Is One Of The Best In Africa - Chinese Ambassador To Namibia.” *Space in Africa*, 3 Sept. 2019, <https://africanews.space/china-namibia-relationship-on-space-is-one-of-the-best-in-africa-chinese-ambassador-to-namibia/>.

⁹¹ African Union, “Science, Technology and Innovation Strategy for Africa 2024.” https://au.int/sites/default/files/documents/38756-doc-stisa_science_tech_innovation_strategy.pdf, 2.

⁹² Klinger, China and Africa Initiative, p. 5-8, SpaceX launched Ghana’s first satellite in 2017.

⁹³ Executive Order 13959 of November 12, 2020, Addressing the Threat From Securities Investments That Finance Communist Chinese Military Companies *Code of Federal Regulations, title 3(2020); 73185-73189*, <https://public-inspection.federalregister.gov/2020-25459.pdf?1605534335>.

⁹⁴ 51 USC §30701. Competitiveness and international cooperation

(a) Limitation.—

(2) Agreements with People’s Republic of China.—The Administrator shall certify to Congress at least 15 days in advance of any cooperative agreement with the People’s Republic of China, or any company owned by the People’s Republic of China or incorporated under the laws of the People’s Republic of China, involving spacecraft, spacecraft systems, launch systems, or scientific or technical information, that—

(A) the agreement is not detrimental to the United States space launch industry; and

(B) the agreement, including any indirect technical benefit that could be derived from the agreement, will not improve the missile or space launch capabilities of the People’s Republic of China.

⁹⁵ Executive Order 13959 of November 12, 2020, “Addressing the Threat from Securities Investments That Finance Communist Chinese Military Companies,” *Code of Federal Regulations*, (2020) 85 FR 73185,

73185-73189, <https://www.federalregister.gov/documents/2020/11/17/2020-25459/addressing-the-threat-from-securities-investments-that-finance-communist-chinese-military-companies>.

⁹⁶ State Department, Joint Regional Strategy, (Washington, DC, Department of State) August 23, 2018. 5. https://www.state.gov/wp-content/uploads/2019/04/JRS_AF-AFR_UNCLASS_508_CMC.pdf 5.

⁹⁷ G77 and China, “Draft resolution on the fiftieth anniversary of the first United Nations Conference on the Exploration and Peaceful Uses of Outer Space: Space as a driver of sustainable development” 12 April 2018., United Nations Conference on the Exploration and Peaceful Uses of Outer Space.

https://www.unoosa.org/documents/doc/copuos/Proposal_by_G77_and_China_NEW_as_at_12_April.pdf; China also submitted a proposal in the Composition and Election of the Bureau of the Working Group on the Long-term Sustainability of Outer Space Activities (LTS2.0 Working Group) that there be one Chair and one vice-Chair. It further proposes that if the Chair is from a developed country, the vice-Chair should come from an emerging space power. Under either scenario, China is poised to be either the Chair or the vice-Chair as it can simultaneously claim to be a developed country as well as an emerging space power. https://www.unoosa.org/documents/pdf/copuos/stsc/2021/LTS/Intersessional_non-paper_-_LTS_-_China.pdf