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Unfinished Business: Export Control and Foreign Investment Reforms

Emma Rafaelof, Policy Analyst, Economics and Trade

Key Findings

- Defining a list of “emerging and foundational” technologies is a crucial part of implementing the Foreign Investment Risk Review Modernization Act (FIRRMA) and the Export Control Reform Act (ECRA). Since these acts became law in 2018, there has been a significant delay in forming this list along with a lack of clarity on the process and methodology. The list would support the development of the new controls directed by these two acts and identify additional national security risks not covered by preexisting control lists. In crafting ECRA, Congress entrusted the U.S. Department of Commerce with implementing its intent for strengthening U.S. export control laws, but the Department of Commerce has, to date, failed to carry out its responsibilities.
- Lack of clarity from the Department of Commerce on what constitutes emerging and foundational technologies impedes the ability of the Committee on Foreign Investment in the United States (CFIUS) to fulfill its responsibilities. The years-long delay in developing these definitions may exacerbate national security risks. By law, a list of technologies defined as emerging and foundational triggers mandatory filings on certain transactions, drawing CFIUS scrutiny to higher-risk transactions. In the absence of the complete list, CFIUS continues to operate without this additional guidance and may be constrained in its ability to screen transactions.
- Interagency coordination and full utilization of private sector and academic expertise could support the development of this list. The Department of Commerce has strengthened the role of the relevant expert advisory body and solicited public comments on compiling the list of emerging and foundational technologies, but there is no clarity on how, whether, or when their expertise will be incorporated. Coordination of national security risk assessments across other agencies could also lead to a faster completion of the list and encourage agencies to fill gaps in protecting technologies across the board.

Introduction

In 2018, U.S. lawmakers tightened U.S. export control policies and the process for screening inbound foreign direct investment (FDI). These changes were prompted by Chinese entities’ efforts to acquire sensitive U.S. technology

and greater awareness of the risks posed by China's military-civil fusion* strategy and industrial policies, such as Made in China 2025.¹ In addition, Congress wanted to clarify the transactions and items covered by these laws for foreign governments and the private sector. In August 2018, as part of the National Defense Authorization Act, the 115th Congress included two pivotal bills related to U.S. national security: FIRRMA and ECRA.² The inclusion of these bills flowed from bipartisan consensus regarding risks from China and recognition that the United States needed updated practices and greater clarity to better address new technologies and the rapid pace of innovation.³ FIRRMA targeted reform of both the process and scope for screening FDI and acquiring sensitive U.S. technology. Meanwhile, ECRA effectively replaces the defunct Export Administration Act of 1979, which expired in 2001, to permanently codify existing export control procedures.⁴

Same Structures, New Authorities, and Updated Mandates

FIRRMA and ECRA did not significantly change the underlying structure of either CFIUS or the export control regime. Under CFIUS, the U.S. Department of the Treasury serves as the lead of an interagency review process that screens foreign acquisitions of U.S. assets for potential national security risks.⁵ The Department of Commerce administers and enforces the bulk of U.S. export controls on commercially available items, with the exception of controls on U.S.-origin defense articles, which are administered by the U.S. Department of State.⁶ ECRA serves as a codification of the Export Administration Regulations (EAR), which is administered and enforced by the U.S. Department of Commerce's Bureau of Industry and Security (BIS). Under ECRA, the Department of Commerce retains administration and implementation of the EAR.⁷

FIRRMA and ECRA outlined a number of new procedures and authorities that give the U.S. government increased flexibility to respond to the rapid pace of innovation and adjust measures to protect national security. The new legislation also contained an array of implementing measures and required reports to follow the enactment of the law, including development of a list of "emerging and foundational" technologies (see Table 1). By law, the Department of Commerce would refer to the list of emerging and foundational technologies to determine the necessity of additional export controls on a given technology. According to ECRA, the secretary of state must coordinate with the secretary of commerce to propose any newly designated emerging or foundational technologies for addition to multilateral control regimes in the following year, which is a more accelerated, precise timeline for promoting unilateral controls to multilateral ones than previously codified.[†]

Emerging and foundational technologies were intended to be classified as controlled exports in addition to items already covered by the EAR, such as those items on the Commerce Control List (CCL), with an Export Control Classification Number (ECCN), or on the EAR99 list. The CCL covers all items under the EAR, which includes both tangible goods and software. New items from this emerging and foundational technologies list would be assigned an ECCN followed by any appropriate controls. Items with an ECCN require a license to export.⁸ The EAR99 designation is reserved for all other items not subject to specific controls but that may require a license for export to sanctioned countries, parties of concern, or other prohibited end uses.

* China's military-civil fusion relies on a broad set of policies and government-backed mechanisms to maximize civilian innovation for China's defense sector, blurring the line between civilian academic collaboration, business partnerships, and defense research. For more on military-civil fusion, see U.S.-China Economic and Security Review Commission, "Chapter 3, Section 2: Emerging Technologies and Military-Civil Fusion: Artificial Intelligence, New Materials, and New Energy," *2019 Annual Report to Congress*, November 2019, 205–247. <https://www.uscc.gov/sites/default/files/2019-11/Chapter%203%20Section%202%20-%20Emerging%20Technologies%20and%20Military-Civil%20Fusion%20-%20Artificial%20Intelligence,%20New%20Materials,%20and%20New%20Energy.pdf>

† The U.S. government has sought to align the development of multilateral controls with its own unilateral controls. Since 2012, the Department of Commerce has classified certain items of concern, "including emerging technologies," not already on the CCL or the U.S. Munitions List under ECCN 0Y521. Classification under ECCN 0Y521 creates a temporary control that can be extended annually, while the Departments of Commerce, State, and Defense must arrange for multilateral control of the item. U.S. Department of Commerce Bureau of Industry and Security, "Revisions to the Export Administration Regulations (EAR): Export Control Classification Number 0Y521 Series, Items Not Elsewhere Listed on the Commerce Control List (CCL)," *Federal Register* 72:22191, April 13, 2012. <https://www.federalregister.gov/documents/2012/04/13/2012-8944/revisions-to-the-export-administration-regulations-ear-export-control-classification-number-0y521>.

Table 1: ECRA and FIRMA Requirements and Implementation Status

<i>Law</i>	<i>Requirement</i>	<i>Steps Taken</i>	<i>Steps Needed</i>
ECRA	Create and maintain a list of “emerging technologies.”	Advanced notice of proposed rulemaking issued November 2018; partial implementation in June 2020. ⁹	Finalize list
	Create and maintain a list of “foundational technologies.”	Advanced notice of proposed rulemaking issued August 2020. ¹⁰	Finalize list
	Issue a semiannual report to CFIUS of key actions pursuant to ECRA within 180 days of enactment (February 9, 2019) and for continual release every 180 days.	Reports issued as of 2019. ¹¹	None
	Establish a system for businesses seeking assistance and provide report within 270 days of enactment (no later than May 10, 2019).	Report issued in 2019. ¹²	None
	Conduct comprehensive review within 270 days (May 10, 2019) of enactment on existing arms embargoes, the CCL, and licensing provisions or presumption of denial.	Review conducted throughout 2019 and 2020.*	None
	Establish a system to assist small and medium-sized businesses with licenses; create relevant plan within 120 days (December 11, 2019) of enactment.	Plan completed in September 2019. ¹³	None
	Produce report specific to the interagency dispute settlement process to be submitted to Congress within 180 days (February 9, 2019) of enactment.	Submitted to Congress June 2019. [†]	None
	Modify the objectives and mandate of the Emerging Technology Research Advisory Committee.	Implemented June 2018. ¹⁴	None
FIRMA	Produce annual report on CFIUS implementation.	Published annually as of 2018.	None
	Publish implementing regulations.	Final regulations released February 2020. ¹⁵	None

Source: Compiled by Commission staff based on agency reporting.

* BIS has not published a direct confirmation of the review’s completion but refers to ongoing review of the CCL, arms embargoes, and licensing practices in various documents as recently as 2020. U.S. Department of Commerce Bureau of Industry and Security, “Advanced Surveillance Systems and Other Items of Human Rights Concern,” *Federal Register* 85:43532 (July 17, 2020). <https://www.federalregister.gov/documents/2020/07/17/2020-15416/advanced-surveillance-systems-and-other-items-of-human-rights-concern>; U.S. Department of Commerce Bureau of Industry and Security, *Annual Report to the Congress for Fiscal Year 2018*, May 29, 2019, 32. <https://www.bis.doc.gov/index.php/documents/pdfs/2401-2018-bis-annual-report/file>.

† The president delegated the task to the secretary of commerce on January 15, 2019, moving the deadline to June 15, 2019. U.S. Department of Commerce Bureau of Industry and Security, *Review of Interagency Dispute Resolution Process*, March 31, 2020.

Difficult Definitions Process Raises More Questions than Answers

Creating a list of emerging and foundational technologies is a key feature of ECRA and one of the most challenging to implement. BIS published two separate advance notices of proposed rulemaking (“advance notice”)* for emerging and foundational technologies to garner additional expertise and input on the ways to best identify technologies and to narrowly tailor controls.¹⁶ In November 2018, BIS published an advance notice to form an emerging technologies list identifying 45 sample technologies under 14 broad categories of “representative technologies” such as artificial intelligence (AI) and biotechnology (see Appendix).¹⁷ The advance notice solicited views on how best to determine specific technologies in the future, how restricting any of the listed technologies would impact U.S. leadership, and whether different approaches to identification of technology at different stages of its development could warrant additional controls. Industry representatives, academics, and other experts submitted 246 responses.¹⁸

Two years since the advance notice, BIS has not yet finalized its emerging technologies list but has pursued some related actions. In January 2020, BIS released a rule to place interim controls on geospatial imagery involving AI neural networks on a one-year temporary classification list; this designation was renewed in January 2021 for another year.¹⁹ Some law firms speculated this might also be the first identification of an “emerging technology” under ECRA, but BIS never specified that this action was pursuant to its emerging technologies list.²⁰ In June 2020, BIS published three new sets of ECCNs covering 24 items related to chemical and biological weapons, human and animal pathogens and toxins, and associated equipment as the first set of “emerging technologies.”²¹ These initial categories do not appear to be directly related to any of the proposed categories outlined in the original advance notice but instead were published as part of ongoing consultations for the implementation of multilateral controls.²²

In addition to public comments and multilateral discussions, BIS also can rely on specially designated advisory committees to come to a decision. BIS’s use of this resource, however, has been minimal over the past three years. In accordance with ECRA and the Federal Advisory Committee Act, in June 2018 BIS announced that one of its advisory committees was repurposed to “focus on the identification of emerging and foundational technologies that may be developed over a period of five to ten years.”²³ The Emerging Technology Technical Advisory Committee, formerly the Emerging Technology and Research Advisory Committee, began a recruitment process for new members in August 2018 according to new advisory committee rules.²⁴ After the secretary of commerce chose 19 industry and academic representatives from among the applicants from the recruitment process, the advisory committee met for the first time under its new mandate in May 2020.²⁵ The advisory committee has since met twice with some apparently active discussions, but there do not yet appear to have been any conclusions or follow-on actions as a result of these meetings. The advisory committee chairperson is obligated to contribute to the secretary of commerce’s mandatory annual ECRA report and may also be required to submit additional reports on emerging and foundational dual-use technologies as determined by the assistant secretary for export administration. While the Department of Commerce has issued the annual ECRA report regularly since 2018, the assistant secretary for export administration has not commissioned a specific report on dual-use technologies.

BIS has made even less progress on the foundational technologies list, with little clarity on even the definition of the term itself. In August 2020, nearly two years after the publication of the emerging technologies advance notice, BIS released the long-anticipated foundational technologies advance notice.²⁶ Rather than suggesting particular technologies, BIS requested public comments on how to further define foundational technology and devise a methodology for identifying it. The BIS approach was to reevaluate items already on the CCL, defining foundational technologies as “those that may warrant stricter controls if a present or potential application or capability of that technology poses a national security threat to the United States.”²⁷ In November 2020, BIS received 54 comments from industry and academia but has published nothing further.²⁸

* According to the Office of the Federal Register, an advance notice of proposed rulemaking (“advance notice”) is a preliminary step in providing the public with information on a new regulatory change and an opportunity to shape the next step, a notice of proposed rulemaking, because it triggers an initial public comment period. Office of the Federal Register, *A Guide to the Rulemaking Process*, January 2011, 3–4. https://www.federalregister.gov/uploads/2011/01/the_rulemaking_process.pdf.

The Entity List

Establishing controls based on specific technologies and end uses has some distinct advantages over controls directed at particular end users, such as Huawei Technologies, Hikvision, and various construction companies operating in Xinjiang and the South China Sea. In recent years, however, the U.S. government has favored the latter approach as evidenced by its increased use of the Entity List. The Entity List remains one of the most potent mechanisms of U.S. export control policy, providing BIS a great deal of discretion to restrict listed entities (e.g., individuals, companies, research institutes) from receiving some or all items subject to the EAR. Entity List restrictions are highly specific, focused on identifying end uses and end users whose activities are “contrary to U.S. national security and/or foreign policy interests.”²⁹

Under the broad scope of national security and U.S. foreign policy interests, the Entity List can cover a wide range of activities, more recently including human rights violations in addition to more traditional national security threats, such as advancing military capabilities. This end-user-based approach clearly is useful for targeting specific bad actors while controls on a specific technology or end use more effectively address a broader national security risk. Defining emerging and foundational technologies could also serve to expand the scope of entities deemed acting or appearing to act contrary to the interest of the United States. A clear methodology for identifying items on either technology list would assist BIS in refining designation of listed entities. A clear methodology is relevant not only for U.S.-developed technologies, but also for foreign technology: BIS analysis must also take into account the status and potential risks of other countries developing these emerging and foundational technologies, either for their own uses or for sale to users purchasing the technology for purposes contrary to U.S. interests.³⁰ Moreover, a defined list of emerging and foundational technologies would allow the U.S. government to be more precise in identifying national security risks and controlling access to more items by listed entities.

The Changing Definition of “Critical Technologies”

In October 2018, Treasury launched a pilot program that would serve as an interim mechanism for reviewing transactions as the U.S. government worked to craft final regulations implementing FIRRMA.³¹ The pilot program included mandatory filings for certain transactions in 27 industries, particularly those Treasury referred to as “critical technologies.”³² The pilot program remained in effect until February 12, 2020, when Treasury adopted final implementing regulations for FIRRMA.³³ The pilot program captured 114 transactions in total, 94 of which were in 2019, the only full calendar year of the pilot program’s run.³⁴ According to a final rule published by Treasury in October 2020, CFIUS would refer to the Department of Commerce’s list of critical technologies* to determine cases with mandatory filings.³⁵ The Department of Commerce’s definition of critical technologies constitutes a combination of all existing control lists[†] and, importantly, is inclusive of the yet unfinished lists of emerging and foundational technologies mandated under ECRA. This change in procedure allows for CFIUS to place further scrutiny on emerging and foundational technologies, but without a completed list for either it remains unclear how many transactions CFIUS should have reviewed since the rule change.

Consequences and Constraints of Missing Lists

Treasury has fulfilled its implementation requirements for FIRRMA, but BIS’s ongoing failure to clarify what constitutes emerging and foundational technologies hampers CFIUS’s ability to screen foreign acquisition of

* CFIUS previously relied on the North American Industry Classification System (NAICS) to determine critical technology categories. NAICS is the standard classification system used by U.S. federal agencies for recording and analyzing data about U.S. businesses. U.S. Census Bureau, *North American Industry Classification System*, March 24, 2021. <https://www.census.gov/naics/>.

† In addition to the Entity List and the CCL, the EAR also covers a number of other end-user- and end-use-based controls, including the Military End User List, which identifies both military end users or “entities that function or support military end uses,” and the Unverified List, which covers entities whose end use for items subject to the EAR cannot be verified by the U.S. government. U.S. Department of Commerce Bureau of Industry and Security, *Export Administration Regulations, Part 744*, March 16, 2021. <https://www.bis.doc.gov/index.php/documents/regulations-docs/2343-part-744-control-policy-end-user-and-end-use-based-2/file>.

potentially sensitive technologies. The United States consistently ranks as the top destination for FDI, challenging CFIUS with a huge volume of potentially risk-laden transactions, many of which go into possibly sensitive, cutting-edge technologies. A key element of FIRRMA and its implementing regulations was to provide CFIUS with a more precise scope to screen transactions by requiring mandatory filings for certain transactions. Without complete lists to define critical technologies, CFIUS still faces the same challenges to catch sensitive transactions related to some technologies and narrow its case screenings.

Without the additional clarity of definitions or lists, significant gaps remain in the export control system as U.S. companies continue to export items that may eventually be covered by a final list. Investors and companies must work around these ambiguities as they consider new investments or contracts that may fall under the proposed categories of emerging technologies from BIS. With the current ambiguity, no one can reasonably predict how foundational technologies might ultimately be understood under the export control regime. The related advance notice did not include a list of any specific technologies, detail on how BIS may come to define the term “foundational,” or a clear methodology on identifying such technologies. A more precise understanding of this methodology would be helpful for researchers and businesses to better anticipate compliance and would also assist regulators across agencies working on CFIUS and other relevant national security matters.

Critical Technologies Missing from CFIUS’s Radar

With the list of emerging and foundational technologies still under development, CFIUS may be unable to fully implement some of the new authorities and processes intended to scrutinize or prevent certain transactions. Researchers at the Center for Strategic and Emerging Technology (CSET) found that between 2019 and 2020, U.S. AI startups drew in just over \$17 billion of foreign investment.³⁶ This total did not account for undisclosed funding, which previous CSET research argued could be twice as large.³⁷ The potential size of undisclosed transactions* and the scope of different AI applications make this a notable gray area of activity that foreign investment may be exploiting. Many technologies and applications of AI and machine learning could fall under BIS’s proposed categories of emerging technology. Clear definitions of AI technologies considered emerging or foundational likely would have triggered a mandatory filing requirement for some of these transactions and made the task of examining such a high volume of transactions far simpler.

Without a final rule or determination, it remains unclear what types of technologies should be subject to CFIUS review. CFIUS has the authority to identify national security risks and review transactions, even when companies involved did not notify the committee. For example, in May 2020 CFIUS prevented California-based Ekso Bionics from engaging in a joint venture with Chinese investors.³⁸ Ekso Bionics manufactures robotic mechanical suits, also called exoskeletons, for medical applications as well as health and safety uses. U.S. agencies expressed concerns throughout the formation of the venture that the exoskeletons may have military applications and that robotics could qualify as a critical technology.³⁹ Robotics was one of the proposed technology categories under the emerging technologies advance notice issued, but BIS has not yet issued a final definition or rule.

As BIS continues to struggle with defining these technologies, regulatory uncertainty may lead to fewer investments across broad categories of technology due to lack of clarity. Foreign investors are increasingly wary of putting money in a venture that may face additional restrictions if it eventually falls under an emerging or foundational technology category in the final rule.⁴⁰ Since 2018, there has been a decline in FDI to the United States, with FDI shrinking 37.7 percent in 2019.⁴¹ This decline is likely not wholly attributable to uncertainty, as it is but one of many components of the policy environment during that period. The decline is also not unique to the United States, with the Organization for Economic Cooperation and Development (OECD) reporting a broad trend of declining global FDI flows due to increased trade disruptions and policy uncertainty.⁴²

* According to the expanded definition of “covered transactions” under FIRRMA and additional Treasury rules published in 2020, CFIUS has authority to scrutinize a larger number of transactions, even for noncontrolling foreign investments, particularly where the investment may concern a critical technology. 31 CFR § 800.211 Covered investment, February 13, 2020. https://www.ecfr.gov/cgi-bin/text-idx?node=pt31.3.800&rgn=div5#se31.3.800_1211.

Ambiguity May Perpetuate Risks in Exports

Technologies proposed under the advance notice for emerging technologies may eventually be subject to export controls, but the long process to finally identifying them has allowed for unfettered U.S. exports of these technologies in the meantime. For instance, current export controls already cover conventional bioweapons such as viruses and toxins, but the U.S. government has yet to take concrete, final steps to address risks of gene editing. The key innovative capacity of gene editing comes from cutting-edge software and related processing equipment.⁴³ The risk inherent in gene editing technology is its potential to simplify or refine the development of biological weapons or bioweapons that target the environment.⁴⁴ In November 2020, BIS issued a notice of proposed rulemaking on software related to gene editing as a follow-up to the 2018 emerging technologies advance notice, but it has yet to finalize the rule and create the first emerging technology control.⁴⁵ The extended timeline from the emerging technologies advance notice in 2018 to the specific notice of proposed rulemaking around gene editing in 2020 raises significant questions about delays in the rulemaking process. While not all 45 technologies listed in the advance notice may necessarily merit the introduction of additional export controls, the identification process appears to have impeded up-to-date determinations on dual-use technologies like gene editing.

Lack of Coordinated Interagency Response and Comprehensive Review

Formation of the emerging and foundational technologies lists presents a particular opportunity to establish greater consistency around determinations of risk both within BIS and among agencies. The process of implementing ECRA has largely been left to the Department of Commerce, though ECRA also codified an interagency process to coordinate policy and information sharing. The export control process has multiple stakeholders, whereby other executive branch agencies are responsible for lists, restrictions, and other risk assessments unique to those agencies. It is unclear how BIS receives input on crafting the emerging and foundational technology lists, but other agencies have certainly conducted relevant evaluations on specific technologies, such as AI chipsets* and advanced surveillance. For example, there are already a number of preexisting controls on end uses of microprocessors that relate to AI chipsets and government warnings regarding the sale of advanced surveillance technology overseas.⁴⁶ Academic discussion has also supported further controls for the semiconductor manufacturing equipment as opposed to more stringent controls on AI chipsets, which have broader commercial applications.⁴⁷

Despite even BIS identifying national security or foreign policy risks related to ECRA implementation and reviews, the bureau has taken limited action to strengthen or introduce new controls. Advanced surveillance technology is one area that has received increased scrutiny by the U.S. government and incremental responses from BIS. While the CCL already covers some forms of advanced surveillance technology, such as specific radar systems and surveillance hardware, BIS does not have controls for newer types of advanced surveillance software, though face and voice recognition were named in the emerging technologies advance notice. With the emerging technologies list still unresolved, BIS published a notice of inquiry on advanced surveillance systems in July 2020 as part of a periodic review pursuant to ECRA.⁴⁸ BIS also stated that its notice of inquiry sought to update existing CCL classifications to promote human rights, citing the extensive use of surveillance systems in Xinjiang for the mass detention of Uyghurs.⁴⁹

Stronger coordination across agencies on methodology and identification of export-controlled items might enable faster, more uniform implementation of controls and other national security tools across the U.S. government. In September 2020, the State Department issued guidance on due diligence for U.S. companies to avoid exporting products or services with surveillance capabilities to governments committing human rights abuses.⁵⁰ Otherwise, no additional controls on this category have been introduced, though several advanced surveillance technology companies have been placed on the Entity List for both human rights and national security reasons.⁵¹ In other words,

* In March 2021, the National Security Committee for Artificial Intelligence, created under the 2019 NDAA, echoed comments made in 2018 from emerging technologies advance notice respondents stating that the Department of Commerce should pursue end-use controls on certain high-end AI chips. National Security Committee for Artificial Intelligence, “Final Report,” 500. <https://www.nsc.ai.gov/wp-content/uploads/2021/03/Full-Report-Digital-1.pdf>.

the U.S. government appears to consider that export of advanced surveillance technologies carries national security risks in addition to human rights concerns, but current enforcement does not consistently reflect this assessment across agencies. Controls on the technology rather than restrictions on identified end users would broadly prevent exports of technology pursuant to both U.S. national security and other foreign policy interests.

Conclusion and Considerations for Congress

An oft-advocated approach to export controls and FDI screening has been “small yard, high fence,” meaning the targeted list of affected items should be narrow but garner robust protection.⁵² With the current policy and tools available, the United States has the capability to build a robust fence, yet its agencies lack the necessary guidance on how to determine the boundary of its yard. Current progress in implementation falls short of congressional expectations for expediency in addressing a key national security concern, though the difficulties in determining this guidance for the better period of two and a half years remain somewhat unclear. Curation of these lists naturally requires a great deal of technical expertise and deep understanding of use cases from practitioners. In fact, in its fiscal year 2021 budget submission to Congress, BIS requested an additional five positions to assist with ongoing review and identification for emerging and foundational technologies, noting the need for technical skills.⁵³

Even without full definition of the technologies themselves, a clear methodology, which is sufficiently complex from a technical and regulatory standpoint, might prove particularly useful for government and industry analysts moving forward. Timely and transparent administration of export controls is one way to increase efficiency in U.S. bureaucracy and guard against risk in a constantly shifting technology environment. Congress might consider the following questions in seeking to resolve delays in implementing export control reforms:

- What has caused the more than two-year delay in publishing lists of emerging and foundational technologies? Should Congress work with the Department of Commerce’s inspector general to investigate the delay?
- To what extent has CFIUS been constrained by the absence of lists for emerging and foundational technologies?
- How might the Emerging Technologies Technical Advisory Committee be better utilized for BIS’s identification and methodology for determining emerging and foundational technologies?
- How could interagency determinations be coordinated to ensure a swift and uniform response to threats across the U.S. government?
- What additional oversight would be necessary to ensure that the Department of Commerce can respond to emerging and foundational technology risks quickly?
- Is the Department of Commerce best positioned to continue enforcing export controls? If not, how should Congress delegate the authority?

Appendix: Emerging Technologies and Chinese Strategic Sectors

Proposed Emerging Technologies (2018)	Made in China 2025 (2015) Industrial Priorities
Biotechnology <ul style="list-style-type: none"> Nanobiology Synthetic biology Genomic and genetic engineering Neurotech 	Biopharmaceuticals and High-Tech Medical Devices
AI and machine learning technology, such as: <ul style="list-style-type: none"> Neural networks and deep learning Evolution and genetic computation Reinforcement learning Computer vision Expert systems Speech and audio processing Natural language processing Planning Audio and video manipulation technologies AI cloud technologies AI chipsets Microprocessor technology, such as: <ul style="list-style-type: none"> Systems-on-Chip (SoC) Stacked Memory on Chip 	Next-Generation IT Integrated Circuits
Position, Navigation, and Timing (PNT) technology Hypersonics, such as: <ul style="list-style-type: none"> Flight control algorithms Propulsion technologies Thermal protection systems Specialized materials 	Space and Aviation Maritime Equipment and High-Tech Ships
Advanced computing technology, such as: <ul style="list-style-type: none"> Memory-centric logic Data analytics technology, such as: <ul style="list-style-type: none"> Visualization Automated analysis algorithms Context-aware computing Brain-computer interfaces, such as: <ul style="list-style-type: none"> Neural-controlled interfaces Mind-machine interfaces Direct neural interfaces Brain-machine interfaces Quantum information and sensing, such as:	High-End Computerized Machines and Robots

<ul style="list-style-type: none"> Quantum computing Quantum encryption Quantum sensing <p>Robotics, such as:</p> <ul style="list-style-type: none"> Micro-drone and micro-robotic systems Swarming technology Self-assembling robots Molecular robotics Robot compliers Smart Dust 	
<p>Logistics technology, such as:</p> <ul style="list-style-type: none"> Mobile electric power Modeling and simulation Total asset visibility Distribution-Based Logistics Systems 	Advanced Railway Transportation Equipment
	New Energy and Energy-Saving Vehicles
	Energy Equipment
	Agricultural Machines
<p>Advanced materials, such as:</p> <ul style="list-style-type: none"> Adaptive camouflage Functional textiles Biomaterials 	New Materials
Additive manufacturing	
<p>Advanced surveillance technologies, such as:</p> <ul style="list-style-type: none"> Faceprint and voiceprint technologies 	

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This report is the product of professional research performed by the staff of the U.S.-China Economic and Security Review Commission and was prepared at the request of the Commission to support its deliberations. Posting of the report to the Commission’s website is intended to promote greater public understanding of the issues addressed by the Commission in its ongoing assessment of U.S.-China economic relations and their implications for U.S. security, as mandated by Public Law 106-398 and Public Law 113-291. However, it does not necessarily imply an endorsement by the Commission, any individual Commissioner, or the Commission’s other professional staff, of the views or conclusions expressed in this staff research report.

Endnotes

- ¹ Ian Fergusson and Karen Sutter, “U.S. Export Control Reforms and China,” *Congressional Research Service*, January 14, 2021. <https://crsreports.congress.gov/product/pdf/IF/IF11627/3>; Kevin J. Wolf et al., “The Export Control Reform Act of 2018 and Possible New Controls on Emerging and Foundational Technologies,” *Akin Gump*, September 12, 2018. <https://www.akingump.com/en/news-insights/the-export-control-reform-act-of-2018-and-possible-new-controls.html>.
- ² 115th U.S. Congress, “H.R. 5515 – John S. McCain National Defense Authorization Act for Fiscal Year 2019,” August 13, 2018. <https://www.congress.gov/bill/115th-congress/house-bill/5515>.
- ³ House Foreign Affairs Committee, *Remarks: Chairman Royce on Export Control Reforms*, March 14, 2018. <https://gop-foreignaffairs.house.gov/press-release/remarks-chairman-royce-export-control-reforms/>.
- ⁴ Kevin J. Wolf et al., “The Export Control Reform Act of 2018 and Possible New Controls on Emerging and Foundational Technologies,” *Akin Gump*, September 12, 2018. <https://www.akingump.com/en/news-insights/the-export-control-reform-act-of-2018-and-possible-new-controls.html>.
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