China's Strategic Situational Awareness Capabilities

A Country Primer

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Introduction

China has invested considerably in advancing its capabilities for strategic situational awareness.[1] Although traditional shortcomings in strategic early warning have been a serious concern for China, the People's Liberation Army (PLA) today is developing a more mature architecture that could enhance its capability to undertake nuclear counterattack and conventional operations. Although the improvement of capabilities for early warning and situational awareness will remain a challenge for the PLA,[2] these capabilities today encompass a growing number of satellites for remote sensing and electronic intelligence (ELINT), large, phased array radars and a range of other radars that are increasingly sophisticated, and early warning aircraft, as well as unmanned systems. The expansion and maturation of these varied systems will continue to be a priority for the PLA, pursuant to new missions and operational requirements in the region and worldwide.

China will likely redouble these efforts in response to new strategic requirements in coming years. According to the 2015 Ministry of National Defense white paper on "China's Military Strategy," "China will optimize its nuclear force structure, improve strategic early warning, command and control, missile penetration, rapid reaction, and survivability and protection."[3] This focus on improving strategic early warning reflects persistent concerns that the PLA has been lacking and lagging in these capabilities, which may exacerbate the risks of a "false negative" if a nuclear attack were to occur undetected.[4] Meanwhile, the new focus in some authoritative writings on options for "rapid reaction" (快速反应) to an attack appears to imply the capability for a rapid second strike. There has been some speculation that China's posture could evolve toward that of "launch on warning," which

[1] Please note that I am using the phrasing "strategic situational awareness" in reference to the framework that informs this CSIS PONI project, to characterize not only encompassing strategic early warning capabilities of relevance to China's nuclear arsenal but also other intelligence, surveillance, and reconnaissance capabilities that might be relevant in a high-end conflict contingency. This paper is not intended to provide a comprehensive assessment but rather attempts to provide an overview of the status of these developments.

[2] "Expert: China's People's Liberation Army's Early Warning Capability Construction Confronts Multiple Challenges" [专家：中国解放军预警能力建设面临多重挑战], *China Military Online*, August 2, 2013, http://military.china.com.cn/2013-08/02/content_29602761.htm. The details included come from an interview with Professor Yan Shiqiang (闫世强), who is the director of an early warning laboratory at the Air Force Early Warning Academy.

[3] Ministry of National Defense of the People's Republic of China [中华人民共和国国防部], "China's Military Strategy" [中国的军事战略],"The State Council Information Office of the People's Republic of China, May 26, 2015, http://www.scio.gov.cn/zfbps/ndhf/2015/document/1435161/1435161.htm.

[4] For a great analysis of these concerns and how this may impact the Chinese military's approach to leveraging emerging technologies, see: Lora Saalman, "Fear of false negatives: AI and China's nuclear posture," *Bulletin of the Atomic Scientists*, April 24, 2018, https://thebulletin.org/landing_article/fear-of-false-negatives-ai-and-chinas-nuclear-posture/.

would demand much more reliable early warning systems.[5] Such a posture could be consistent with China's traditional commitment to a "no first use" policy.[6] The PLA also intends to expand its construction of a space-based system for strategic surveillance that could detect indicators of a potential nuclear attack, including warning of a surprise attack against China's missiles.[7] These trends will continue to merit analytic attention.

Historical Developments

The origins of China's early warning capabilities can be traced back to the 640 Project (640工程).[8] This initiative was launched in 1964 to advance the development of anti-missile systems under the orders of Mao Zedong, who declared at the time in response to concerns over nuclear threats, "If there is a spear, there must be a shield" (有矛必有盾).[9] Before the program was discontinued in 1982, its various projects had enabled advances in foundational technologies and capabilities that set the stage for some of China's modern advances.[10]

In particular, China's first anti-ballistic missile system, HQ (红旗)-18 was linked to the CK (长空)-1 ELINT satellite, which was intended to provide early warning of any attack from the Soviet Union.[11] It operated in conjunction with the Type 110 and Type 7010 radars, developed through Project 640-4.[12] The Type 7010 passive electronically scanned array radar, located at Huangyang Mountain in Hebei Province, first entered operation in 1974.[13] The Type 110 mono-pulse radar, capable of long-range precision tracking, which is located in Yunnan, entered service in 1977.[14]

Early Warning and Anti-Stealth Radars

These initial radars appear to remain in operation and have since been augmented by more advanced systems. Based on overhead imagery, China is known to possess at least four ground-based, large phased-array radars (LPARs) that could be used for ballistic missile tracking, which are variously located near Huanan, Yiyuan, Hangzhou, and Korla.[15] At least one of China's LPAR radars is a P-band radar, developed by the 14th Research

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[5] The 2013 AMS textbook, Science of Military Strategy, discusses this possibility, and the Pentagon's 2019 report on the PLA notes this aspiration in its assessment. See the Pentagon's Annual Report to Congress: Office of the Secretary of Defense, Military and Security Developments Involving the People's Republic of China 2019, (Washington, D.C.: Department of Defense, June 2019), https://dod.defense.gov/Portals/1/Documents/pubs/2017_China_Military_Power_Report.PDF.

[6] Academy of Military Science Military Strategy Research Department [军事科学院军事战略研究部] (ed.), The Science of Military Strategy [战略学].

[7] Xiao Tianliang [肖天亮] (ed.), The Science of Military Strategy [战略学], National Defense University Press, 2015.

[8] See, for example, the history of the project released online: "640 Project – Mao Zedong and Qian Xuesen's Discussion on "If There's a Spear, There Must Be a Shield"" [640工程--毛泽东和钱学森"有矛必有盾"的谈话], http://www.cwzg.cn/history/201703/34993.html.

[9] Ibid.

[10] Reportedly, this discontinuation exempted the development of laser weapons and nuclear electromagnetic pulse technology, the remaining anti-missile projects were all stopped. Certain of these lines of effort appear to have been continued under the auspices of China's 863 Plan.

[11] For further information, see: "640 Project."

[12] "Secret "640 Program: China's Anti-Missile Research" [揭秘640工程：中国反导研究已秘密实施45年], January 18, 2010, https://web.archive.org/web/20190128000450/http://news.ifeng.com/history/zhongguoxiandaishi/201001/0118_7179_1514505.shtml.

[13] For a quick analysis, see: "7010 Phased-Array Missile Warning Radar," *Global Security*, https://www.globalsecurity.org/wmd/world/china/lpar.htm.

[14] "640-5 Project - 110 Tracking Radar," *Global Security*, https://www.globalsecurity.org/space/world/china/640-5.htm.

[15] Andrew Tate, "China integrates long-range surveillance capabilities," *IHS Jane's*, 2017, https://www.janes.com/images/assets/477/75477/China_integrates_long-range_surveillance_capabilities.pdf.

Institute of the China Electronics Technology Group (CETC) and disclosed in open sources in 2016.[16] The radar in question is estimated to have a detection range of 4,000 kilometers and reportedly possesses the capability to detect incoming missiles and to track satellites. In addition, China's radars include those designated the JL-1A and JY-27A, which have been assessed to be designed to address the threat of ballistic missiles.[17] Reportedly, the JL-1A is "capable of precision tracking of multiple ballistic missiles."[18] The JY-27A is a VHF active electronically scanned array (AESA) radar for long-range surveillance and guidance that is characterized as resistant to jamming, as displayed by CETC at the 2016 Zhuhai Air Show.[19]

Currently, China is developing and deploying a number of more advanced radar technologies that could augment an existing network of radars deployed along its coast, including a number of over-the-horizon radar systems.[20] For example, CETC's 14th Research Institute has exhibited a number of anti-stealth radars based on advanced phased array radar technology, including the SLC-7 and YLC-8B radars, which it claims can track enemy stealth fighters.[21] Of course, it remains difficult to confirm with confidence the technical characteristics of these radars. However, it appears that China's indigenous development of high-end radars is maturing, seemingly closer to being on par with that of the United States.[22] Reportedly, CETC has tested and prototyped both a quantum radar and terahertz radar that it claims could possess the sensitivity to detect a stealth fighter or bomber, but these reports cannot be confirmed.[23] Potentially, quantum radar technology could also contribute to the monitoring of incoming ballistic missiles.[24] However, there are also reasons for skepticism about these

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[16] "PLA suspected to have fielded strategic early warning radar, can [engage in] long-term monitoring of enemy missile launches" [**解放**军疑似列装战略预警雷达 **可**长期监视敌导弹发射], *Sina Military*, October 9, 2016, http://junshi.xilu.com/jsgc/20161009/1000010000964072.html.

[17] See again: Office of the Secretary of Defense, "Military and Security Developments Involving the People's Republic of China 2017," May 2017, https://dod.defense.gov/Portals/1/Documents/pubs/2017_China_Military_Power_Report.PDFhttps://dod.defense.gov/Portals/1/Documents/pubs/2017_China_Military_Power_Report.PDF.

[18] Ibid.

[19] "Anti-stealth radars unveiled at air show," *China Daily*, November 7, 2016, http://www.chinadaily.com.cn/china/2016-11/07/content_27292022.htm.

[20] "PLA has already formed a radar network" [**解放**军已形成雷达组网], *China News*, August 2, 2013, http://www.chinanews.com/mil/2013/08-02/5116635.shtml.

[21] "China's new military radar revealed," *China Military Online*, November 22, 2017 http://english.chinamil.com.cn/view/2017-11/22/content_7837250.htm.

[22] ""Where is the radar?" summit forum convened," [**雷达在哪里**"**高峰**论坛举行], *China Electronics News*, November 16, 2018, http://webcache.googleusercontent.com/search?q=cache:7rNT6CnDOxkJ:m.cena.com.cn/ia/20181116/96813.html+&cd=11&hl=en&ct=clnk&gl=us.

[23] For analysis and reporting on the question of quantum radar, see: "Quantum Radar: 'Clairvoyant' with Insight into the Future Battlefield" [**量子雷达**：**洞察未来**战场"**千里眼**"], PLA Daily, September 22, 2016, http://jz.chinamil.com.cn/n2014/tp/content_7271314.htm; "China's First Single-Photon Quantum Radar Successfully Developed," [**中国首部**单光子量子雷达系统研制成功], CETC, September 18, 2016, http://www.cetc.com.cn/zgdzkj/_300931/_300939/445284/index.html; "14th Research Team Radar Team" [14**所量子雷达**团队]; "Indigenous Innovation Leads Radar and Detection into the Subtle Quantum World" [**自主**创新引领雷达探测领域跨入精微的量子世界], CETC, June 16, 2017, http://webcache.googleusercontent.com/search?q=cache:Ht6zlxB_y9UJ:mobile.acfun.cn/a/ac3789523+&cd=1&hl=en&ct=clnk&gl=us.

[24] "China can use quantum radar technology to monitor high-speed aircraft from space" [**中国可用量子雷达技**术可从太空监视高速飞行器], *Global Times*, June 18, 2018, http://military.china.com/zxjq/11139042/20180618/32546024.html.

reports, given likely technical limitations that may constrain the actual capabilities of these new radars.[25] Nonetheless, continued advances in radar technology could become vital enablers of the PLA's "system of systems" for future crisis or conflict scenarios.[26] As the PLA continues to build systems for early warning and surveillance, integration among platforms and services remains a major challenge.[27]

Airborne Systems

The PLA Air Force and PLA Naval Aviation operate a range of airborne early warning and control (AEW&C) aircraft.[28] The KJ (空警)-2000, which uses a Russian airframe and indigenous Type 88 early warning radar, entered operation in the early 2000s, but just four aircraft were developed to start.[29] The KJ-200 variant of the KJ-2000 has been fielded in larger numbers, estimated to amount to eleven in total.[30] The KJ-200 aircraft have AESA radars, known as the "Silk Eye," designed by the CETC 38th Research Institute.[31] Reportedly, "strategic warning balloons" equipped with large phased array radar, have also been used for low-altitude detection, including of fighter jets.[32]

Beyond these early aircraft, KJ-500 aircraft is indigenous in its design, equipped with a three-sided AESA radar.[33] According to recent estimates, there may be more than fifteen in operation across the PLAAF and PLAN, including several on Hainan in close proximity to the South China Sea, and the aircraft is believed to have entered mass production as of 2018.[34] Traditionally, China's indigenous development of AEW&C aircraft has been constrained by shortcomings in design, including engines and airframes, as well as apparent

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[25] Thomas Withington, "Chinese Claims of Terahertz Radar," July 26, 2018, https://www.crows.org/news/410881/CHINESE-CLAIMS-OF-TERAHERTZ-RADAR.htm.

[26] ""Where is the radar?" summit forum convened," [雷达在哪里"高峰论坛举行], *China Electronics News*, November 16, 2018, http://webcache.googleusercontent.com/search?q=cache:7rNT6CnDOxkJ:m.cena.com.cn/ia/20181116/96813.html+&cd=11&hl=en&ct=clnk&gl=us.

[27] "Yan Shiqiang: Our military early warning and surveillance equipment system has formed a joint air condition warning network supported by radar networking technology" [闫世强：我军预警监视装备体系已形成了以雷达组网技术支撑下的联合空情预警网], *China News*, August 2, 2013, http://www.chinanews.com/mil/2013/08-02/5116635.shtml.

[28] For a very accessible explanation of China's multiple early warning aircraft, see: Thomas Newdick, "Wow, China Has a Lot of Different Early-Warning Planes," *War is Boring*, March 16, 2015, https://medium.com/war-is-boring/wow-china-has-a-lot-of-different-early-warning-planes-7e7ac7edae8.

[29] For context, see: "Why is China's Air Force not equipped with a large number of KJ-2000 early warning aircraft?" [为什么中国空军没有大量装备空警-2000预警机？], *Sohu*, September 25, 2015, www.sohu.com/a/194505104_536837+&cd=3&hl=en&ct=clnk&gl=us.

[30] For basic background, see: "KJ-200," Baike, https://baike.baidu.com/item/%E7%A9%BA%E8%AD%A6-200/15598551?fromtitle=%E7%A9%BA%E8%AD%A6200&fromid=4856986.

[31] "CETC Releases the "Silk Eye" Radar, Will Be Displayed at Zhuhai Airshow" [中国电科推出"丝路眼"机载预警雷达 将亮相珠海航展], *Global Times*, October 29, 2018, https://mil.news.sina.com.cn/china/2018-10-29/doc-ihnaivxq2790198.shtml+&cd=10&hl=en&ct=clnk&gl=us.

[32] "China's strategic early warning balloon program exposed" [中国战略预警气球曝光], *Sohu*, February 2017, https://m.sohu.com/n/557067298/.

[33] "China's new generation of early warning aircraft KJ-500's equipment and platform localization" [中国新一代预警机空警５００装备、平台国产化], *Xinhua*, March 13, 2016, http://www.xinhuanet.com/mil/2016-03/14/c_128797638.htm.

[34] Mike Yeo, "China ramps up production of new airborne early warning aircraft," Defense News, February 5, 2018, https://www.defensenews.com/digital-show-dailies/singapore-airshow/2018/02/05/china-ramps-up-production-of-new-airborne-early-warning-aircraft/.

limitations in sensors and avionics.[35] The PLA Air Force's future fielding of these aircraft will continue to contribute to extending the range of China's integrated air defense system.[36] The KJ-600, which is currently under development, will provide an improved early warning capability, replacing the prior usage of helicopters, and it could be operated off China's new aircraft carrier to enhance its capabilities.[37]

The PLA Navy also operates a number of aircraft that are used variously for electronic warfare and intelligence, maritime domain awareness, and anti-submarine warfare. The Gaoxin-6 (高新-6) is intended for use in reconnaissance and anti-submarine warfare, based on modified versions of the Y-8/9 transport aircraft, which were introduced to the PLA Navy around 2014.[38] The deployment of the Gaoxin-6, which is equipped with a 360-degree sea search radar and a magnetic anomaly detector, has greatly increased Chinese anti-submarine warfare capabilities, according to state media.[39] However, its actual performance is difficult to evaluate from available information.

The PLA Navy and Air Force also operate a number of unmanned aerial vehicles (UAVs) for early warning, reconnaissance, and surveillance, and the PLA is likely to continue expanding its employment of UAVs for these purposes.[40] The PLA Navy operates the BZK-005 high-altitude long-endurance (HALE) UAV, for maritime surveillance, including in the East and South China Seas, where it has been spotted on a number of occasions.[41] The PLAN has also integrated the Xiang Long ("Soar Dragon," 翔龙) HALE UAV, initially designated the EA-03 but seemingly referred to as the WZ-9 (无侦-9) of 2018, spotted at the Lingshui Naval Airbase on Hainan Island, where it could be used in support of airborne early warning.[42] The PLA Air Force also operates the GJ-1 (Gongji-1 or "Pterodactyl"), which has the capabilities for integrated reconnaissance and precision strike.[43] Of lesser strategic relevance, multiple services in the PLA, including in the PLA Army and

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[35] For a more detailed assessment of this and other Chinese military aircraft, see: Andreas Rupprecht, *Modern Chinese Warplanes: Chinese Naval Aviation - Combat Aircraft and Units*, Harpia Publishing, June 2018.

[36] Office of the Secretary of Defense, Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2018, (Washington, D.C.: Department of Defense), May 2018, https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-CHINA-MILITARY-POWER-REPORT.PDF.

[37] For initial context, see: Jeffery Lin and P.W. Singer, "Meet KJ-600, the aircraft that could help China's navy rival America's," *Eastern Arsenal*, July 12, 2017, https://www.popsci.com/kj-600-china-plane/.

[38] Minnie Chan, "China's PLA Navy sends new surveillance planes on submarine hunt in disputed waters," *South China Morning Post*, June 30, 2015, https://www.scmp.com/news/china/diplomacy-defence/article/1830431/chinas-pla-navy-sends-new-surveillance-planes-submarine.

[39] "Expert: "Gaoxin-6" improves China's anti-submarine capability greatly," *China Military Online*, July 10, 2015, http://english.chinamil.com.cn/news-channels/china-military-news/2015-07/10/content_6581434.htm.

[40] Zhang Zhenguo [张振国], Sun Xu [孙旭], Sun Wenfeng [孙文峰], "Feasibility Analysis of UAV Used in Air Force Strategic Early Warning Operation" [无人机用于空军战略预警作战的可行性分析], *Modern Radar* 2012, no. 10 (2012), http://www.cnki.com.cn/Article/CJFDTOTAL-XDLD201210003.htm.

[41] "Beihang Successfully Researches and Develops Our Nation's First Chang Ying Large Long-Endurance UAV" [北航成功研制我国首款长鹰大型长航时无人机], *Sina*, September 13, 2011, http://mil.news.sina.com.cn/2011-09-13/1345665189.html; "Satellite Imagery Reveals China's New Drone Base," June 29, 2015, https://www.bellingcat.com/news/rest-of-world/2015/06/29/satellite-imagery-reveals-chinas-new-drone-base/?utm_source=Sailthru&utm_medium=email&utm_term=%2ASituation Report&utm_campaign=SitRep0630; Ankit Panda, "Meet China's East China Sea Drones," *The Diplomat*, June 30, 2015, https://thediplomat.com/2015/06/meet-chinas-east-china-sea-drones/.

[42] "South Sea Fleet Tests Xianglong Unmanned Reconnaissance Aerial Vehicle" [南海舰队试用翔龙无人侦察机], *Sina*, April 18, 2018, http://mil.news.sina.com.cn/jssd/2018-04-18/doc-ifzihnep2775237.shtml; "Xianglong UAVs spotted on China's Hainan Island," *IHS Jane's Defense Weekly*, March 2, 2018, http://www.janes.com/article/78751/xianglong-uavs-spotted-on-china-s-hainan-island.

[43] "Attack-1 UAV Fills the Chinese Air Force's Integrated Reconnaissance and Strike Gap" [攻击-1无人机填补中国空军察打一体无人机空白], *Xinhua*, November 14, 2014, http://news.xinhuanet.com/mil/2014-11/13/c_1113239224.htm.

Rocket Force, operate smaller UAVs of the ASN series that are capable of localized reconnaissance, including support of targeting.[44]

Based on ongoing developments, the PLA will have a greater range of options of UAVs available for this purpose. The first unmanned Airborne Warning and Control System (AWACS) was displayed at the Zhuhai airshow in the fall of 2018.[45] The JY-300 Airborne Unmanned Early Warning Vehicle, which has a range of more than 1,000 kilometers and a practical ceiling of more than 5,000 meters, is reportedly capable of detecting third-generation fighters at a distance of up to 50 kilometers and may enter service.[46] Moreover, new HALE UAVs, including some that are stealthy, are variously under development and are beginning to be fielded, including the Shendiao, which could be employed for early warning.[47] Meanwhile, the Chinese defense industry is actively developing several high-altitude, solar-powered, and long-endurance UAVs, including AVIC's Morning Star and China Aerospace Science and Technology Corporation's (CASC) Rainbow,[48] which could enable persistent surveillance for months, or even years, at high altitudes and even in near space, thus providing an alternative to satellites with greater flexibility, including for sea area surveillance.[49]

Space Systems

China has developed and launched a robust architecture of space systems to support its strategic situational awareness. The Chinese satellites that are currently operational were estimated to number around 299 as of spring 2019, second only to the United States.[50] These satellites provide a wide range of sensors that include ELINT, electro-optical (EO) sensors, synthetic aperture radar (SAR), staring camera, stereoscopic imagers, and hyperspectral, among others.[51] Initially, China's space program was under the aegis of the former General Armaments Department, but the new PLA Strategic Support Force (PLASSF) Space Systems Department is now the primary authority for China's space systems and capabilities.[52]

The PLASSF has been characterized as responsible for raising an "information umbrella" (信息雨伞) for the entire military, facilitating information transmission, processing, and distribution, and to support early warning.[53] Indeed, the PLASSF appears to have taken on nearly every aspect of China's space operations: space launch

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[44] Elsa B. Kania, "The PLA's Unmanned Aerial Systems," China Aerospace Studies Institute, August 2018,

[45] "CETC Showcases World's First Unmanned Early Warning UAV" [中国电科展出世界首款无人预警机], November 7, 2018, http://www.dgdrpc.com/tiyu/1764.html.

[46] Ibid.

[47] Office of the Secretary of Defense, Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2017.

[48] Liu Zhen, "Chinese solar-powered drone Morning Star spreads its wings in successful test flight," *South China Morning Post*, October 31, 2018, https://www.scmp.com/news/china/military/article/2171081/chinese-solar-powered-drone-spreads-its-wings-successful-test.

[49] "Chinese-built solar drone 'Rainbow' reaches 20,000 meters high," CGTN, June 14, 2017, https://news.cgtn.com/news/3d59444f3449444e/share_p.html.

[50] For this estimate of the total number, see: Union of Concerned Scientists, "UCS Satellite Database," https://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.XE6li89Kg_U.

[51] For a more detailed discussion of China's space ambitions and capabilities, see Kevin Pollpeter, "Testimony before the U.S.-China Economic and Security Review Commission: Hearing on China's Advanced Weapons," February 23, 2017, https://www.uscc.gov/sites/default/files/Pollpeter_Testimony_0.pdf.

[52] "Inaugural Meeting of the Army's Leading Organs, Rocket Force, and Strategic Support Force Was Convened in Beijing" [陆军领导机构火箭军战略支援部队成立大会在京举行], *Xinhua*, January 1, 2016, http://news.xinhuanet.com/politics/2016-01/01/c_1117646667.htm.

[53] "The Strategic Support Force that Xi Jinping Inspected is What Kind of Force?" [习近平视察的战略支援部队是一支怎样的力量？], CCTV, August 30, 2016, http://news.cctv.com/2016/08/30/ARTI2Xi1zgynCfj6TYsecOcb160830.shtml.

and support; space telemetry, tracking, and control (TT&C); spatial information support, including remote sensing, ELINT, and surveillance; and likely certain elements of space attack and defense.[54] As China seeks to advance the development of a “space-ground integrated networks” (天地一体化网络), identified as a national science and technology major project prioritized for progress by 2030, concurrent advances in the networking and "intelligentization" of spatial information systems can further facilitate intelligence and situational awareness.[55] For example, one start-up has launched what it characterizes as China’s first ‘artificial intelligence (AI) satellites,’ capable of automated analysis processing of data and imagery,[56] and advances in software-defined satellites also promise flexibility and enhanced capabilities.[57] Indeed, one Chinese company plans to launch a constellation with 192 satellites equipped with AI systems.[58] Such improved capabilities could increase not only situational awareness, but also may have the potential to improve the tempo of targeting in ways that increase speed and precision.

Remote Sensing

China possesses robust remote sensing capabilities. Of China’s satellite constellations, Yaogan (遥感), which employs optical and SAR sensors, is the most mature, involving more than 50 satellites.[59] The Gaofen (高分) series, a sub-meter resolution optical satellite that has been developed by China Academy of Space Technology (CAST), is a clear priority, with six new satellites launched as of mid-2018.[60] Gaofen has been highlighted as a model of military-civil fusion (军民融合), given the range of defense and commercial applications that it will support, including those pursuant to China’s Belt and Road Initiative (or “One Belt, One Road” 一带一路).[61]

China is on track for rapid expansion of its remote sensing satellites. The LKW-3 satellite, developed by CAST and launched in January 2018, after launches of the LKW-1 and LKW-2 in December 2017, has also been characterized as intended for remote sensing purposes, potentially as an extension or augmentation of the

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[54] John Costello and Joe McReynolds, “China's Strategic Support Force: A Force for a New Era,” National Defense University Press, 2018.

[55] Elsa B. Kania, “Chinese Military Innovation in Artificial Intelligence,” Testimony before the U.S.-China Economic and Security Review Commission Hearing on Trade, Technology, and Military-Civil Fusion, June 7, 2019, https://www.uscc.gov/sites/default/files/June%207%20Hearing_Panel%201_Elsa%20Kania_Chinese%20Military%20Innovation%20in%20Artificial%20Intelligence.pdf.

[56] “Chinese commercial space start-ups launch two AI satellites in a hundred days” [中国商业太空初创企业百天内发射两颗AI卫星], Global Times, November 26, 2018, http://smart.huanqiu.com/ai/2018-11/13645096.html?agt=15422.

[57] For context and background, see: “China to launch first software-based satellite,” *Global Times*, April 8, 2018, http://www.globaltimes.cn/content/1096970.shtml. See also: Tang Shihua, “China's World-First Software-Defined Satellite Enters Orbit,” *Yicai*, November 20, 2018, https://www.yicaiglobal.com/news/china-world-first-software-defined-satellite-enters-orbit.
For a more technical assessment of the topic, see: Xu, Shuang, Xing-Wei Wang, and Min Huang. "Software-defined next-generation satellite networks: Architecture, challenges, and solutions." IEEE Access 6 (2018): 4027-4041.

[58] Wang Yi, “ADASpace set to star in AI satellite constellation sphere,” *Global Times*, June 30, 2019, http://www.globaltimes.cn/content/1156263.shtml.

[59] Ibid.

[60] Andrew Jones, “China to launch next Beidou navigation satellite pair on Wednesday,” *Global Times*, September 17, 2018, https://gbtimes.com/china-to-launch-next-beidou-navigation-satellite-pair-on-wednesday.

[61] “Gaofen satellite’s application for the country's overall capability initially formed” [高分卫星应用国家整体能力初步形成], *Xinhua*, April 19, 2017, http://www.cnsa.gov.cn/n6758824/n6759009/n6759041/n6759071/c6780473/content.html.

Yaogan series.[62] In addition, China plans to launch 60 high-resolution optical remote sensing satellites, known as Jilin-1,[63] by 2020. There are at least 13 in space as of 2019,[64] including the latest launched in China's first sea-based launch. [65] By 2020, China intends and is on track to create "a global, 24-hour, all-weather earth remote sensing system."[66] This China High-Resolution Earth Observation System (CHEOS, 中国综合地球观测系统) will includeEO and SAR satellites, as well as airborne and near-space systems, such as drones or stratospheric balloons.[67, 68] Some of China's big data centers designed for military-civil fusion have also concentrated on making data from space systems, such as remote sensing imagery, more readily available.[69]

China's capabilities in remote sensing will be enhanced by the expansion of the infrastructure, as well as improvement of techniques, to allow processing of data from its remote sensing satellites. For example, China's new overseas satellite ground station near the North Pole in Kiruna, Sweden, completed in 2016, will allow Beijing to collect satellite data anywhere on Earth at speeds more than twice as fast as previously.[70] This China Remote Sensing Satellite North Pole Ground Station (中国遥感卫星地面战北极接收站) has been characterized as integral to Gaofen,[71] reportedly possessing the potential to "improve greatly China's rapid global remote sensing data acquisition capabilities," with download speeds that are "the fastest in the world."[72]

This network of ground stations could continue to expand.[73] China plans to continue to strengthen its cooperation with countries, often under the aegis of One Belt, One Road, including the construction of further remote sensing satellite ground stations."[74] For example, in April 2018, China and Finland signed an agreement

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[62] "Third Chinese Launch of the Week Deploys LKW-3 Land Survey Satellite," SpaceFlight 101, January 13, 2018, http://spaceflight101.com/third-chinese-launch-of-the-week-deploys-lkw-3-land-survey-satellite/.
[63] The Jilin-1 was developed by Chang Guang Satellite Technology Co. Ltd., which is under the Chinese Academy of Sciences and Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP).
[64] "China to launch 60 high-resolution EO satellites by 2020," *Geospatial World*, January 29, 2018, https://www.geospatialworld.net/news/china-launch-60-high-resolution-video-satellites-2020/; and "Jilin-1: China's first commercial remote sensing satellites aim to fill the void," *Xinhua*, January 27, 2018, http://www.xinhuanet.com/english/2018-01/27/c_136929344.htm.
[65] Stephen Clark, "China's first sea launch declared a success," *Space Flight Now*, June 5, 2019, https://spaceflightnow.com/2019/06/05/chinas-first-sea-launch-declared-a-success/.
[66] "China to launch 60 high-resolution EO satellites by 2020," *Geospatial World*, January 29, 2018, https://www.geospatialworld.net/news/china-launch-60-high-resolution-video-satellites-2020/.
[67] "Status and development of China High-Resolution Earth Observation System and application," IEEE, July 2016, https://ieeexplore.ieee.org/document/7729969/.
[68] "Our Nation's High-Endurance UAV Remote Sensing System Research and Development Successful" [我国超长航时无人机遥感系统研制成功], *National Remote Sensing Center*, July 16, 2014, http://www.nrscc.gov.cn/nrscc/wrj/xwdt/201407/t20140716_32813.html.
[69] "The military-civil fusion big data center highlights the effects of aggregation" [军民融合大数据中心凸显聚集效应], *China Military Network*, May 3, 2017, http://www.81.cn/gfbmap/content/2017-05/03/content_176276.htm.
[70] Ibid.
[71] "China Remote Sensing Satellite Ground Station Achieved Gaofen 1, 2, 3, 4 Satellite Data Receipt" [中国遥感卫星地面站实现高分一号02、03、04卫星数据接收], *Xinhua*, April 4, 2018, http://news.cctv.com/2018/04/04/ARTIbukP04rsv3oMuLB2FUF6180404.shtml.
[72] "China's First Overseas Land Satellite Receiving Station Put into Operation," *Chinese Academy of Sciences*, December 16, 2016, http://english.cas.cn/newsroom/news/201612/t20161215_172471.shtml.
[73] "China's overseas remote sensing satellite station starts operation," *China Daily,* December 16, 2016, http://www.chinadaily.com.cn/china/2016-12/16/content_27687937.htm.
[74] "CAS Remote Sensing Global Institute" [中科院遥感地球所], *Science News*, December 25, 2017, http://news.sciencenet.cn/htmlnews/2017/12/398077.shtm.

to cooperate in research and spatial information acquisition, which will include access to facilities.[75] The "Space Silk Road" has expanded through multiple partnerships and agreements for cooperation. Even if such collaborations are typically characterized as being oriented toward scientific and commercial applications, these engagements may also support future military operations.

Maritime Surveillance

The PLA recognizes the continued construction of a maritime strategic early warning system as critical to its overall national strategic early warning system, given the increased prominence of maritime security threats.[76] The PLA is enhancing its capabilities for maritime surveillance through sea- and space-based systems, ranging from the launch of satellites dedicated to that mission to the construction of an "underwater great wall" of sensors, augmented by a range of underwater sensors and unmanned and autonomous underwater vehicles (A/UUVs). These developments not only have concentrated on establishing "sea control" (制海权) but also extend into the Pacific in ways that may have strategic implications for the balance of power in the region.

China is continuing to launch satellites in the Haiyang (海洋) series of maritime observation satellites. These include Haiyang-1A, launched in 2002; Haiyang-1B, launched in 2007; Haiyang-2A, launched in 2011; and Haiyang-1C, launched in 2018, along with the Haiyang-1D to be launched in 2019, all of which have various instruments for marine observation and oceanography.[77]

China's militarization of the South China Sea has involved the placement of a network of radars on its various installations on features, such as Fiery Cross, Subi Reef, and Mischief Reef, throughout the South China Sea.[78] These radar may contribute to early warning, signals intelligence, and even stealth detection, including via high-frequency (HF) arrays that are located on Cuarteron and Fiery Cross reefs.[79]

The PLA Navy has upgraded its capabilities with a ship-based over-the-horizon (OTH) radar to develop a compact version that can allow improved surveillance at much greater distances. According to the lead scientist on this project, Liu Yongtan, a professor at the Harbin Institute of Technology, who received China's top science award from President Xi Jinping for his efforts, "relying on traditional technologies, our surveillance and monitoring could only cover about 20 per cent of our maritime territory. With the new system, we can cover the whole area."[80]

China is pursuing the "Underwater Great Wall Project." This network of sensors, which will include those placed on the seabed integrated with a range of gliders, is currently under development by the China State Shipbuilding

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[75] "China and Finland signed a cooperation agreement for the Arctic Space Observation Joint Research Center," Institute of Remote Sensing and Digital Earth, April 17, 2018, http://www.radi.ac.cn/dtxw/rdxw/201804/t20180417_4997963.html.

[76] "China Must Construct a Maritime Strategic Early Warning Center" [中国需建海上战略预警中心 研导弹预警卫星], *Global Times*, December 3, 2014, http://mil.news.sina.com.cn/2014-12-03/1107813928.html.

[77] Stephen Clark, "China launches satellite to monitor world's oceans," *Space Flight Now*, September 9, 2018, https://spaceflightnow.com/2018/09/09/china-launches-satellite-to-monitor-worlds-oceans/.

[78] Alexander Neill, Meia Nouwens, and Laurence Taylor, "China's radar installations in the Spratly Islands – what do they tell us about its ambitions for the South China Sea?," *International Institute for Strategic Studies*, February 19, 2018, https://www.iiss.org/blogs/analysis/2018/02/china-radar.

[79] Sam LaGrone, "New Possible Chinese Radar Installation on South China Sea Artificial Island Could Put U.S., Allied Stealth Aircraft at Risk," USNI, February 22, 2016, https://news.usni.org/2016/02/22/new-possible-chinese-radar-installation-on-south-china-sea-artificial-island-could-put-u-s-allied-stealth-aircraft-at-risk.

[80] Stephen Chen, "Chinese navy's new 'compact' radar will allow it to keep watch over an area the size of India," *South China Morning Post*, January 9, https://www.scmp.com/news/china/science/article/2181251/chinese-navys-new-compact-radar-will-allow-it-keep-watch-over.

Corporation, intended to facilitate the detection of adversary submarines.[81] The Chinese government has also acknowledged the existence of new underwater listening devices between Guam and the South China Sea that are likely being used to monitor foreign submarines.[82]

For the PLA Navy, the introduction of a range of unmanned and autonomous systems could augment its maritime surveillance capabilities. The PLA Navy is starting to deploy and experiment with a range of intelligent/autonomous surface vessels and underwater vehicles, including some that are bionic in design.[83] Notably, the Haiyi (海翼) or "Sea Wing," an underwater glider designed by the Chinese Academy of Sciences (CAS) Shenyang Institute for Automation, has been employed primarily for scientific missions in the South China Sea.[84] It also has potential military utility because of its low acoustic signature.[85] PLAN gliders like the Haiyi could contribute to the detection of foreign submarines, thus enhancing PLA anti-submarine warfare capabilities.[86, 87] The "Haiyan" (海燕) glider, capable of conveying large sensors, has been used in the South China Sea, where it could be employed in the future for patrol, escort, or combat operations.[88] On the surface, 'intelligent' vessels, such as the Jinghai (精海), which is capable of navigating autonomously,[89] has entered service with the PLAN and might support maritime sensing and domain awareness.[90]

Tracking and Detection

The Space Systems Department has taken on responsibility for TT&C functions. Under the China Maritime Tracking and Control Department (中国卫星海上测控部), the PLA's fleet of seven Yuanwang (远望) vessels supports tracking and detection of satellites and spacecraft.[91] In addition, the China Launch and Tracking Control Systems Department (中国卫星发射测控系统部) is responsible through its Xi'an Satellite Control Center

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[81] Catherine Wong, "'Underwater Great Wall': Chinese firm proposes building network of submarine detectors to boost nation's defence," *South China Morning Post*, May 19, 2016, https://www.scmp.com/news/china/diplomacy-defence/article/1947212/underwater-great-wall-chinese-firm-proposes-building.

[82] Stephen Chen, "Surveillance under the sea: how China is listening in near Guam," *South China Morning Post*, January 22, 2018, https://www.scmp.com/news/china/society/article/2130058/surveillance-under-sea-how-china-listening-near-guam.

[83] For another analysis of the capabilities under development, see: Lyle J. Goldstein, "Meet the HN-1, China's New AI-Powered Underwater Drone," *National Interest*, July 15, 2018, https://nationalinterest.org/feature/meet-hn-1-chinas-new-ai-powered-underwater-drone-25706.

[84] "Sea Wing Series of Underwater Gliders Achieves the Largest Model of Swarms Simultaneously Observing" ["海翼"系列水下滑翔机实现最大规模集群同步观测], Shenyang Institute of Automation, August 24, 2017, http://www.cas.cn/syky/201707/t20170724_4609536.shtml.

[85] See "Ordinance Industry Science and Technology, 2017, Issue 19" [《兵工科技》2016年第19期杂志], September 22, 2016, https://freewechat.com/a/MzA5MTk4MTI1OA==/2651705629/1.

[86] Lyle Goldstein, "America May Soon Find Itself in an Underwater War with China," *National Interest*, July 24, 2017, https://nationalinterest.org/feature/america-may-soon-fight-itself-underwater-war-china-21650.

[87] "China's underwater glider completes Indian Ocean, S. China Sea missions," *Global Times*, January 05, 2018, http://en.people.cn/n3/2018/0105/c90000-9311787.html.

[88] "Demystifying the PLA's Six Major Mysterious Military Science and Technology in 2014" [解秘2014年解放军六大神秘军事科技], *Xinhua*, July 02, 2015, http://webcache.googleusercontent.com/search?q=cache:gu4aUAyuON0J:military.people.com.cn/n/2014/0702/c1011-25229236.html+&cd=3&hl=en&ct=clnk&gl=us.

[89] Kelvin Wong, "IMDEX 2017: China's Yunzhou-Tech showcases latest USVs," *IHS Jane's International Defence Review*, May 18, 2017, http://www.janes.com/article/70540/imdex-2017-china-s-yunzhou-tech-showcases-latest-usvs.

[90] ""Jinghai Series" Unmanned Sensing Boat Debuts" [精海号"无人测量艇亮相], November 4, 2015, http://ocean.china.com.cn/2015-11/04/content_36975694.htm.

[91] "This unit is responsible for water service support tasks throughout the year" [这支部队常年担负水上勤务保障任务], PLA Pictorial, November 22, 2017, http://photo.81.cn/pla/2017-11/22/content_7836185_6.htm.

for operating a number of fixed and mobile TT&C stations in and beyond China. The Chinese locations include Miyun (Beijing), Sanya (Hainan), Kashgar (Xinjiang), and Kunming (Yunnan), estimated to receive satellite signals encompassing about 70 percent of Asia.

The reach of the China Launch and Tracking Control Department has expanded globally; it has operated stations and established a presence in Karachi, Pakistan; Swakopmund, Namibia, Malindi, Kenya; Dongara, Australia; Santiago, Chile; Alcantara, Brazil; Neuquén, Argentina; and Kiruna, Sweden.[92,93,94] The geography of these ground stations and locations may be leveraged for strategic purposes, provoking security concerns in some cases. For example, China's leasing of the ground station in Dongara, motivated by geography advantageous for telemetry, resulted in controversy because of its proximity to sensitive U.S. military facilities.[95] The Neuquén Deep Space Facility in Argentina, built and operated by China to support lunar exploration missions, also possesses potential military relevance.[96]

Data Relay and Communications

China also is developing a limited but expanding architecture of satellites for data relay and communications. Thus far, these include the Fenghuo (烽火), Zhongxing (中星), and Shentong (神通) series of communication satellites.,[97] By late 2016, four Tianlian satellites (天鏈), designed to relay data among satellites and ground stations including for purposes of military communications, had become operational.[98] The launch of the secretive TXJSSY-1 communications engineering test satellite in September 2015 may have been related to an experimental early warning satellite program, according to some accounts.[99]

As of May 2018, the Queqiao (鹊桥) data relay satellite, which will support China's mission to the far side of the moon, also has been launched.[100] China has also begun to launch the first in a new array of 320 low-orbit satellites for communications, known as the Hongyan (鸿雁) constellation, which has been developed by

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[92] "Swakopmund, Namibia," Global Security, https://www.globalsecurity.org/space/world/china/swakopmund.htm

[93] "Namibia and China sign an employment agreement," Republic of Namibia Ministry of Education, March 29, 2012, http://www.moe.gov.na/news_article.php?type=pressrelease&id=60&title=Namibia.

[94] "China launches its first fully owned overseas satellite ground station near North Pole," *South China Morning Post*, December 16, 2016, https://www.scmp.com/news/china/policies-politics/article/2055224/china-launches-its-first-fully-owned-overseas-satellite.

[95] "China has Australia space tracking station," Phys.org, November 6, 2011, https://phys.org/news/2011-11-china-australia-space-tracking-station.html.

[96] Ernesto Londoño, "From a Space Station in Argentina, China Expands Its Reach in Latin America," *New York Times*, July 28, 2018, https://www.nytimes.com/2018/07/28/world/americas/china-latin-america.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=second-column-region&region=top-news&WT.nav=top-news.

[97] For a recent launch, see: "Zhongxing-9A Comsat lifts off atop Chinese Long March 3B, Launch Outcome Unclear," Spaceflight, June 18, 2017, http://spaceflight101.com/long-march-3b-zhongxing-9a-launch/. Rui C. Barbosa, "China returns from Spring break with Zhongxing-6C launch," March 9, 2019, https://www.nasaspaceflight.com/2019/03/china-returns-spring-break-zhongxing-6c-launch/; Stephen Clark, "China begins 2019 launch campaign with a success," *Space Flight Now*, January 10, 2019,

https://spaceflightnow.com/2019/01/10/china-begins-2019-launch-campaign-with-a-success/.

[98] "China's fourth launch of November puts 4th Tianlian-1 tracking and relay sat in orbit," GBTimes, November 22, 2016, https://gbtimes.com/chinas-fourth-launch-november-puts-4th-tianlian-1-tracking-and-relay-sat-orbit.

[99] For reporting and speculation at the time of its launch, see: "China Sends an Experimental Satellite Into Space on a Secretive Launch," *Spaceflight Insider*, September 13, 2015, https://www.spaceflightinsider.com/missions/defense/china-sends-an-experimental-satellite-into-space-on-a-secretive-launch/.

[100] "China launches relay satellite to explore Moon's far side," *Xinhua*, May 21, 2018, http://www.xinhuanet.com/english/2018-05/21/c_137194776.htm.

CASC.[101] There are plans to introduce the Xingyun (星云) project, another constellation of 156 low-orbit satellites for narrow-band commercial communications developed by the China Aerospace Science and Industry Corporation (CASIC).[102]

Challenges of Systems Integration

In the future, China could employ more integrated strategic early warning systems. In the PLA, the capabilities for various elements of early warning are primarily divided among the PLA Air Force, Strategic Support Force, and Rocket Force. The integration of these systems and capabilities necessarily requires integration of information among them, and the effectiveness of that coordination is difficult to evaluate. In the meantime, the efforts of the Chinese defense industry, particularly those of CETC, in developing systems for early warning appear more mature. At the Zhuhai Air Show in the fall of 2018, CETC revealed a range of new radar- and satellite-based early warning defense systems, claiming that these systems have improved datalinks that can enable real-time sharing and integration of intelligence for enhanced situational awareness.[103]

These systems aim to fulfill a range of operations anti-missile operations, space attack and defense, joint theater operations, far seas operations, and global surveillance and strike.[104] For example, the anti-missile warfare early warning system "focuses on achieving full-process intelligence acquisition of the ballistic missile target ascending and mid-to-end segments, supporting strategic counterattacks and anti-missile interception operations."[105] The design of these systems, which provide "multi-source fusion and comprehensive integration" of information, is intended to anticipate the demands of future warfare, involving information dominance, system of systems coordination, and all-domain operations. However, it is difficult to evaluate how capable these systems may be at present or the extent of their potential deployment.[106]

Cyber Espionage and Technical Reconnaissance

China's capabilities for cyber espionage and technical reconnaissance (i.e., signals intelligence) will also contribute to its situational awareness in a crisis or conflict scenario. Traditionally, the Third Department (3PLA) of the former PLA's General Staff Department (GSD) possessed primary responsibility for pursuing these activities. Along with the Technical Reconnaissance Bureaus (TRBs) of various services, 3PLA's units, of which perhaps the most infamous was Unit 61398 in Shanghai, were known for undertaking extensive hacking campaigns, often stealing intellectual property. Of course, their operations were also intended to support military intelligence and decision-making, such as through the theft of data relevant to understanding a potential

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[101] "CASC Hongyan Low-Orbit Communication Satellite Constellation" [航天科技的鸿雁低轨通信卫星星座], China Aerospace Science and Technology Corporation, May 19, 2017, https://www.chinaspaceflight.com/satellite/HONGYAN/HONGYAN.html.

[102] "China aerospace giant working on satellite clusters for global communications," *Global Times*, November 2, 2017, http://www.globaltimes.cn/content/1073321.shtml.

[103] "China tech group unveils radar, satellite-based warning system," *Asia Times*, November 6, 2018, http://www.atimes.com/article/china-tech-group-unveils-radar-satellite-based-warning-system/.

[104] "CETC Released "Radar Five Major Operational Early Warning Systems" to show you every corner of the world" [中国电科发布"雷达五大作战预警体系"带你看遍全球每个角落], *Global Times*, November 5, 2018, http://china.huanqiu.com/article/2018-11/13454077.html.

[105] Ibid.

[106] Liu Yang and Leng Shumei, "CETC reveals radar early warning systems for wars," *Global Times*, November 5, 2018, http://www.globaltimes.cn/content/1126030.shtml.

adversary's intentions. The former GSD Fourth Department (4PLA) engaged in electronic warfare and offensive operations in cyberspace.

Pursuant to the PLA's reforms and reorganization, the Strategic Support Force was established, incorporating the former 3PLA as the core of the Network Systems Department, which serves as a de facto "cyber command" for the PLA. As the process of force construction continues, the PLASSF will continue to recruit and train personnel, including expanding its human capital ecosystem of talents for cyberattack or defense. Beyond the Strategic Support Force, the PLA Army, Navy, Air Force, and Rocket Force, as well as the PLA's new theater commands (战区), each possess their own TRBs, among other intelligence capabilities. The measurement of cyber power is deeply challenging and it is particularly difficult to compare U.S. and Chinese cyber capabilities directly, given the opacity associated with operations in these domains. However, Chinese cyber capabilities and operational experience render the PLA a potentially formidable competitor in this domain.

Concluding Assessments

China's strategic situational awareness capabilities are robust and multifaceted, yet still constrained by certain technical and operational limitations. From the development of new radar and early warning aircraft to the rapid expansion of China's already extensive architecture of satellites, China has invested in expanding its capabilities for early warning and surveillance in ways that can enhance its readiness and capabilities in a future crisis or conflict. In some cases, it is difficult to assess the technical specifications of capabilities that have remained under development and are still overcoming past challenges in indigenous innovation, including issues of systems integration.

As the Chinese military is tasked to become a "world-class" force by mid-century, continued advances in its capabilities could enable the PLA to leapfrog ahead of the U.S. military in certain domains and technologies. Seeking to establish itself as an "aerospace superpower" (航天强国), China has launched a range of satellites at a rapid pace, quickly expanding its space-based surveillance capabilities, including its capacity to rapidly process and glean insights from that data. The PLA is actively experimenting with unmanned systems for early warning and reconnaissance, fielding and integrating a growing number of systems that could increase its flexibility in enhancing situational awareness in a crisis or conflict. Meanwhile, continued increases in PLA cyber capabilities could also contribute significantly to Chinese espionage.

As U.S.-China military rivalry continues to intensify, these improvements in the PLA's strategic situational awareness capabilities could prove stabilizing in certain respects, but they may also create new risks and challenges. For example, improved strategic early warning could decrease Chinese anxieties about the risks of a "false negative" and enable more time for decision-making in a crisis in ways that mitigate the risks of accidental escalation. However, the continued improvement of Chinese strategic early warning over the next decade or more could facilitate a transition to a posture of rapid response or even launch on warning that could prove risky or destabilizing, particularly if this trend corresponds with an increased reliance on complex emerging technologies, such as AI. At the same time, these increased capabilities will also improve the PLA's war-fighting capabilities in its near seas, including in likely conflict contingencies, while enabling future power projection. In this regard, these trends present another indication of China's emergence as a rival that can challenge traditional American military and technological leadership.

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