The Heritage Foundation

CONGRESSIONAL TESTIMONY

"China's High Technology Challenge to the United States"

Testimony before
Committee of Oversight and Government Reform

United States House of Representatives

September 26, 2018

Dean Cheng
Senior Research Fellow
The Heritage Foundation

My name is Dean Cheng. I am a Senior Research Fellow at The Heritage Foundation. The views I express in this testimony are my own and should not be construed as representing any official position of The Heritage Foundation.

Over the past three decades, the American view of the People's Republic of China (PRC) as a potential competitor in various areas of high technology has steadily evolved. In the 1980s, a decade after Deng Xiaoping began his policy of "Reform and Opening," China was still seen as primarily a source of cheap goods of limited sophistication. China's economic growth, however, saw not only an expanding array of goods, but a steady increase in their sophistication.

Today, China is seen as a near-peer competitor in terms of its scientific and technological prowess. Chinese supercomputers are among the world's fastest, while China is now their leading manufacturer. The world's largest radio telescope is located in China. A Chinese lunar probe will make an unprecedented landing on the far side of the Moon. American policymakers have worried about the effects of a Chinese lead in quantum computing and artificial intelligence development.[1]

At the same time, the Chinese Communist Party (CCP), the ruling element within the PRC, sees itself as both competing with the United States and in a period of "strategic opportunity."[2] The implication is that the current competition is most likely to remain peaceful, focused on the non-military aspects of "comprehensive national power," and affording the PRC a historic opportunity to catch up with the more developed countries of the West, including the United States, Europe, and Japan.

"Comprehensive National Power" in the "Period of Strategic Opportunity"

[1]Ben Guarino, Emily Rauhala, and William Wan, "China Increasingly Challenges American Dominance of Science," *Washington Post*, June 3, 2018, https://www.washingtonpost.com/national/health-science/china-challenges-american-dominance-of-science/2018/06/03/c1e0cfe4-48d5-11e8-827e-190efaf1f1ee_story.html?noredirect=on&utm_term=.79778c5f5aae (accessed September 18, 2018).

[2] Chen Erhou, Liu Zhen, et. al., "Seize the Strategic Opportunity and Concentrate Progressive Energy," *Xinhua*, March 4, 2018, http://www.xinhuanet.com/politics/2018lh/2018-03/04/c_1122483315.htm (accessed September 23, 2018), and Li Junru, "Fully Recognize Our Nation's Vital Strategic Opportunity Period for National Development," *Study Times*, February 21, 2011, http://theory.people.com.cn/GB/13967607.html (accessed September 23, 2018)

Central to understanding how the PRC views science and technology (S&T) is the idea of "comprehensive national power" (*zonghe guojia liliang*; 综合国家力量). According to the China Institute of Contemporary International Relations (CICIR), a Chinese think-tank associated with the Ministry of State Security, comprehensive national power (CNP) is the "total of the powers or strengths of a country in economics, military affairs, science and technology, education, resources, and influence."[3]

One of the central lessons from the collapse of the Soviet Union was Moscow's over-emphasis on the military, while neglecting other elements of national power. For China, given that it is starting from an even lower level of national development, the focus has been on improving all the elements of CNP.
This, in turn, means advancing the various strands of national power that define a nation and, as important, how it compares with other states. CNP includes both hard and soft power. It involves not only military capability and economic strength, but also diplomatic respect, political cohesion, and levels of scientific and technical attainment.

In this context of lifting China's CNP, science and technology plays an increasingly pivotal role since it affects multiple strands of power, including the economy and the military. Lack of scientific and technological progress condemns a nation to second-class status, forever reacting to developments elsewhere. Advances, on the other hand, allow a nation to set the terms of economic and military engagement.

The role of science and technology has accelerated in the past several decades. According to Chinese assessments, the world has shifted from the Industrial Age to the Information Age. National economic power is no longer a function of just industrial output (e.g., tons of bauxite smelted or steel produced). Instead, it is increasingly affected by the ability to gather, transmit, and generate accurate information rapidly. The developments in the area of information and communications technology (ICT) has led to a revolution in the measure of national power, which in turn has widespread political, social, and military ramifications.

ICT, however, is itself the product of a number of disciplines, including software engineering, microchip design, batteries and energy storage, and also is related to aerospace technologies (e.g., communications satellites), electromagnetic spectrum management, and even maritime technology (in the laying of undersea cables). If the PRC is to compete in the Information Age, then it must develop capabilities in many if not all of these sub-disciplines and associated fields.

The interest in improving China's level of science and technology has redoubled during this "period of strategic opportunity." The Chinese assess the first decades of this century as a period of relative quiescence, with few direct threats to Chinese security. Consequently, now is the opportunity for China to improve its economic and technological competitiveness, elevate its international standing, and make the leap to a mid-level power (in the Chinese conception).[4] As Xi Jinping declared at the 19th Party Congress in 2017, China will use the current period to improve its standing. By the middle of the 21st century, according to Xi, China will have become "a global leader in terms of comprehensive national power and international influence."[5]

In the Chinese view, demonstrating prowess in various fields of scientific endeavor enhances China's reputation in terms of both soft and hard power. With the former, it makes China a more desirable partner in

[3] China Institute of Contemporary International Relations, *Global Strategic Pattern—International Environment of China in the New Century* (Beijing: Shishi Press, 2000), cited in Hu Angang and Men Honghua, "The Rising of Modern China Comprehensive National Power and Grand Strategy."

[4]State Council Information Office, *China's Military Strategy* (Beijing, PRC: State Council Information Office, 2015), https://jamestown.org/wp-content/uploads/2016/07/China%E2%80%99s-Military-Strategy-2015.pdf (accessed September 18, 2018), and Ian Rinehart, "The Chinese Military: Overview and Issues for Congress," Congressional Research Service, 2016, p. 9, https://fas.org/sgp/crs/row/R44196.pdf (accessed September 18, 2018).

[5]Bonnie Glaser and Matthew Funaiole, "Xi Jinping's 19th Party Congress Speech Heralds Greater Assertiveness in Chinese Foreign Policy," *The Lowy Interpreter*, October 26, 2017, https://www.lowyinstitute.org/the-interpreter/19th-party-congress-more-assertive-chinese-foreign-policy (accessed September 18, 2018).

both economic and scientific projects. At the same time, an advanced scientific and technological base can have a deterrent effect on potential adversaries, since it implies that China can field sophisticated military systems.

To this end, improving China's scientific and technological capabilities is a clear priority.

A Long-standing Interest in S&T

It is not a ***new*** priority, however. When Deng Xiaoping came to power in 1978, the PRC was an economic disaster. The policies of Mao Zedong from 1949 to 1978, emphasizing central planning, forced draft industrialization and economic isolation. Deng's policies, which reformed all of these aspects, laid the foundation for the subsequent forty years of growth. China's annual gross domestic product (GDP) growth from 1979 to 2016 has averaged 9.6 percent. "This has meant that on average China has been able to more than double the size of its economy in real terms every eight years."[6]

One of the key reasons for this growth was Deng's reassessment of the "tenor of the times." Under Mao Zedong, the Chinese leadership operated under the belief that a major war between the capitalist and socialist camps was likely. Moreover, after the Sino-Soviet split of 1960, there was also the likelihood of a Chinese war with the Soviet Union.

Consequently, the PRC had to prepare for "major war, early war, nuclear war." Chinese economic efforts were focused on supporting a protracted conflict that would likely include nuclear strikes on Chinese soil, and a potential invasion by the Soviet Union. Not only was major investment focused on supporting military industries, but many factories were inefficiently distributed across China, to help sustain an extended resistance by guerrilla forces.

Deng, however, concluded that the current era was not marked by the likelihood of war, but was one of "Peace and Development." Far from facing the prospect of imminent war, according to Deng, there was only a limited likelihood of great power conflict. China could therefore safely adjust its priorities, and focus on improving its economy. Deng therefore slashed the size of the People's Liberation Army (PLA), and also redirected resources towards building commercial industries. Military industries were given the stark choice of going out of business or shifting their products to commercial goods for the civilian market. Deng's efforts are described by the Chinese as "Reform and Opening" (*gaige yu kaifang*; 改革与开放).

Even in the early days of Chinese reform, however, there was a recognition that Chinese long-term competitiveness required investments in high technology. Chinese scientists approached Deng Xiaoping in 1986, proposing a national effort to foster certain high-technology sectors. Deng personally approved the National High-Tech R&D Program, "Plan 863," which fosters Chinese high-technology development in key technical fields deemed to be of particular strategic value. These include:

- Information technology,
- Bio-technology and advanced agricultural technology,
- Advanced materials technology,
- Advanced manufacturing and automation technology,
- Energy technology, and
- Resource and environment technology.[7]

Aerospace technology was also an early focus for Plan 863. In the mid-1990s, the Chinese added marine technology to the list. Research areas included in Plan 863 enjoy additional funding and priority access to top research facilities.

Other Chinese technology development efforts include Plan 973, the National Basic Research Program, which supports research in "cutting edge" technology areas; the Key Technologies R&D Program, which apparently supports applied technology areas that aid manufacturing; the Spark Program, focused on technology benefiting rural

[6]Wayne M. Morrison, "China's Economic Rise: History, Trends, Challenges, and Implications for the United States," RL 33534, Congressional Research Service, February 2018, p. 5, https://fas.org/sgp/crs/row/RL33534.pdf (accessed September 18, 2018).

[7]PRC Ministry of Science and Technology, "National High-Tech R&D Program (863 Program)," http://www.most.gov.cn/eng/programmes1/ (accessed September 18, 2018).

areas; and the Torch Program, which supports commercialization of high technology.[8]

In February 2016, the Chinese press reported that several major technology programs, including Plan 863 and 973, had been merged into a single new program, in order to improve efficiency. These reports indicate that the new program, operating under the PRC Ministry of Science and Technology, would support an initial group of 59 projects, and would "focus on key fields such as

- Biotechnology
- Space
- Information
- Automation
- Energy
- New Materials
- Telecommunications
- Marine Technology."[9]

Within all of these areas, the expectation is that Chinese scientists will be leaders, not simply followers. That is, the Chinese are pushing for "indigenous innovation" (*zizhu chuangxin*; 自主 创), and not simply copying (or stealing) foreign technology.

Indeed, alongside the various funding programs intended to foster certain specific research areas has been a broader effort to push Chinese innovation, i.e., the application of S&T. In 2006, the PRC promulgated the "National Medium and Long-Term Program for Scientific and Technological Development," providing guidelines for areas of emphasis and funding through 2020. This plan marked the formal incorporation of "indigenous innovation" into Chinese strategic economic planning. It identified some 39 key areas, frontier technologies, and scientific and engineering megaprojects.[10]

The purpose of this program is to promote innovation within China, by Chinese scientists and research establishments, for the benefit of China. Elements include:

- A substantial increase in research and development (R&D) funding, to reach 2.5 percent of GDP by 2020;
- Tax policies to promote investment in research by Chinese businesses; and
- A reduction in the reliance on foreign technologies.[11]

In association with the Medium and Long-Term Program, especially the effort to reduce reliance on foreign technologies, Chinese policymakers subsequently also created a system for accrediting products based on the level of national indigenous innovation. This system, announced in 2009, would initially be applied in six product areas, including computers and software, telecommunications products, and energy equipment. The assessed level of indigenous innovation would then be used to "guide" national, provincial, and local government procurement.[12]

Not surprisingly, this effort to limit foreign access to Chinese markets led to a major international outcry. Even though the PRC eventually stepped back from this effort, however, the extent to which Chinese policymakers would go to promote indigenous

[8]Joel R. Campbell, "Becoming a Techno-Industrial Power: Chinese Science and Technology Policy," Brookings Institution *Issues in Technology Innovation* No. 23, April 2013, https://www.brookings.edu/wp-content/uploads/2016/06/29-science-technology-policy-china-campbell.pdf (accessed September 18, 2018).

[9]Chinese Academy of Sciences, "China Inaugurates National R&D Plan," Xinhua, February 17, 2016, http://english.cas.cn/newsroom/china_research/201602/t20160217_159669.shtml (accessed September 18, 2018).

[10]National Research Council of the National Academies, *The New Global Ecosystem in Advanced Computing* (Washington, DC: National Academies Press, 2012), p. 99, https://www.nap.edu/read/13472/chapter/16 (accessed September 18, 2018).

[11]Josef Bichler and Christian Schmidkonz, "The Chinese Indigenous Innovation System and Its Impact on Foreign Enterprises," Munich Business School *Working Paper* 2012-1 (Munich, Germany; Munich Business School, 2012), p. 3, https://www.munich-business-school.de/fileadmin/mbs_daten/dateien/working_papers/mbs-wp-2012-01.pdf (accessed September 18, 2018).

[12]Jingxia Shi, "China's Indigenous Innovation and Government Procurement," *Bridges*, Vol. 14, No. 3 (September 16, 2010), https://www.ictsd.org/bridges-news/bridges/news/china%E2%80%99s-indigenous-innovation-and-government-procurement (accessed September 18, 2018).

innovation was made clear. As important, it demonstrates how China can promote its own industries and encourage its S&T through the establishment and manipulation of technical and industrial standards. This approach is arguably more difficult to counter than outright theft of intellectual property, since it ostensibly employs market tools and legal measures.

Additional Means of Accessing Advanced Technology

The employment of accreditation also highlights the evolving set of tools available to Chinese decision makers in developing and acquiring advanced technologies. Not only does the Chinese government control access to a potentially enormous market, but the economic growth of the past four decades has given Beijing financial resources that allow it to purchase technologies and companies outright.

Foreign companies that seek access to the Chinese market, especially those in key high-technology industries or sectors, are often only able to do so if they establish a local footprint. This may be in the form of an equity joint venture or a contractual joint venture. The former entails the creation of legal entities that have partial foreign ownership and partial Chinese ownership. The latter is the creation of a specific, contractually based entity, rather than a new organization.[13] While recent Chinese legal reforms have loosened which types of joint ventures are necessary for particular industries, and in some cases expanded the permissibility of wholly foreign investment, high-technology areas typically remain constrained.

As important, the Chinese system often encourages foreign companies to establish R&D facilities in the PRC, whether as part of a joint venture or not. As one observer of pharmaceuticals noted, "In principle, companies with local operations are eligible for fast-track approval of new products." As a result, a number of foreign pharmaceutical companies have established research campuses in China.[14]

China has also increasingly tried to purchase foreign high-technology companies. Chinese efforts in the United States have at times been stymied by the Committee on Foreign Investment in the United States (CFIUS), which can block foreign acquisitions of American companies if it is seen as posing a potential national security challenge. As a result, China has increasingly targeted European companies.

Chinese investments in Germany, for example, have risen substantially since 2015. China has acquired German plastics, biotechnology, and engineering firms.[15] The Chinese purchase of the German robot manufacturer Kuka for 4.4 billion euros (approximately $5.1 billion) in 2016 set off alarms, and has led to discussion of the establishment of a German equivalent of CFIUS to review foreign acquisitions of German companies.[16]

Earlier in 2018, Chinese investors acquired the French chip manufacturer Linxens. The company's products are mainly used in security and identity applications. "The group's products are used in areas ranging from smartphones, transport cards, identity cards and passports to contact and contactless transactions and biometrics."[17]

Ongoing Chinese Concerns

[13]Paul Edelberg, "Is China Really Opening Its Doors to Foreign Investment?" *China Business Review*, November 8, 2017, https://www.chinabusinessreview.com/is-china-really-opening-its-doors-to-foreign-investment/ (accessed September 18. 2018).

[14]Matthew Nitkoski, "The Heat Is on for the Chinese Pharmaceutical Industry," CKGSB Knowledge, November 14, 2016, http://www.knowledge.ckgsb.edu.cn/2016/11/14/.../heat-chinese-pharmaceutical-industry/ (accessed September 18, 2018).

[15]"Factbox: Chinese Investments in German Companies," Reuters, February 26, 2018, https://www.reuters.com/article/us-daimler-geely-factbox/factbox-chinese-investments-in-german-companies-idUSKCN1GA1RO (accessed September 18, 2018).

[16]Benjamin Bathke, "China's Unsatisfied Hunger for German Companies," Deutsche Welle, July 12, 2017, https://www.dw.com/en/chinas-unsatisfied-hunger-for-german-companies/a-39658363 (accessed September 18, 2018).

[17]Don Weinland, Harriet Agnew, and Javier Espinoza, "China's Unigroup Buys French Chipmaker Linxens for $2.6 Billion," *Financial Times*, July 25, 2018, https://www.ft.com/content/f919b032-8fe5-11e8-b639-7680cedcc421 (accessed September 18, 2018).

Despite these efforts, however, Chinese leaders remain concerned about the state of China's high-technology capabilities. In key technology areas, China remains heavily dependent on foreign sources. A World Bank study in 2012 concluded that China had a $10 billion intellectual property deficit; that is, China imported some $10 billion more than it exported.[18] Despite Chinese investments in high technology in the intervening six years, it is not clear how much the situation has changed.

In 2018, for example, the United States announced that it would impose a seven-year ban on sales of microprocessors and other components to Chinese telecommunications company ZTE. It soon emerged that such a ban would effectively kill China's second largest telecommunications company. Nor is ZTE unique; many other major Chinese companies, including key state-owned enterprises such as Petro China, depend on Western high technologies for their operations.[19]

China's "Made in 2025" program, where the Chinese hope to be able to become largely autonomous in key manufacturing areas by 2025, should therefore be seen as part of the larger effort to promote Chinese science and technology, not only in terms of innovation and R&D, but sustaining China's industry by localizing the entire technology development, commercialization, and production process.

****

[18] UNESCO, "China: Taking Stock of Progress Toward Becoming an Innovation-Driven Nation," *Science, Technology and Innovation Policy*, December 2, 2016, http://www.unesco.org/new/en/natural-sciences/science-technology/single-view-sc-policy/news/china_taking_stock_of_progress_towards_becoming_an_innovati/ (accessed September 18, 2018).

[19] Jean Baptiste Su, "Analysis: ZTE's Collapse Reveals China's Huge Dependence on U.S. Technologies," *Forbes*, April 22, 2018, https://www.forbes.com/sites/jeanbaptiste/2018/04/22/analysis-ztes-collapse-reveals-chinas-huge-dependence-on-u-s-technologies/#6237918b7326 (accessed September 18, 2018).

Committee on Oversight and Government Reform
Witness Disclosure Requirement — "Truth in Testimony"

Pursuant to House Rule XI, clause 2(g)(5) and Committee Rule 16(a), non-governmental witnesses are required to provide the Committee with the information requested below in advance of testifying before the Committee. You may attach additional sheets if you need more space.

Name:

1. Please list any entity you are representing in your testimony before the Committee and briefly describe your relationship with each entity.	
Name of Entity	**Your relationship with the entity**
None	

2. Please list any federal grants or contracts (including subgrants or subcontracts) you or the entity or entities listed above have received since January 1, 2015, that are related to the subject of the hearing.					
Recipient of the grant or contact (you or entity above)	**Grant or Contract Name**	**Agency**	**Program**	**Source**	**Amount**
None					

3. Please list any payments or contracts (including subcontracts) you or the entity or entities listed above have received since January 1, 2015 from a foreign government, that are related to the subject of the hearing.					
Recipient of the grant or contact (you or entity above)	**Grant or Contract Name**	**Agency**	**Program**	**Source**	**Amount**
None					

I certify that the information above and attached is true and correct to the best of my knowledge.

Signature [signature] Date: Sept. 24, 2018 Page ___ of ___

Dean Cheng, Senior Research Fellow

Dean Cheng is currently the Senior Research Fellow for Chinese Political and Military Affairs at the Heritage Foundation. He is fluent in Chinese, and uses Chinese language materials regularly in his work.

Prior to joining the Heritage Foundation, he was a senior analyst with the China Studies Division (previously, Project Asia) at CNA from 2001-2009. He specialized on Chinese military issues, with a focus on Chinese military doctrine and Chinese space capabilities.

Prior to joining CNA, he was a senior analyst with Science Applications International Corporation (SAIC), and an analyst with the US Congress' Office of Technology Assessment in the International Security and Space Division.

He is the author of the volume ***Cyber Dragon: Inside China's Information Warfare and Cyber Operations*** (Praeger Publishing, 2016).

In addition, he has written a number of papers and book chapters examining various aspects of Chinese security affairs, including Chinese military doctrine, the military and technological implications of the Chinese space program, and Chinese concepts of "political warfare." Recent publications include:

- "Space Deterrence, the US-Japan Alliance, and Asian Security: A US Perspective," in ***The US-Japan Alliance and Deterring Gray Zone Coercion in the Maritime, Cyber, and Space Domains***, with Scott Harold, Yoshiaki Nakagawa, Junichi Fukuda (Santa Monica, CA: RAND Corporation, 2017)

- "Space and the Evolving Chinese Military," in ***Crisis Stability in Space***, with Bruce MacDonald, Admiral Dennis Blair, Karl Mueller, and Victoria Samson (Washington, DC: Foreign Policy Institute, 2016).

- "The PLA's Wartime Structure," in ***The PLA as Organization v. 2.0***, ed. by Kevin Pollpeter and Kenneth Allen (Merrifield, VA: DGI, 2015). www.pla-org.com

- "Converting the Potential to the Actual: Chinese Mobilization Policies and Planning," in ***The People's Liberation Army and Contingency Planning in China***, ed. by Andrew Scobell, Arthur S. Ding, Philip C. Saunders, and Scott W. Harold (Washington, DC: NDU Press, 2015).

- "Chinese Concepts of Space Security" in ***Springer Handbook of Space Security,*** ed. by K.U. Schrogl (NY: Springer Publishing, 2015)**.**

- "Information Dominance: PLA Views of Information Warfare and Cyberwarfare," in ***Chinese Cybersecurity and Cyberdefense,*** ed. by Daniel Ventre (Hoboken, NJ: Wiley Publishers, 2014).

- "Chinese Lessons from the Gulf Wars," in ***Chinese Lessons from Other People's Wars***, ed. by Andrew Scobell, David Lai, and Roy Kamphausen (Carlisle, PA: Strategic Studies Institute, 2011).

- “Chinese Views on Deterrence,” ***Joint Force Quarterly*** (#60, January 2011)

He has testified before Congress, and spoken at the National Space Symposium, the US National Defense University, the STRATCOM Deterrence Symposium, Harvard, and MIT. He has appeared frequently in print and broadcast media to discuss Chinese space and military activities.