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China's Military Diplomacy and Overseas Security Activities, Panel III:

China's Foreign Military Sales and Technological Acquisition

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Chair Bartholomew, members of the Commission and staff, thank you very much for your invitation to testify on developments in China's technology acquisition methods.

China's defence industrial base (DIB) is the primary actor in supplying the Chinese military with military equipment. China's DIB has become increasingly modern, and today is able to support the People's Liberation Army (PLA) in nearly all areas of procurement of modern and advanced technology. However, while the DIB today is more technologically advanced and efficient and has been directed to work with China's private sector civilian companies through military-civil fusion on integrating emerging and disruptive technologies in the PLA's capability mix, the Chinese DIB still depends on foreign innovation, education and components for some of its R&D and manufacturing. While the US have over successive years strengthened their ability to counter technology acquisition by the Chinese DIB and PLA, US-allies in Europe and elsewhere have only recently begun to address these issues in a more substantive and coordinated way. In order to continue fine-tuning US and allied policies to protect national innovation and industrial strengths, it remains necessary to increase common understanding across allies countries of how China's DIB has developed over time, how Chinese methodologies of licit and illicit technology acquisition may change over time in response to greater scrutiny by foreign governments, and how best to coordinate countries outside of the alliance who have significant innovation capacity but may not yet have developed strategies to protect it.

Changes to China's reliance on foreign acquisition of military or dual-use technology changed over the past decade.

China's reliance on foreign acquisition of military or dual-use technology has changed significantly since its early years under Mao.[1] From 1949 until the deterioration of the Sino-USSR relationship, China's defence industry, dominated by large state-owned enterprises, depended heavily on the USSR for defence technology and equipment through arms sales and technology transfer. During Deng Xiaoping's era of economic reforms, Chinese defence companies began producing dual-use technologies as well as military products. While the defence industry grew during this time, innovation and production of military equipment lagged behind Western and Russian defence technology despite a more diversified defence relationship between China and the West. Following the 1989 Tiananmen Square massacre, China's defence industry was cut off from Western technology, and turned to Russia as its primary source of foreign technology and innovation. Since then, China's defence industry has undergone successive reforms and restructuring in order to downsize the country's large-scale industry, turn the country's five large SOEs into ten companies each focussed on aviation, space, nuclear, shipping, and land warfare. By doing so, the Chinese government aimed to increase competition within each sector and to restructure companies into more commercial entities. Since the early 2000's the original ten SOEs have seen further changes. In

[1] Beraud-Sudreau, Lucie, and Meia Nouwens, "Weighing Giants: Taking Stock of the Expansion of China's Defence Industry," Defence and Peace Economics, Vol. 32, No. 2, February 2021.

2002, China Electronics Technology Enterprise (CETC) was created, which focussed on defence-electronics. In 2008, AVIC I and AVIC II, the country's two aviation SOEs were reconsolidated to form AVIC. In 2020, the country's two shipping giants, CSGC and CSSC, were merged to form CSSC, one of the world's largest shipbuilding conglomerates.[2] To a certain extent, this reflects a lack of successful competition between companies in each sector. Aside from re-mergers, some companies have specialised to produce certain subsystems for the PLA.

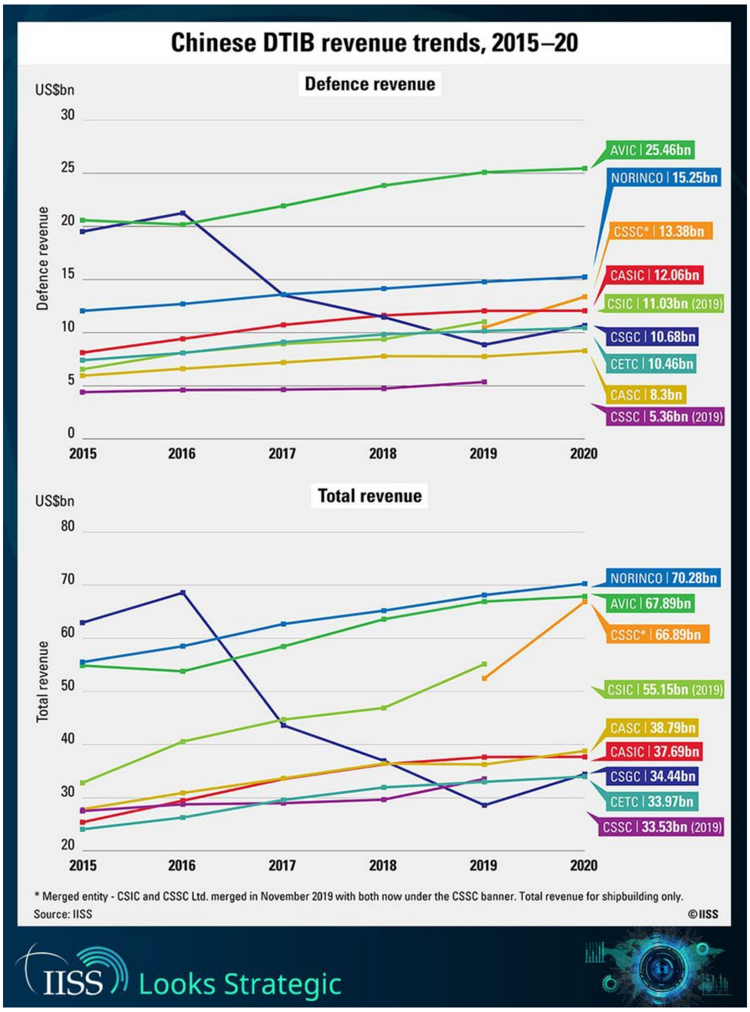
DIB Manufacturing Emphasis	Parent SOE	Manufacturing Activity
Land warfare, ground forces	• China North Industries Group Corporation (NORINCO) • China South Industries Group Corporation (CSGC)	Ground combat vehicles, main battle tanks, infantry fighting vehicles and soldier equipment, small arms and light weapons, ordnance
Air warfare, air forces	• Aviation Industry Corporation of China (AVIC)	Fixed-wing combat, transportation, bomber aircraft, rotary-wing aircraft
Naval warfare, sea forces	• China State Shipbuilding Corporation (CSSC) (the China Shipbuilding Industry Corporation [CSIC] was merged into the CSSC in 2019–2020)	Frigates, corvettes, destroyers, and cruisers; submarines (diesel and nuclear-powered); aircraft carriers; dock landing ships
Electronic warfare, electronic equipment	• China Electronics Technology Group Corporation (CETC)	Light unmanned aerial vehicles (UAVs), radars, computing resources, other military electronics
Space warfare, space forces	• China Aerospace Science and Technology Corporation (CASC) • China Aerospace Science and Industry Corporation Limited (CASIC)	Surface-to-air missile systems; intelligence, surveillance, and reconnaissance (ISR) systems; heavy UAVs, ballistic missiles, space launch vehicles
Nuclear warfare, nuclear facilities	• China National Nuclear Corporation (CNNC)	Nuclear reactors, nuclear weapons

Source: Beraud-Sudreau, Lucie, and Meia Nouwens, "Weighing Giants: Taking Stock of the Expansion of China's Defence Industry," Defence and Peace Economics, Vol. 32, No. 2, February 2021.

Nevertheless, by 2022 the seven SOEs that are responsible for non-nuclear defence-related production are estimated to rank in the top 20 of defence companies globally, based on the annual value of defence-related revenue.[3] China's defence industry has over time become more self-sufficient in its ability to innovate and produce equipment for the PLA across the above-mentioned sectors.

[2] Meia Nouwens, "Is China's shipbuilding merger on course?", Military Balance Blog, 4 September 2020, https://www.iiss.org/blogs/military-balance/2020/09/china-shipbuilding-merger

[3] McGerty, F. and Meia Nouwens, "A strong 2021 for China's defence companies", Military Balance Blog, 17 August 2022, https://www.iiss.org/blogs/analysis/2022/08/strong-2021-for-china-defence-companies



Private Chinese companies also form part of the defence industrial base though reports indicate that despite national-level guidance to do so, they continue to find it difficult to penetrate the highly state-driven defence industry. Under the guidance of President Xi, the national development strategy of military-civil fusion (军民融合) aims to encourage a greater degree of integration between the military and civilian economies. Though not a new policy, as civil-military integration has been attempted since the foundation of the Chinese state, Xi has given the policy greater prioritisation. While much attention has been paid to this policy, initial reporting from Chinese sources seems to indicate varied success in practice.[4]

While the Chinese defence industrial base has matured, and arms imports have decreased since the 1980s, arms imports remain an important source of technology, particularly in specific sectors. Chinese companies still rely on foreign sources of innovation and technology for advanced goods

[4] Kania, E. B. and Lorand Laskai, "Myths and Realities of China's Military-Civil Fusion Strategy", Center for a New American Security, 28 January, 2021, https://www.cnas.org/publications/reports/myths-and-realities-of-chinas-military-civil-fusion-strategy

and components. According to SIPRI, China imported US$1.1 billion in arms goods and services in 2017.[5] According to SIPRI, between 2018 and 2020, military imports to China originated from Russia and Ukraine for aircraft and naval engines and missiles. In that same period, SIPRI reports that France has supplied China with aircraft and naval engines and rotary-wing aircraft, while the UK has sold aircraft engines and Switzerland has sold air defence and fire control radar systems to China. In 2020, SIPRI reported a decrease in imports to China, though this is likely to be reflective of the dip in global arms trade activity due to the COVID-19 pandemic.

China also imports goods that fall below SIPRI's threshold for inclusion in its database but include components and materials that likely find their way into PLA weapons systems. Here, US and US-allied countries play a significant role. In a report by C4ADS, almost 20 percent of imports to companies in China's defence industrial base were from the US, and eight of the top ten countries were US-allies.[6]

Foreign military or dual-use technologies that China is reliant upon for the development of weapons for the PLA's own use.

China's defence industrial base is still reliant on foreign inputs such as education, material imports, intellectual property, intermediate goods and components and aircraft and naval engines. However, it is important to note that the list of technologies that the PLA is dependent on foreign sources is gradually decreasing. Depending on the product or service in question, imports could reflect a deficiency in the Chinese defence industry and lacking capacity to meet the PLA's demands or reflects an area of technology that the defence industry is still unable to produce indigenously.

Between 2015 and 2020, according to SIPRI, aircraft and naval engines represented the largest share of all Chinese arms imports, and almost half of SIPRI's data on weapons imports to China are for aircraft engines, marine turbine engines, and armoured vehicle engines.

China remains an importer of advanced components for military equipment and systems. In particular, China still imports precision measurement tools, integrated circuits and semiconductors. China is only able to produce 15.3 percent of its domestic demand for semiconductors, and imports have primarily been sourced from Korea, Taiwan and US-based manufacturers for designs, software, production-related machinery and semiconductors.[7] Between 2015 and 2019, China's relied on foreign sources for the vast majority of subcategories in electrical machinery and equipment, which

[5] Stockholm International Peace Research Institute, SIPRI Arms Transfers Database, March 15, 2021. As of January 10 2023

[6] Marcel Angliviel de la Beaumelle, Benjamin Spevack, and Devin Thorne, "Open Arms: Evaluating Global Exposure to China's Defense-Industrial Base", Center for Advanced Defense Studies, 17 October 2019, https://c4ads.org/reports/open-arms/

[7] Du, D. and Seaumus Grimes, "China's emerging role in the global semiconductor value chain", Telecommunications Policy, Vol. 46, Issue 2, March 2022, https://www.sciencedirect.com/science/article/pii/S0308596120300513

points to a continued failure in the domestic industry to indigenously respond to China's integrated circuit requirements.

China also remains reliant on US and Western-allied countries for specialist machinery such as: semiconductor fabrication tools and equipment; instruments and tools for optical photographic, cinematographic, and measuring; personal, transportation and other vehicles; and pharmaceuticals such as medicine, blood products, and sterile surgical materials.[8] These are imported from Taiwan, South Korea, Vietnam, Japan, Germany, the US and Ireland among other countries.

China's ability to innovate indigenously has improved over the past decade as reflected by the country's output but also inputs into the innovation ecosystem. China's national R&D spending has increased 35-fold between 1991 to 2018, reaching US$426.6 billion.[9] The amount of investment poured into China's R&D expenditure remains below that of the US, but is more than Japan, Germany, South Korea and France combined. Exactly how much of this spending relates to defence-research is unknown due to a lack of transparency in Chinese government budget breakdowns. China's R&D efforts have improved the country's global rankings in some ways. China ranks second behind the US in terms of scientific publications, however, the gap between the two countries is narrowing year-on-year. While the US ranked ahead of China nearly a decade ago in terms of high impact scientific publications (denoted by the number of citations received), in 2020, that trend reversed. However, China's defence-related innovation system remains dependant on international suppliers for education and IP, as China's STEM workforce remains insufficient for the country's needs in terms of quality and quantity.[10]

For example, approximately 1 million Chinese studies studied abroad, with roughly a third thereof studying in the US. Despite disruptions caused by Covid-19, Chinese students remain the largest group of international students in the US. Roughly 120,000 Chinese students are studying in US science, technology, engineering and mathematics programs in 2020/2021, up from 30,000 in 2005.[11] A recent drop in Chinese student enrolment in the US has found to be correlated with an increase in the number of Chinese student enrolments in countries like the UK.

As mentioned previously, Chinese weapons imports have shown that historically China's defence industry has relied on foreign technology, which was subsequently reverse engineered for adaptation to the PLA or reproduction in China. For example, the PLA Air Force and PLA Rocket

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[8] Weinbaum, C., Caolionn O'Connell et.al, "Assessing systemic strengths and vulnerabilities of China's 'EU industrial base: with a repeatable methodology for other countries", RAND, 11 February 2022, https://www.rand.org/pubs/research_reports/RRA930-1.html

[9] "Is China a global leader in research and development?", CSIS China Power Project, https://chinapower.csis.org/china-research-and-development-rnd/

[10] Tai Ming Cheung, Thomas Mahnken, Deborah Seligsohn, Kevin Pollpeter, Eric Anderson, and Fan Yang, *Planning for Innovation: Understanding China's Plans for Technological, Energy, Industrial, and Defense Development*, prepared for U.S.-China Economic and Security Review Commission, 28 July 28 2016

[11] Zwetsloot, R. and Zachary Arnold, "Chinese Students are not a fifth Column", Foreign Affairs, 23 April 2021, https://www.foreignaffairs.com/articles/united-states/2021-04-23/chinese-students-are-not-fifth-columnhttps://cset.georgetown.edu/article/chinese-students-are-not-a-fifth-column/

Force platforms and systems are the result of reverse engineering of foreign technology that was acquired through arms imports or licensing agreements.[12] The scale of this activity in previous decades has allowed China's defence industry to provide the PLA with weapons and platforms on a potentially vastly accelerated timeline compared to if these technologies were indigenously researched and developed.

However, China's defence industry is becoming more capable and only requires foreign IP for a few remaining technologies, such as engines. The defence industry is expected to continue leveraging foreign IP when and where it is available, despite calls for greater indigenous innovation by Chinese leadership under President Xi Jinping.

China obtains foreign military technology or technology with dual-use applications through various methods and from a variety of Western countries.

China's means of technology transfer include various methodologies, ranging across sectors and varied stakeholders. Technology transfer from non-Chinese entities can occur both in China as well as abroad. While much attention has been paid to illicit transfer of technology to China through, for example, industrial espionage, many forms of technology and innovation transfer are also lawful. Lawmakers should note that as countries such as the US and its allies respond to Chinese technology acquisition methods through policy initiatives, so too will China's methods of technology acquisition change in nature, technological focus and geography.

Illicit

Illicit forms of technology acquisition from foreign entities to Chinese companies and ultimately the PLA have been covered thoroughly in existing research. The US Federal Bureau of Investigations Director Christopher Way has called Chinese counterintelligence and economic espionage the "greatest long-term threat to [the US's] information and intellectual property, and to [the US's] economic vitality."[13] A survey by CSIS of 160 publicly reported cases of Chinese espionage directed against the US between 2000 and 2021 that occurred in the US encapsulates the variety of stakeholders and methods used.[14] 42 percent of actors involved in reported incidents were Chinese military or government employees, while 32 percent were private Chinese citizens and 26 percent were non-Chinese actors. While just over half of the incidents sought to acquire commercial technologies, just over one third sought to acquire military technology. Almost half of the incidents involved cyber espionage, mainly by Chinese state-affiliated actors, while 16 percent of reported incidents involved the attempted acquisition of information from US civilian agencies or politicians. The data also showed that these efforts have been more reported or possibly increased in frequency

[12] Cheung, Tai Ming, *Strengths and Weaknesses of China Defense Industry and Acquisition System and Implications for the United States*, San Diego, Calif.: University of California, San Diego, School of Global Policy and Strategy, UCSD-AM-18-218, June 25, 2018

[13] https://www.fbi.gov/investigate/counterintelligence/the-china-threat

[14] https://www.csis.org/programs/strategic-technologies-program/archives/survey-chinese-espionage-united-states-2000

since 2009. Only 24 percent of the reported incidents took place between 2000 and 2009, while 76 percent took place between 2010 and 2021. Similar incidents are reported in US-allied countries with industrial strengths in sectors that are of strategic interest to China, for example Germany, the UK, France and The Netherlands.[15]

Industrial espionage is not limited to activity outside of China's borders. Indeed, foreign companies from certain sectors wishing to operate in China have in the past been required to cooperation with local companies through joint ventures in order to access the Chinese market. Following the formation of joint ventures, some companies have reported IP theft. The European Union Chamber of Commerce in China's Business Confidence Survey in 2021 found that "16 percent of respondents reported being compelled to transfer technology, with 65 percent saying that it took place within the last two years and 31 percent stating that it was ongoing".[16]

While industrial espionage has reportedly assisted the PLA in acquiring platforms that would otherwise have taken much longer to develop indigenously, such as the case of the J-35 and F-22[17], authors such as Gilli and Gilli argue that transferring IP gained through industrial espionage becomes more difficult as foreign platforms and systems become more complex.[18]

Licit

In addition to the import of weapons and platforms as examined previously, technology transfer also occurs through other lawful methods. Similar to technology transfer from joint ventures, the acquisition of foreign IP through mergers and acquisitions by Chinese companies of Western entities has raised alarm bells. Though foreign investment mechanisms in the US have become stricter over time, like-minded countries have been slower to respond to this challenge. In Europe, cases like the

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[15] See: "Two former French agents sentenced to prison over China spying case: France Info", Reuters, 11 July 2020, https://www.reuters.com/article/us-france-intelligence/two-former-french-agents-sentenced-to-prison-over-china-spying-case-france-info-idUSKCN24C0F3; "Nederlandse Veiligheidsbelangen kwetsbaaar voor activiteiten andere landen" Algemene Inlichtingen- en Veiligheidsdienst (AIVD), 3 February 2021, https://www.aivd.nl/actueel/nieuws/2021/02/03/nederlandse-veiligheidsbelangen-kwetsbaar-voor-activiteiten-andere-landen?utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axioschina&stream=china#_ga=2.263213391.235249041.1674609820-1648208376.1674213780; "China spying on Germany, say intelligence chiefs", Deutsche Welle, 17 October 2022, https://www.dw.com/en/china-spying-on-germany-say-intelligence-chiefs/a-63467038; Dan Sabbagh, "50 Chinese students leave UK in three years after spy chiefs' warning", The Guardian, 6 July 2022, https://www.theguardian.com/uk-news/2022/jul/06/50-chinese-students-leave-uk-in-three-years-after-spy-chiefs-warning

[16] "Event: Tech Transfer for European SMEs in China – A Crash Course", European Commission, 15 December 2021, https://intellectual-property-helpdesk.ec.europa.eu/news-events/events/event-tech-transfer-european-smes-china-crash-course-2021-12-15_en

[17] Wendell Minnick, "Chinese businessman pleads guilty of spying on F-35 and F-22", Defense News, 24 March 2016, https://www.defensenews.com/breaking-news/2016/03/24/chinese-businessman-pleads-guilty-of-spying-on-f-35-and-f-22/

[18] Gilli, A. and Mauro Gilli, "Why China has not caught up yet", International Security, Vol. 43, Issue 3, Winter 2018/2019, https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/Gilli-and-Gilli-isec_a_00337-15022019.pdf

2016 acquisition of Kuka, a German robotics company by the Chinese company Midea raised alarm bells across Europe that strategic industries may be at risk of transferring to foreign ownership.[19]

Following the acquisition of Kuka, Chinese investment in Europe has continued though in different forms. In 2021, China's foreign direct investment into the UK and EU continued on a downward trajectory from a high in 2016.[20] The Netherlands was the largest recipient of Chinese investment, due to Hillhouse Capital's takeover of Philips. Germany, France and the UK accounted from 39 percent of total Chinese investment into Europe. Investment into European sectors were mainly automotive; health, pharma, and biotech; information and communications technology; and energy sectors.

Importantly, there has been a change in the Chinese stakeholders that are investing in like-minded countries. State-owned investors are becoming less prevalent in annual figures, though their investments were mostly in energy and infrastructure projects in southern Europe.[21] Instead, Chinese venture capital (VC) investment has increasingly funded European tech starts-ups. In 2021, Rhodium reported that Chinese VC investment in Europe was more than double that of the previous year, totalling EUR 1.2 billion, directed mainly to start-ups in the UK and Germany. Chinese VC funding predominantly targeted European start-ups working in e-commerce, fintech, gaming, AI and robotics. Chinese capital has also reportedly been invested into US venture firms and US private-equity firms. Since 2010, at least US$4 billion has been invested into the former by Chinese government entities, funds, private individuals and corporations, with US$3.5 billion going to the latter.[22] Some reports, however, note that Chinese venture capitalist investment into Silicon Valley has been declining since 2018.[23]

Talent

Academia and science and technology experts have also been at the receiving end of knowledge and skill transfer methods by the PRC. While industrial espionage and mergers and acquisitions serve the purpose of acquiring technology and IP to reverse engineer or learn from, talent programs seek to fill the PRC's talent gaps. These have taken the form of talent programs, funding the post-graduate education of Chinese government of military officials at overseas universities and research institutes in areas of strategic interest, and ad-hoc opportunism. The Chinese Communist Party has established over 200 talent-recruitment programs, which offer favourable working conditions for

[19] "Midea of China moves a step closer to takeover of Kuka of Germany", New York Times, 4 July 2016, https://www.nytimes.com/2016/07/05/business/dealbook/germany-china-midea-kuka-technology-robotics.html

[20] Kratz, A., M. Zenglein, G. Sebastian and M. Witzke, "Chinese FDI in Europe: 2021 Update", Rhodium Group, 27 April 2022, https://rhg.com/research/chinese-fdi-in-europe-2021-update/

[21] Ibid.

[22] Heather Somerville, "Chinese investment flows into Silicon Valley Venture Funds", Wall Street Journal, 15 September 2022, https://www.wsj.com/articles/chinese-investment-flows-to-silicon-valley-venture-funds-11663234202&cd=1&hl=en&ct=clnk&gl=us

[23] Rebecca Fannin, "How the US-China trade war has starved some Silicon Valley start-ups", CNBC Tech Drivers, 1 February 2020, https://www.cnbc.com/2020/01/31/chinese-venture-capitalists-draw-back-silicon-valley-investments.html

overseas researchers to work in China, which have drawn in close to 60,000 overseas professionals between 2008 and 2016.[24] These programs aim to leverage foreign technology and expertise to contribute to China's own technological ambitions. While this type of activity is not covert or illegal, some experts have in recent years been penalized for not reporting their involvement in Chinese overseas talent recruitment programs, particularly where these may have presented a conflict of interest with their employer.[25] It should be noted that in many cases, technology transfer that occurs via academic collaboration is the result of academic freedoms and openness in Western academic systems, and academics do not always knowingly play a role in this technology transfer. As will be discussed in policy recommendations at the end of this testimony, upholding the norms and values of academic freedom and international collaboration, even with China, should be constant goal. Greater clarity is needed, however, for universities and research institutes, on what areas of research governments consider of key importance to national security and defence, and are therefore off-limits to certain types of collaboration.

In some cases, Chinese academics and researchers who have been linked to the PLA or Chinese military research institutes have also been sent abroad to establish relationships with researchers and institutions globally.[26] Some of these researchers have taken up academic post-doctoral positions in Western universities or research institutes. Their affiliation to the PLA is sometimes omitted, though some investigative journalists have been quick to point out that preliminary research in Chinese is sufficient to uncover this.

At times, academic collaboration occurs not directly through a talent program but rather through a lack of scrutiny by researchers or university of their Chinese research partners. These programs have been reportedly targeting US academics as well as academics and experts in Europe. For example, Denmark's Aalborg University was reported to have inadvertently collaborated with the Chinese navy-linked Naval University of Engineering on the development of electrical components for power systems in ships and submarines.[27] Follow the Money, a Netherlands-based platform for investigative journalism, found that since 2000, Western European universities have collaborated in

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[24] Alex Joske, "Hunting the Phoenix: The Chinese Communist Party's global search for technology and talent", ASPI, 20 August 2020, https://www.aspi.org.au/report/hunting-phoenix

[25] "Harvard University Professor convicted of making false statements and tax offenses", United States Attorney's Office District of Massachusetts, 21 December 2021, https://www.justice.gov/usao-ma/pr/harvard-university-professor-convicted-making-false-statements-and-tax-offenses

[26] Alex Joske, "Picking flowers, making honey", ASPI, 30 October 2018, https://www.aspi.org.au/report/picking-flowers-making-honey

[27] Sebastian Kjeldtoft, "Aalborg Universitet beklager samarbejde: Hjalp kinesisk militærforsker", Politiken, 26 July 2020, https://politiken.dk/udland/int_kina/art7865938/Aalborg-Universitet-beklager-samarbejde-Hjalp-kinesisk-milit%C3%A6rforsker

studies with Chinese research institutes that are directly linked to the PLA.[28] The platform investigated 2,994 papers in which these two sides collaborated, and found that 2,210 of these were conducted with colleagues from China's National University of Defence Technology. European university researchers also collaborated with the PLA Information Engineering University, the China Academy of Engineering Physics, the China Aerodynamics Research and Development Center, the Air Force Engineering University, the Army Engineering University, the Naval University of Engineering and the Information Engineering University. The number of collaborations strongly increased after 2012 and dipped in 2019, likely due to the COVID-19 pandemic. The research areas covered in these studies reflects key areas of strategic interest for the PRC, including computer science, physics and chemistry, engineering, new materials, mathematics, photonics, and AI.

PRC talent acquisition has likely also taken advantage of ad-hoc opportunism. For example, in 2022, the UK's defence intelligence would reportedly issue a threat alert warning that the PLA was attempting to recruit serving and retired RAF jet pilots to train the PLA air force with generous recruitment packages.[29] Around 30 retired RAF pilots were believed to have taken part of these packages since 2019, though efforts are believed to have increased since the end of pandemic restrictions in the UK. These programmes are also reportedly believed to be directed at air force pilots from other Western militaries.

Priority technologies for China's acquisition efforts moving forward.

Moving forward, the PRC is likely to prioritise IP, technology and talent acquisition in key areas of weakness and strategic sectors that are prioritised by the Chinese government. These are clearly identified in working government documents such as the 14th Five Year Plan (FYP) for National Economic and Social Development and Long-Range Objectives for 2035, and National Medium- and Long-Term Program for Science and Technology Development (2006-2020). The technologies identified in these documents point to the desire to become a global innovation powerhouse in 'leapfrog' technologies that would provide the PLA with asymmetric technological advantage through their dual-use applications. The focus on these technologies will also likely drive technology and talent acquisition methods and targets to pre-competitive and pre-commercial sources, such as academic and research institutes and early-stage start-ups in the US, Europe and like-minded partner countries with strengths in these strategic areas of technology.

The former has set forth that between 2021-2025 China's public and private R&D will increase by 7 percent annually and will strive for a higher investment intensity than the preceding FYP. According

[28] De Bruijn, A. Dorine Booij, et.al., "European universities are helping China to build the world's most modern army", Follow The Money, 19 May 2022, https://www.ftm.eu/articles/china-science-investigation-launch?share=axL6eISdgf%2BSOLdgmmvGgqGGaQzkii6UaQ2e1x40o2snVVVkLaZPnwD19vE6IO4%3D

[29] Dan Sabbagh, "UK to issue 'threat alert' over China's attempts to recruit RAF pilots", The Guardian, 17 October 2022, https://www.theguardian.com/uk-news/2022/oct/18/uk-officials-threat-alert-china-attempts-to-recruit-raf-pilots

to the Plan, strategic emerging industries such as next-generation ICT, biotech, new energy, new materials, high-end equipment, new-energy vehicles, green tech, aeronautics and astronautics and marine equipment will be prioritised. Specific mention was made to AI, quantum information, integrated circuits, life and health, brain science, bio breeding, aerospace technology, deep earth and deep-sea technologies, and blockchain, cloud computing big data, IoT, industrial internet, and virtual reality and augmented reality.[30]

Echoing some of the sectors listed above, the National Medium- and Long-Term Program for Science and Technology Development also placed emphasis on specific 'frontier technology' sectors, including biotechnology, IT, advanced material technology, advanced manufacturing technology, advanced energy technology, marine technology, laser technology and aerospace technology.[31]

Gaps in U.S. and European countries' regulatory environment that that China exploits to obtain overseas military technology, and implications of China's overseas technology acquisition for the United States and its allies.

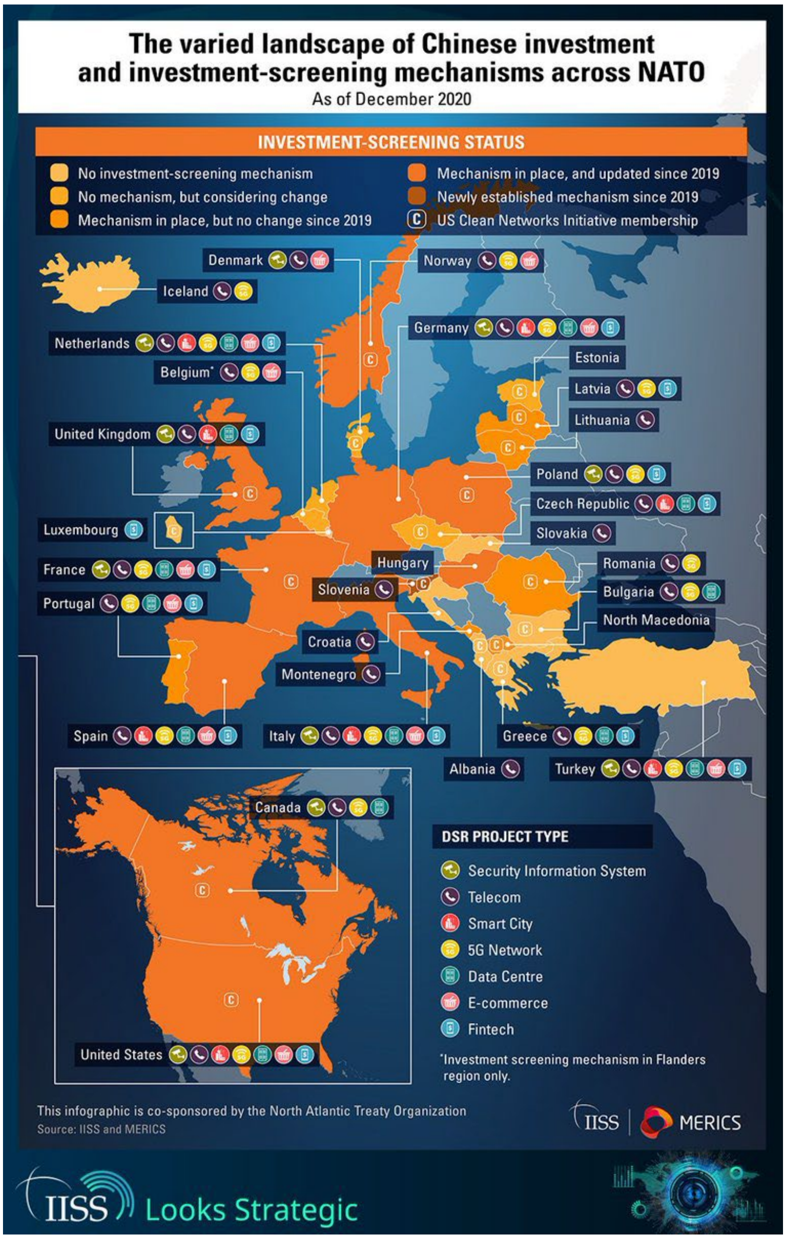
While the US has deepened and expanded its export controls and foreign investment screening mechanisms, Europe has only recently followed suit with the adoption of an investment screening regulation by the European Parliament in 2019.[32] The regulation called on (but did not require) all EU member state governments to create a national investment screening mechanism where these did not exist yet, and to create a level foundation of investment screening across all member states. The regulation also allows for reviews of potential investments of concern by the European Commission, on its own request, voluntary request for review by a member state, or at the request of a member state regarding a potential investment in another member state. The difference between the EU regulation and similar US measures is that any review by the European Commission takes the form of advice, and implementation of that advice remains at the discretion of the member state government in question. By 2022, some European Union member states have deepened their investment screening mechanisms to make these stricter following the COVID-19 pandemic and concerns over potential predatory investments. While outside of the EU, the UK has strengthened its own national investment screening mechanism in recent years. Others have created a mechanism nationally that meets the EU regulation's basic recommendations for issues like investment thresholds. A few EU member states, however, still have not made any moves towards creating an

[30] "华人民共和国国民经济和社会发展第十四个五年规划和 2035 年远景目标纲要" [The Fourteenth Five Year Plan for the Economic and Social Development of the People's Republic of China and Outline of the Long-term Goals for 2035], State Council of the People's Republic of China, 13 March 2021, http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

[31] "国家中长期科学和技术发展规划纲要（2006—2020 年）"[National Medium- and Long-Term Program for Science and Technology Development (2006-2020)], State Council of the People's Republic of China, 2006, http://www.gov.cn/gongbao/content/2006/content_240244.htm

[32] "Press Release: EU investment screening and export control rules effectively safeguard EU security", European Commission, 2 September 2022, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_5286

investment screening mechanism at the national level. The EU's landscape thus remains one of a patchwork of national screening mechanisms.



While neither the US nor the European Union currently have an outbound investment screening mechanism in place, both sides of the Atlantic are discussing the possibility of creating one in the future. The US is likely to be ahead in terms of the maturity of its discussions, while the EU may deepen its discussions on the matter in 2023.

The implication of this uneven transatlantic approach to inbound investment screening mechanisms (and potentially in the future outbound investment screening mechanism) is that Chinese actors have been able to leverage this uneven regulator landscape to their advantage. As doors in the US have closed to inbound Chinese investment, or Chinese actors have found it increasingly difficult to import key technologies from the US, Chinese investors and importers have instead turned to

Europe, where doors to Chinese investment remain more open. Furthermore, as investment screening mechanisms target particular sectors or are only implemented beyond a certain financial or shareholder value threshold, Chinese investment has responded to focus on different stakeholders. The challenge for the US government and those of like-minded countries is to respond to existing challenges and foresee new ones that policy action may create. This needs to be done not in isolation from each other, but in coordination with like-minded states.

Ultimately, China's technology acquisition practices will not be limited to the US and Europe. Though much of the attention of technology transfer has been placed on countries' experiences across the Atlantic, technology acquisition will also expand beyond traditional target countries. Countries in across the Indo-Pacific will become a greater focus for Chinese efforts to acquire cutting edge innovation in emerging and disruptive technologies as young entrepreneurs there continue to innovate in these spaces. In the Middle East and Gulf, too, Chinese private companies are investing heavily in innovative start-ups, and founding collaborative research and development spaces. Until now, how these regions have experienced or responded to technology transfer has remained understudied.

Remaining knowledge gaps and recommendations for policy makers.

To respond to Chinese technology transfer methodologies, the US Administration and Congress should continue to deepen their understanding of and track incidents of technology and talent acquisition processes, both at home, with allied-countries, and in like-minded partner countries in key regions of strategic interest.

Firstly, Congress should support a public investigation into the incidents of technology transfer across sectors and industries. Current understanding of Chinese practices lacks a cross-sector and cross-industry overview, with incidents limited to larger private sector companies. How technology transfer is being conducted through the investment in or acquisition of US, allied, or like-minded start-ups should be of interest to Congress. Building on public awareness of these activities will also help to build resilience in these industries.

Secondly, as explained in this testimony, any effort that the US undertakes will have a follow-on impact on allied and like-minded partner countries as Chinese flows of investment shift in response to US policy action. It is therefore imperative that any action the US government takes is not done in isolation, but in coordination with partners and allies alike. This should go beyond the scope of traditional allies and partner countries in regions like the Indo-Pacific.

Thirdly, similar measures should be taken to counter talent-recruitment programs. This overlaps slightly with the above-mentioned point as the focus of Chinese acquisition shifts from end-stage mature technologies to skilled talent through the targeting of academic and research organisations and pre-competitive stage companies. Universities in like-minded partner and allied countries would benefit from greater knowledge and best-practice sharing with the US.

Fourthly, academic collaboration with China should be continued to be supported. This serves as important people-to-people links between the US and China, and ultimately supports US innovation and research and development. It is also fundamentally part of the Western norms and values of academic openness. The exploitation of these norms does not make them less important – indeed, they should remain at the heart of US and like-minded values. It is therefore imperative that the government work with the actors across the US innovation landscape on identifying the risk to, and defining clearly what are considered, strategic areas of research and what is open to collaboration. This should also be done in collaboration with allied and like-minded partner countries.

Fifthly, in order to respond to technology and talent acquisition, more needs to be done to fill the financial and funding gap that China presents to universities, companies and start-ups. If Chinese funding in strategic areas of technology research or work is undesirable due to the risk of technology or talent transfer, then there must be a government-led effort to help find support through other sources of financial support or investment. This, too, is an area where the US government could work collaboratively with allied or like-minded partner countries to, for example, support innovative research or start-ups with defence or dual-use application in areas of strategic interest to the US.

Lastly, the US should continue to work with allied and like-minded partner countries beyond Europe to help strengthen or establish sound investment screening legislation. Failing to do so would result in a continued patchwork landscape of investment opportunity and would risk missing the opportunity to work more closely with innovative researchers and companies at age stage of development abroad. In a similar vein, the US should work with allied countries on outbound investment screening mechanisms, particularly with the EU where the Union's experience with creating a level investment screening mechanism across all member states is likely to be repeated to the EU's specific mandate.