

The Chinese Acquisition Process

Christian Curriden

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Testimony of Christian Curriden¹
The RAND Corporation²

Before the U.S.-China Economic and Security Review Commission

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Given enough time, money, and clear operational tasks, the People's Liberation Army (PLA) research, development, and acquisition (RDA) system is clearly capable of producing innovative and advanced platforms. Over the past 30 years, it has made great progress in a number of very difficult fields, including hypersonic vehicles, carrier-based aviation, and propulsion systems, though jet engines and naval diesel engines seem to present some difficulties.³ Despite these achievements, it is a system plagued by many inefficiencies.

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³ Note that, while the Chinese have made great progress in jet engine production, as of March 2023, supply chain efforts continue to impede mass production of military jet engines. Civilian jet engines remain even further behind. That said, China's ability to replace many of its Russian engines with domestic products suggests that, at least for military platforms, it may be close to addressing this problem. Note, too, that, as of 2022, the Chinese struggled with multi-fuel small-watercraft engines. On the diesel-naval-engine front, until at least 2020, Chinese destroyers were being built with German engines license-produced in China. Although domestic alternatives seem to be available, the fact that China continued to purchase these German models despite the country's emphasis on domestic development of weapon systems suggests that the Chinese models may have been deficient in some way. See Minnie Chan, "China's Next-Gen J-20 Stealth Fighter Jettisons Russian Engine in Favor of Home-Grown Technology," *South China Morning Post*, January 8, 2021; Amanda Lee, "China's C919 Jet to Be More Home-Grown with a Domestically Made Engine, But How Long Will It Take?" *South China Morning Post*, October 12, 2022; Amanda Rivkin, "German Technology Found in China's Warships: Report," *Deutsche Welle*, November 6, 2021; U.S. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China*, 2022, p. 153; and Mike Yeo, "Supply Chain Issues Impede Mass Production of New Chinese Engine," *Defense News*, March 27, 2023.

PLA oversight over the large, state-owned conglomerates that monopolize the defense sector remains an issue. RDA is also a slow process—generally ten to 15 years to produce new large platforms, and sometimes considerably longer.⁴ There may be some exceptional systems that have been developed more rapidly (the DF-17 hypersonic missile may be one such example), and upgrades to existing systems can come more quickly, but most of the aircraft, ships, tanks, and missiles the PLA employs today have been under development since at least the early 2010s, and perhaps even much earlier. This consistent focus on ambitious projects and generous expenditure of resources over time is perhaps the greatest strength of the Chinese RDA process. While the PLA has encountered many difficulties and failures since the turn of the millennium, it has learned from them, has continued to improve, and now produces some of the most effective weapon systems in the world.

It is important to note that this testimony is based entirely on publicly available sources. Given the opacity of China's RDA process, the reliance on publicly available sources has presented some difficulties and led to a certain degree of uncertainty over milestones like program start and end dates. It also necessitates a focus on large platforms, such as aircraft, warships, armored vehicles, and ballistic missiles, which are easier to track in open sources. The conclusions in this testimony might not apply to software, platform upgrades, key components like radar or other sensors, or other smaller-scale acquisition efforts. Given the length of time the PLA RDA system usually takes to produce a new platform, most of the systems examined were begun before Xi Jinping's major military reforms, so it is difficult to see the full impact of those reforms on the entire RDA process from start to finish for a single major platform.

Xi Jinping and Acquisition Reform

Since taking office in 2012, Xi Jinping has made reforming and modernizing the Chinese military and wider defense industrial base one of his key priorities. From 2012 to 2020, he made as many as 120 visits to sites or events associated with military modernization, far more than his predecessors.⁵ These visits included appearances aboard China's new aircraft carrier, at the National University of Defense Technology (the Chinese military's main science and technology university), and at the All-Army Armament Conference in Beijing.⁶

Many of the largest changes that Xi made were reminiscent of the U.S. Goldwater-Nichols reforms of the late 1980s. Most operational control has been shifted from the PLA service branches to newly formed joint theater commands, leaving the services responsible for

⁴ U.S. timelines can also take well over a decade.

⁵ Tai Ming Cheung, "Keeping Up with the *Jundui*: Reforming the Chinese Defense Acquisition, Technology, and Industrial System," in Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N. D. Yang, and Joel Wuthnow, eds., *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms*, National Defense University Press, 2019, pp. 589–591; Tai Ming Cheung, *Innovate to Dominate: The Rise of the Chinese Techno-Security State*, Cornell University Press, 2022, p. 144.

⁶ Cheung, 2019, pp. 589–591.

organizing, training, and equipping China's military.⁷ The PLA's four general departments (staff, political affairs, logistics, and armaments) have been largely dismantled, and many of their responsibilities and institutions have either gone to a new set of 15 offices, commissions, and departments directly under the Central Military Commission or devolved to the services.⁸

One of the bureaucratic losers in this reform was the PLA's General Armaments Department, which lost many of its responsibilities for direct oversight of acquisition programs to the PLA service branches (especially the PLA Army, or ground forces).⁹ It also lost its oversight of the Science and Technology Committee, which now operates directly under the Central Military Commission.¹⁰ The General Armaments Department's successor, the Equipment Development Department (EDD), remains responsible for "centralized unified management" of the PLA armament system and joint issues affecting the entire military.¹¹ Along with the State Administration of Science, Technology, and Industry for National Defense (SASTIND), it is also in charge of licensing processes and regulations for firms in the defense industry.¹² The PLA service branches each have their own equipment development departments, which seem to be in charge of managing the military representative systems and overseeing weapon tests for their services, while the EDD seems responsible for overall design and regulation of the testing and evaluation process, as well as establishment of military-wide standards.¹³ The EDD is also responsible for developing an overall Weapons Equipment Development Strategy, which lays out the basic assumptions about geostrategic trends, technological developments, and future conflicts that underpin the PLA's weapon development.¹⁴ This strategy serves as the basis for

⁷ Some services may retain some operational control, but these are the exception rather than the rule (Joel Wuthnow and Phillip C. Saunders, "Introduction," in Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N. D. Yang, and Joel Wuthnow eds., *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms*, National Defense University Press, 2019, pp. 7–8).

⁸ Wuthnow and Saunders, 2019, pp. 6–7.

⁹ Cheung, 2019, p. 592.

¹⁰ Mark Ashby, Caoliann O'Connell, Edward Geist, Jair Aguirre, Christian Curriden, and Jonathan Fujiwara, *Defense Acquisition in Russia and China*, RAND Corporation, RR-A113-1, 2021, pp. 16–17, https://www.rand.org/pubs/research_reports/RRA113-1.html.

¹¹ Cheung, 2019, p. 592; Cheung, 2022, p. 163.

¹² Cheung, 2022, p. 114.

¹³ It is possible that the EDD is more directly responsible for overseeing some tests (Cheung, 2022, p. 164; Hu Kaibing [胡锴冰] and Jin Yongchan [金永昆], "Navy Equipment Development Department Builds Cross-Service Military Representative Contract Oversight System" ["海军装备部坚持质量至上以战领建原则 探索构建跨军兵种军代表合同监管体系"], China Military Online [中国军网], October 29, 2019, http://www.81.cn/jpdbfy2019/ywyl_206455/9663060.html; Hu Kaibing [胡锴冰], Lei Zhu [雷柱], and Wang Haofan [王皓凡], "Taking a Closer Look at a Navy Military Representative Office and Getting a Feel for the 'Battlefield Perspective' of the New Age" ["让我们走进海军某军代室, 感受新时代监造官们的'战位观'"], China Military Online [中国军网], April 21, 2021, http://www.81.cn/yw_208727/10026068.html.

¹⁴ Cheung, 2022, pp. 151–154.

ten-, five-, and one-year Weapon Equipment Construction Plans, which translate its general principles into concrete weapon programs and requirements.¹⁵

Xi's attention has also resulted in changes in the defense industry more broadly. He has accelerated the consolidation of the major state-owned firms that act as prime contractors for military platforms and moved to strengthen these firms.¹⁶ In particular, he has overseen a reform of their many scientific institutes, addressing many of the ownership, classification, and personnel issues that had hampered their research in the past.¹⁷

More broadly, Xi has repeatedly emphasized the importance of scientific and technological research in both the military and civilian sectors. In particular, he has called on the PLA to shift from a primarily absorptive model of innovation (in which most technological progress is made by buying or stealing foreign technology and incorporating it into the Chinese military) to one based on original innovation.¹⁸ This is not to say that Chinese leaders are opposed to the purchase or outright theft of foreign technology, but they have expressed the need for more of the PLA's systems to be based on indigenous innovation. This drive for domestic technology may be based in part on fears of remaining reliant on foreign sources for components or know-how, as well as the belief that domestic innovation will help China's economy and the PLA remain internationally competitive.¹⁹

Similarities to the U.S. Acquisition Process

Many aspects of China's RDA process are broadly similar to that of the United States. Like the United States, the PLA seems to have five broad steps to its acquisition process. First is a feasibility study to establish requirements and assess the possible costs of a new program. Next comes a project design phase, in which models and prototypes are built and assessed. Third is an engineering and development phase, during which the PLA undertakes full-scale design of the new platform. The program then enters an experiment and design finalization phase, in which the system is subjected to specialized testing by PLA testing-and-evaluation units. Finally, if the system has successfully passed all of these stages, it proceeds to batch production, although, as will be discussed in the following section, this might not mean immediate mass production.²⁰

Chinese acquisition programs generally seem to take between ten and 15 years, with some exceptions. This is broadly in line with the timescale of major U.S. acquisition programs, which generally take more than a decade, though, here again, there are exceptions.²¹ The Y-20 airlifter,

¹⁵ Cheung, 2022, pp. 151–156.

¹⁶ Cheung, 2019, p. 598.

¹⁷ Cheung, 2019, pp. 603–604.

¹⁸ Cheung, 2019, pp. 593–594.

¹⁹ Cheung, 2019, pp. 594–595.

²⁰ Ashby et al., 2021, pp. 17–18.

²¹ There is not enough information in open sources to say whether the Chinese system or the U.S. system is faster. It may depend on the type of weapon system involved. Available information suggests that both systems operate on

for example, underwent about 17 years of research and development before reaching something like initial operational capability.²² Even the carrier-borne J-15 took 11 to 13 years, despite the fact that it was a very high-priority program.²³ In some cases, the PLA has been known to rush the early research and development phases, but this has generally led to lengthy technology, engineering, and demonstration processes and low initial production rates, as seen with the J-15 and the Type 052 destroyer.²⁴ A lack of transparency regarding the earlier stages of the development process can make these timelines difficult to track, and there may be some exceptional programs that were able to proceed with greater speed. The PLA's hypersonic DF-17 missile might be one such exception, though this is far from obvious, as I will discuss later. It should also be reiterated that this testimony is based on research focused on large weapon platforms, not components or upgrades. By and large, however, the PLA and U.S. RDA processes seem to be operating on similar timescales, with most major programs taking more than a decade.²⁵

The U.S. and Chinese defense industrial bases are also similar in terms of the overall size of defense firms. While U.S. defense firms remain the largest in the world in terms of defense revenue, their Chinese counterparts are catching up. As of 2022, eight of the top 20 global defense firms in terms of defense-related revenue were from the United States, and seven were in China.²⁶ It is also worth noting that the Chinese defense state-owned enterprises (SOEs) are significantly larger than their defense revenue would suggest, as about two-thirds of the revenues of most Chinese defense firms comes from non-defense-related activities, such as automobiles or white goods production.²⁷

broadly similar timescales for the development of large weapon platforms (“20 Years of Assessing DOD’s Weapon Programs Shows the Importance of Having the Right Information Before Making Investment Decisions,” *WatchBlog*, Government Accountability Office, July 7, 2022, <https://www.gao.gov/blog/20-years-assessing-dods-weapon-programs-shows-importance-having-right-information-making-investment-decisions>).

²² Ashby et al., 2021, pp. 18–19.

²³ Ashby et al., 2021, pp. 18–19.

²⁴ Ashby et al., 2021, p. 19; Tai Ming Cheung, “Strengths and Weaknesses of China’s Defense Industry and Acquisition System and Implications for the United States,” in *Proceedings of the Fourteenth Annual Acquisition Research Symposium*, Vol. II, Naval Postgraduate School, March 31, 2017, p. 343.

²⁵ Of course, there are some U.S. programs that take considerably longer, and the lack of specificity in open sources makes it difficult to determine exactly whether the U.S. system or the Chinese system operates more rapidly. In terms of major platform development, both systems seem to be operating within broadly similar timescales (“20 Years of Assessing DOD’s Weapon Programs Shows the Importance of Having the Right Information Before Making Investment Decisions,” 2022; Ashby et al., 2021, p. 19).

²⁶ Note that defense revenues at Lockheed Martin and Boeing remain the largest by a sizable margin. Note, too, that the Chinese defense conglomerates are quite large, but much of their revenue comes from non-defense-related subsidiaries (Defense News, “Defense News Top 100,” webpage, undated, <https://people.defensenews.com/top-100/>; see also Ashby et al., 2021, pp. 19–20).

²⁷ Cheung, 2022, p. 170.

Differences from the U.S. Acquisition System

Many of the differences between the U.S. and Chinese RDA processes stem from the relationships that Chinese defense firms share with the PLA and the Chinese Communist Party (CCP), which are significantly different from the relations between the U.S. Department of Defense and its suppliers. Almost all major Chinese military platforms are produced by one of a handful of large SOEs, which, like the PLA, are important interest groups within the CCP. Their chief executives' positions are among those controlled by the nomenklatura system of the Organization Department of the Central Committee of the CCP, and they carry an official rank equivalent to that of a vice minister.²⁸ These firms were formed in the 1980s and 1990s as the CCP carved the carcass of its old Stalinist command economy into distinct enterprises, and they continue to be subject to the regulations of SASTIND, a civilian government agency responsible for overall planning, regulation, and oversight of the defense industry.²⁹ Thus, there is likely limited legal recourse when disputes arise between PLA officials and their SOE suppliers, as both (as well as the courts themselves) are important political actors within the CCP.³⁰ Contracts between the PLA and these SOEs have generally been simplistic and perfunctory, without clear technical obligations.³¹ Most have traditionally been based on a “cost-plus” model inherited from the old command economy, in which a profit of 5 percent is guaranteed to the enterprise, leaving little incentive to improve efficiency or reduce costs.³²

The PLA is not unaware of these problems and has made some moves to rectify them. In 2014, the General Armaments Department (now the EDD) sought to reform the PLA pricing structure to allow for other pricing models and to control costs.³³ Such measures have likely been resisted by defense SOEs, and it is unclear how prevalent cost-plus contracts remain.³⁴ More recently, in late 2021 and 2022, the PLA released several new policies promising a “new system”

²⁸ Top-level SOE executives do form a relatively distinct group within the Chinese elite and often retire or move to different SOEs when their positions end, though some are transferred to other provincial or central government bodies (Wendy Leutert, “The Political Mobility of China’s Central State-Owned Enterprise Leaders,” *China Quarterly*, Vol. 233, March 2018, pp. 1–2).

²⁹ Note, for example, the continued ability of SASTIND to regulate how its research institutes are structured. See Ashby et al., 2021, p. 16; and Cheung, 2022, p. 119.

³⁰ There is limited information available in public sources about how exactly disputes between the PLA and SOEs are resolved. It is not impossible that Xi Jinping’s drive to use the law to strengthen the CCP will result in a larger role for judicial institutions in this process. I find this unlikely because of (1) the traditionally underdeveloped state of court oversight in the defense sector; (2) the fact that the PLA and the SOEs are both powerful party bodies and the courts are under party control, leaving any judicial decisionmaking process at the mercy of backroom deals within the CCP; and (3) the fact that Xi’s focus on law clearly does not mean making the CCP in general subject to legal review. See Ashby et al., 2021, pp. 22–23; and Cheung, 2022, pp. 96, 176.

³¹ Ashby et al., 2021, pp. 22–23; Cheung, 2022, p. 176.

³² Ashby et al., 2021, p. 23; Cheung, 2022, p. 176.

³³ Cheung, 2022, pp. 176–177.

³⁴ Cheung, 2022, pp. 176–177.

for military procurement, including contract management.³⁵ These regulations seem to be classified, and it is currently unclear what effect they will have on the ways the PLA interacts with the SOEs and private firms.

Finally, most of these large SOEs are essentially monopolies for a given set of platforms.³⁶ While there are two Chinese defense conglomerates in some areas (for example, both the China Aerospace Science and Technology Corporation and the China Aerospace Science and Industry Corporation produce long-range missiles), they often specialize in different types of platforms, so, in general, the PLA has only one option to turn to as the lead system integrator for most major programs.³⁷

Often lacking competition or clear contracts to protect its interests vis-à-vis the Chinese defense SOEs, the PLA has traditionally relied on the CCP's administrative control over them and on its own military representative officers.³⁸ These are active-duty PLA officers stationed at the factories or research institutes that are producing the weapons their service branches will be using. They are meant to protect the interests of the PLA by ensuring production quality and contract execution.³⁹ In doing so, they have historically been hampered by low education levels; most are recent college graduates with limited technical training. In addition, these officers often experience conflicts of interest. Their salaries have traditionally been paid by the institutions they are charged with monitoring; they tend to stay at a single institution for a long time; and, after retirement, they often find jobs at the institutions they used to monitor.⁴⁰

Articles published after the Xi Jinping reforms of the mid-2010s show that this military representative system remains in place.⁴¹ Recent reforms have included efforts to establish joint military representative offices to avoid duplication of effort and measures instituted to allow military representatives to remotely monitor the institutions over which they have oversight.⁴² Military representative offices seem to continue to have close, long-term relationships with the

³⁵ “Central Military Commission Chairman Xi Jinping Signs the ‘Military Equipment Purchasing Regulations’” [“中央军委主席习近平签署命令 发布《军队装备订购规定》”], State Council Information Office of China, November 1, 2021, <http://www.scio.gov.cn/tt/xjip/Document/1715707/1715707.htm>; Li Jiaqi [李佳琦], Ma Zijian [冯子剑], and Ding Tuo [丁拓], “Forging the Sharp Blade of Future Victory, We Need a Breakthrough from ‘0 to 1’” [“锻造制胜未来的利刃，我们需要更多”从0到1的突破], China Military Online [中国军网], April 6, 2022, http://www.81.cn/pl_208541/jdt_208542/10146201.html.

³⁶ Ashby et al., 2021, p. 23; Cheung, 2022, p. 172; Peter Woods and Alex Stone, *China's Ballistic Missile Industry*, China Aerospace Studies Institute, May 11, 2021, pp. 5–6.

³⁷ There are exceptions in some areas, such as medium-range ballistic missiles or laser-based air defense systems. See Ashby et al., 2021, p. 23; and Woods and Stone, 2021, pp. 5–6.

³⁸ Tai Ming Cheung, “An Uncertain Transition: Regulatory Reform and Industrial Innovation in China's Defense Research, Development, and Acquisition System,” in Tai Ming Cheung, ed., *Forging China's Military Might: A New Framework for Assessing Innovation*, Johns Hopkins University Press, 2014, pp. 49–52.

³⁹ Ashby et al., 2021, p. 21.

⁴⁰ Ashby et al., 2021, p. 22.

⁴¹ “Central Military Commission Chairman Xi Jinping Signs the ‘Military Equipment Purchasing Regulations,’” 2021; Li, Ma, and Ding, 2022.

⁴² Hu and Jin, 2019; Hu, Lei, and Wang, 2021.

institutions they monitor.⁴³ More research would be needed to determine whether their pay structure, education, and employment patterns after retirement from the PLA have changed.

The PLA's RDA system also tends to be highly iterative. Once a new system goes into production, work often begins on a newer, upgraded version, usually designated an A/B/C/D variant.⁴⁴ For some platforms, at first, only small numbers of systems are produced and distributed to operational PLA units for further testing, and their input can result in changes in future versions.⁴⁵ In some cases (such as the Type 98 tank or the Type 052 destroyer), the first version of the platform has been so unsatisfactory that the PLA has purchased only a relatively small number, waiting for improvements.⁴⁶

The PLA seems to take an especially aggressive approach to buying or stealing foreign technology, and many of its weapon systems are copies of foreign models. There are numerous examples of this. The Chinese J-11 is more or less a copy of the Russian SU-27 with various indigenously produced upgrades, the Chinese CH-4 drone is based largely on the U.S. MQ-9, and China's J-20 borrows heavily from the U.S. fifth-generation fighter programs.⁴⁷ The CCP has devised a number of methods to acquire dual-use technologies from the private sector, including joint ventures with foreign firms, purchase of all or parts of foreign technology companies, and theft.⁴⁸ Acquiring single-use military technologies can be more difficult, though the PLA has been able to make some progress in this area by reverse-engineering military equipment purchased from foreign (usually Russian) firms and engaging in cyberespionage.⁴⁹

Weaknesses

As discussed, the Chinese RDA process can produce unsatisfactory products that require multiple iterations, and even its reverse-engineered platforms can be inferior to the originals on which they are based.⁵⁰ The major defense conglomerates that dominate most of China's defense sector have produced some significant breakthroughs, but they remain relatively unprofitable and

⁴³ Li Xin [李鑫], "Third Academy 8358 Institute Hosts 2022 PLAAF Military Office Coordination Meeting" ["三院 8358 所召开 2022 年空军军所协调会"], CASIC Third Academy, March 21, 2022, <http://www.fhjs.casic.cn/n7160835/n7161156/c23194116/content.html>.

⁴⁴ Ashby et al., 2021, p. 18.

⁴⁵ Ashby et al., 2021, p. 18.

⁴⁶ Ashby et al., 2021, p. 18; "Land Warfare Platforms: Armoured Fighting Vehicles - Type 98; Type 99," *Janes Land Warfare Platforms: Armoured Fighting Vehicles*, March 19, 2021; "China-Navy," *Janes World Navies*, last updated May 19, 2022.

⁴⁷ Ashby et al., 2021, p. 23; "China-Air Force," *Jane's World Air Forces*, February 14, 2023.

⁴⁸ Ashby et al., 2021, p. vii; Sean O'Connor, *How Chinese Companies Facilitate Technology Transfer from the United States*, U.S.-China Economic and Security Review Commission, May 6, 2019.

⁴⁹ David Alexander, "Theft of F-35 Design Data Is Helping U.S. Adversaries – Pentagon," Reuters, June 19, 2013; Ashby et al., 2021, p. 29; Ian Burns McCaslin and Andrew S. Erickson, "The Impact of Xi-Era Reforms on the Chinese Navy," in Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N. D. Yang, and Joel Wuthnow, eds., *Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms*, National Defense University Press, 2019, pp. 130–131.

⁵⁰ Ashby et al., 2021, p. 23.

less innovative than their private-sector counterparts.⁵¹ Oversight over these behemoths has proven difficult. In the old command economy, the CCP enjoyed a large network of administrative offices that it could use to gather information on economic actors and directly control their actions. The end of the command economy saw the dismantling of many of these offices. In theory, competition and market forces were meant to fill some of their functions, forcing SOEs to increase efficiency without needing direct compulsion from the party state.⁵² In the defense sector, however, most subsectors remain dominated by a single state-owned conglomerate. Attempts to introduce private actors have borne some fruit, but they have not changed the fact that, for most platforms, the PLA has only one firm to turn to as the lead integrator. Under Xi Jinping, the trend has been for greater consolidation and government control rather than diversification and market forces.⁵³

The Chinese RDA process can also be constrained by a lack of skilled personnel.⁵⁴ As noted previously, the lack of technical training among military representatives (some of whom must oversee extremely complex systems or research efforts) has been cited as an impediment to their ability to protect PLA interests.⁵⁵ In some new fields, such as artificial intelligence, China seems to be especially deficient in senior engineers with a decade or more of experience.⁵⁶ SOEs also seem to be having trouble retaining top talent in the face of competition from the private sector. The loss of researchers like Zhang Xiaoping (a key designer of liquid-propelled engines) to jobs in private companies almost certainly slows the PLA's progress in some fields.⁵⁷ However, it is difficult to quantify how much of an impact these issues have had. They certainly have not prevented the PLA from producing several very innovative and technically sophisticated weapon systems, including hypersonic missiles, anti-ship ballistic missiles, and aircraft carriers. And Chinese expenditure on research and development is growing rapidly, leading to a growing workforce.⁵⁸ Beijing benefits from large numbers of students returning from technical studies in the United States, though it pays for this privilege both by financially subsidizing U.S. research institutes and by losing at least 20 percent of its best and brightest minds annually, as many of

⁵¹ Ashby et al., 2021, pp. 19, 21.

⁵² Ashby et al., 2021, p. 21.

⁵³ While the two aircraft corporations (Aviation Industry Corporation of China I and II) consolidated into a single firm in 2008, before Xi became China's leader, Xi has overseen the consolidation of China's twin nuclear firms and military shipbuilders, as well as cooperation agreements between China's two major missile producers. See Cheung, 2022, p. 172; and Cheung, 2019, p. 598.

⁵⁴ Woods and Stone, 2021, p. 2.

⁵⁵ Ashby et al., 2021, p. 22.

⁵⁶ Jeffrey Ding, *Deciphering China's AI Dream: The Context, Components, Capabilities, and Consequences of China's Strategy to Lead the World in AI*, Future of Humanity Institute, University of Oxford, March 2018, pp. 26–27.

⁵⁷ Woods and Stone, 2021, pp. 20–21.

⁵⁸ Ashby et al., 2021, p. 24.

these students choose not to return to China.⁵⁹ The proportion of Ph.D. graduates who remain in the United States may be significantly larger.⁶⁰

Chinese leaders often express worry that the PLA and the Chinese economy generally are too dependent on foreign-supplied technologies and components and fear that hostile powers could disrupt their access to these components.⁶¹ U.S. measures, such as export controls to reduce Russia's supplies of critical military components, may have had a deleterious impact on Moscow's operations in Ukraine.⁶² However, there are reasons to believe that cutting the PLA off from critical components may prove more difficult. Many of the components that Chinese arms manufacturers once imported from abroad, such as helicopter engines, can now be produced domestically, and great progress is being made on jet engines as well.⁶³ Furthermore, China is the largest trading partner of 120 countries around the globe, and it may be able to buy on the international market whatever it cannot build itself.⁶⁴ This is not to say that it would be impossible or not worthwhile to restrict PLA access to advanced technology, but more research may be needed to identify what foreign components the PLA is reliant upon, how their loss would affect its operations, and what its options are for obtaining them.

Finally, while it is easy to identify the myriad problems China faces in its RDA process, it is worth noting that the U.S. RDA system suffers from its own inefficiencies. The United States is also heavily reliant on minerals and components imported from abroad, many of them from China.⁶⁵ Like China, the United States struggles with a lack of skilled workers in its defense industrial base.⁶⁶ While U.S. defense conglomerates may be more efficient and profitable than their state-owned Chinese counterparts, and while the U.S. defense sector remains more diversified than China's, consolidation in the U.S. defense market has forced the U.S. military to rely on an ever-shrinking pool of large firms to act as its lead system integrators.

⁵⁹ Zou Shuo, "Overseas Experiences Brought Back to China," *China Daily*, November 25, 2022.

⁶⁰ In the early 2010s, as many as 90 percent of Ph.D. students remained in the United States, though this proportion may have fallen since then (Zhang Ruinan, "China Lures PhD Holders," *China Daily*, February 9, 2018).

⁶¹ Cheung, 2022, pp. 143–144; Richard P. Suttmeier, Cong Cao, and Denis Fred Simon, "China's Innovation Challenge and the Remaking of the Chinese Academy of Sciences," *Innovations*, Summer 2006, p. 79; U.S. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China*, 2022, p. 151.

⁶² Office of the Spokesperson, "The Impact of Sanctions and Export Controls on the Russian Federation," fact sheet, U.S. Department of State, October 20, 2022.

⁶³ Peter Wood, Alden Wahlstrom, and Roger Cliff, *China's Aeroengine Industry*, China Aerospace Studies Institute, March 2020, pp. 26–31, 35–37.

⁶⁴ Mark A. Green, "China Is the Top Trading Partner to More Than 120 Countries," *Stubborn Things*, blog, Wilson Center, January 17, 2023, <https://www.wilsoncenter.org/blog-post/china-top-trading-partner-more-120-countries>.

⁶⁵ Cortney Weinbaum, Caoliann O'Connell, Steven W. Popper, M. Scott Bond, Hannah Jane Byrne, Christian Curriden, Gregory Weider Fauerbach, Sale Lilly, Jared Mondschein, and Jon Schmid, *Assessing Systemic Strengths and Vulnerabilities of China's Defense Industrial Base: With a Repeatable Methodology for Other Countries*, RAND Corporation, RR-A930-1, 2022, p. 52, https://www.rand.org/pubs/research_reports/RR-A930-1.html.

⁶⁶ National Defense Industrial Association, *Vital Signs 2023: Posturing the U.S. Defense Industrial Base for Great Power Competition*, February 2023, pp. 18–19; U.S. Department of Defense, "Defense Department Launches Initiative to Boost U.S. Industrial Workforce," press release, November 23, 2020.

Strengths

Ultimately, the strength of any RDA process must be measured by the quality of the weapon systems it produces. On this count, the Chinese system must be seen as a qualified success. Although it has struggled in many ways and some of its platforms continue to lag behind comparable platforms in the United States and other nations, it has produced a number of unique and highly innovative systems. Its long-range missile force stands out as a particularly great achievement. While China certainly built on some earlier U.S. and Russian technologies, many of the platforms in its Rocket Force have clearly moved far beyond these antecedents to enable innovative and unique concepts of operations.

It must be emphasized that developing these systems was not a quick process. The Chinese have probably been working on building extremely long-range anti-ship missiles since at least the 1995–1996 Taiwan Strait Crisis.⁶⁷ China's RDA system operates on plans that go out as far as 20 years, and many of China's modern weapons date back to Jiang Zemin's decision in 1999 that the PLA needed to be able to deter or defeat U.S. intervention in East Asia.⁶⁸ When major programs have failed or encountered setbacks, Chinese producers have continued to patiently iterate until they produce a satisfactory product.⁶⁹ Many of the PLA's platforms that now worry U.S. planners date back to the 1990s or early 2000s. For example, the J-20 stealth fighter has been in development since around 1998, the 052C/D guided-missile destroyer since around 1997–1998, the J-15 fighter since around 2005, and the Y-20 strategic airlifter since around 2000.⁷⁰ Xi Jinping has certainly left an indelible mark on the PLA, but the physical platforms that have become operational under his leadership are largely an inheritance from his predecessors. Given enough time, money, and clear and consistent operational problems to solve, the Chinese RDA system is clearly capable of producing innovative and highly lethal systems. Its willingness to continue to devote significant resources to these programs over decades, even in the face of failures and setbacks, is one of the system's greatest strengths.

The Chinese long-range missile program in particular stands out as a singular achievement. Unlike in many other areas, in which the PLA seems to be seeking to catch up with the U.S. military and copy U.S. capabilities, China's Rocket Force has pioneered new capabilities and concepts of operations quite beyond those of any other military.⁷¹ In its hypersonics program, the PLA may have even begun to produce new platforms in under ten years, though this is difficult to verify. While the origins and development phase of China's DF-ZF hypersonic glide vehicle

⁶⁷ Mark Stokes, "China's Evolving Space and Missile Industry: Seeking Innovation in Long-Range Precision Strike," in Tai Ming Cheung, ed., *Forging China's Military Might: A New Framework for Assessing Innovation*, Johns Hopkins University Press, 2014, p. 260.

⁶⁸ Cheung, 2022, pp. 151, 181.

⁶⁹ Ashby et al., 2021, p. 18; "China–Navy," 2022; "Land Warfare Platforms: Armoured Fighting Vehicles - Type 98; Type 99," 2021.

⁷⁰ Cheung, 2017, p. 344.

⁷¹ Note, in particular, the PLA Rocket Force's anti-ship ballistic missile strike capabilities. See Andrew S. Erickson, *Chinese Anti-Ship Ballistic Missile (ASBM) Development: Drivers, Trajectories and Strategic Implications*, Brookings Institution Press, 2013, p. 1.

and DF-17 hypersonic weapon remain somewhat murky,⁷² their flight test phase alone seems to have begun in 2014, and the system reached initial operational capability sometime between 2019 and 2022 (five to eight years; sources differ).⁷³ It is not impossible that this would result in a total development timeline of less than ten years, but that would require an exceptionally short design and ground-testing process. For reference, the J-15 fighter had been under development for about four years before its maiden flight, the J-20 stealth fighter for 12 years, and the Y-20 transport for about 12 years.⁷⁴ China could also have other hypersonic programs that are proceeding more quickly.⁷⁵

Policy Insights

The research on which this testimony is based offers the following policy insights to keep in mind as Congress considers the Chinese and U.S. RDA processes:

- The Chinese RDA process has a number of inefficiencies, many of which stem from the basic structure of the Chinese defense industrial base. While Xi Jinping’s anti-corruption reforms may help alleviate these inefficiencies, he has shown little interest in fundamental structural reform to increase market competition among defense companies or to change their relationship to the CCP and the major defense SOEs.
- Given sufficient time and money, the Chinese RDA system is capable of producing innovative and sophisticated weapons. It is capable of devoting massive resources toward ambitious, priority projects over very long periods, resulting in incremental progress and eventual achievement of its goals. The Chinese hypersonic missile program suggests that long-range missiles may be a particular area of excellence.

⁷² The DF-17 is a DF-ZF derived vehicle atop a standard PLA Rocket Force missile.

⁷³ “DF-17,” *Jane’s Offensive Weapons: Strategic*, September 15, 2022; Richard D. Fisher, Jr., “US Officials Confirm Sixth Chinese Hypersonic Manoeuvring Strike Vehicle Test,” *Jane’s Defense Weekly*, November 26, 2015; Peter Wood and Roger Cliff, *A Case Study of the PRC’s Hypersonic Systems Development*, China Aerospace Studies Institute, 2020, pp. 22–23.

⁷⁴ Cheung, 2017, p. 344.

⁷⁵ Researchers working for the China Aerospace Studies Institute have claimed that China is working on at least two hypersonic programs, at least one of which is scramjet powered (Wood and Cliff, 2020, pp. 20–23).