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Assessing the Scope of U.S. Visa Restrictions on Chinese Students

CSET Issue Brief



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Executive Summary

In May 2020, the White House issued a Proclamation barring Chinese graduate students and researchers from studying or working at U.S. universities if they previously had been affiliated with Chinese institutions that “implement or support” China’s military-civil fusion (MCF) strategy. This Brief summarizes what we know—and do not know—about the policy, and uses two new datasets to estimate how the policy’s impact would differ depending on how federal agencies define and operationalize “military-civil fusion.” It also compares the number of students who could be blocked by the Proclamation to the overall number of Chinese student enrollments at U.S. universities.

Our key findings are:

- **The scope of the Proclamation is unclear because it leaves several of the key terms and concepts undefined.**
 - The Proclamation defines China’s MCF strategy as “actions by or at the behest of the PRC to acquire and divert foreign technologies, specifically critical and emerging technologies, to incorporate into and advance the PRC’s military capabilities.” This definition differs in substance and emphasis from how other U.S. government documents define MCF, complicating attempts to assess the impact of MCF-related policies.
 - The Proclamation blocks individuals who have been affiliated with a Chinese entity that “implements or supports” China’s MCF strategy, though individuals who work in fields that “would not contribute” to China’s MCF strategy are exempt. The Proclamation does not specify what criteria will be used to judge which entities or fields are related to MCF.
 - These and other uncertainties mean that assessments of the Proclamation’s likely impact need to be based on assumptions and estimates. This Brief presents such an estimate, focusing on the annual number of Chinese students whose visa applications would be denied under the Proclamation.
- ***Assumption:* The MCF-related “entity” criterion likely targets a small number of Chinese universities that are on the Entity List, including the “Seven Sons of National Defense.”**

- Eleven civilian Chinese universities on the U.S. Department of Commerce’s Entity List (which designates entities subject to strong export control requirements), including all members of the CCP-designated Seven Sons of National Defense.
- Chinese students may also be barred on other grounds, including past employment (at a company involved in MCF-related work or directly for government) or participation in a Chinese scholarship program. We do not have data on all such risk indicators, so our assessment is not comprehensive.
- **Assumption: The MCF-related “field” criterion is likely to encompass all STEM enrollments.**
 - We were unable to find authoritative analyses or documents that list all academic fields relevant to MCF. However, our initial analysis of MCF technology lists suggest they are so broad that all STEM fields could be relevant in some way.
 - At the Ph.D. level, 85 percent of Chinese Ph.D. students at U.S. universities are in STEM fields, compared to less than half of Chinese master’s students. Among graduates from Seven Sons or other Entity List universities, the share of Ph.D. students in U.S. STEM programs is 95 percent.
- **Estimate: The Proclamation could block more than one-fifth of annual new Chinese enrollments in U.S. STEM graduate programs.**
 - To estimate what percentage of Chinese students are affected by the Proclamation, we suggest 3,000 to 5,000 as a reasonable range for the annual number of students affected. This number is in line with news reports, but due to the many sources of uncertainty we consider it a low-confidence estimate.
 - This range reflects an estimate for the number of students rejected *per year*. As such, the most natural comparison group for our estimate is the annual number of new Chinese graduate enrollments in STEM programs. Our estimate of 3,000 to 5,000 blocked students equals between 16 and 27 percent of the roughly 19,000 Chinese STEM students who start U.S. STEM graduate programs per year.
 - Our calculations reflect historical data from 2017 through 2019. Future enrollment changes due to COVID-19 and

other political and economic trends add significant uncertainty to any impact forecast.

- **Our analysis leaves several important questions unanswered.**
 - While the proclamation also applied to “researchers,” we were unable to perform detailed analysis of the number of affected researchers (those on J visas) due to a lack of data. Data gaps on international researchers are significant, and filling them should be a priority.
 - We also recommend further data collection and analysis aimed at disaggregating master’s from Ph.D. students at U.S. universities; determining what academic fields are relevant to China’s MCF strategy; and measuring department- and lab-level affiliations at Chinese universities.

U.S. Visa Restrictions on Chinese Students and Researchers

On May 29, 2020, the White House issued the “Proclamation on the Suspension of Entry as Nonimmigrants of Certain Students and Researchers from the People’s Republic of China” (“the Proclamation”).¹ It bars Chinese graduate students and researchers (undergraduates are exempted) from receiving F and J visas if they have been affiliated with an organization that implements or supports China’s military-civil fusion strategy. The Proclamation defines China’s “military-civil fusion strategy” as “actions by or at the behest of the PRC to acquire and divert foreign technologies, specifically critical and emerging technologies, to incorporate into and advance the PRC’s military capabilities.”

Some observers worry that the language is so broad that it “can be interpreted as an effective ban on Chinese students.”² However, reports by *The New York Times* and Reuters immediately after the policy’s announcement, citing unnamed official sources, suggested between 3,000 and 5,000 Chinese students could be affected.³ Four months after the policy was adopted, the State Department had revoked more than 1,000 visas, but it did not say how many visas it expected to revoke or reject in total.⁴

This Brief explains how the number of individuals affected depends on how the Proclamation is implemented. To do so, we analyze two new data sources with information on Chinese students’ undergraduate affiliations. Our findings suggest that, in line with news reports, the number of individuals affected per year is likely in the low to mid-thousands — *if* the Proclamation applies mainly to those who have attended a Chinese university that is on the Department of Commerce’s Entity List or a member of the Seven Sons. However, that number

would be much larger if the Proclamation is interpreted to include other elite Chinese institutions such as Tsinghua or Beijing University, as some have advocated.

By providing context and data relevant to different implementation scenarios, this Brief seeks to inform discussions and oversight of U.S. visa policy with respect to Chinese students and researchers. Analysts and journalists currently have to evaluate visa policy with very limited information on how policy is, or could be, implemented.⁵ State Department officials emphasized that the Proclamation is “not designed to impact large numbers of people,”⁶ but a small number by itself does not guarantee that a policy is well-targeted. If screening criteria are poorly chosen or operationalized, even a narrow policy may still fail to capture many high-risk students and researchers or, conversely, block many low-risk ones. We also identify several data gaps that complicate analysis of visa policy-related questions; these gaps can inform future U.S. government data collection and dissemination priorities.

This Brief does not take a position on the efficacy of the Proclamation’s approach to visa policy. We believe the data presented here is necessary for assessing the policy’s efficacy, but it is not sufficient. A full assessment of efficacy would also require a comparison to alternative policies and additional data.

The Brief proceeds as follows: First, we lay out open questions about the operationalization of “military-civil fusion” as a criterion for visa screening. Second, we offer plausible answers to these open questions, and we use these answers to assess how many individuals are likely to be affected by the Proclamation. Third, to place the findings in context, we compare the likely number of affected individuals to the overall number of new Chinese graduate enrollments. Finally, we review open questions and remaining areas of uncertainty.

Operationalizing “Military-Civil Fusion” for Visa Screening

Implementing the Proclamation requires federal agencies to operationalize “military-civil fusion” along at least two dimensions: determining which PRC entities “implement or support” MCF, and determining which academic fields “contribute to” MCF.

Determining which entities implement or support military-civil fusion.

Individuals affiliated with “an entity in the PRC that implements or supports the PRC’s ‘military-civil fusion strategy’” are barred by the Proclamation from receiving visas. The terms “implements” and “supports” are left undefined.

The Proclamation assesses an individual's affiliation with a PRC entity on the basis of (a) receiving funding, (b) past or current research activities on behalf of an entity, (c) past or current employment, and (d) past or current study.

Determining which fields are relevant to military-civil fusion. The Proclamation exempts Chinese individuals "studying or conducting research in a field involving information that would not contribute to the PRC's military-civil fusion strategy." What fields fall under this exemption is left undefined; the Proclamation puts the State Department and Homeland Security in charge of making that determination.

To avoid Chinese government circumvention, the U.S. government is unlikely to release a list of precise criteria, Chinese entities, and scientific fields that it deems related to China's MCF strategy.⁷ This paper therefore draws on our analysis of military-civil fusion documents and two data sources to assess how many Chinese students and researchers would be affected under different interpretations of the Proclamation's core concepts.

Estimating the Number of Individuals Affected by the Proclamation

Estimating how many students could be affected by the Proclamation requires analysts to answer three questions: (1) which entities are targeted by the Proclamation; (2) how many individuals who have been affiliated with those entities are in, or are likely to come to, the United States; and (3) how many of those individuals study in fields related to MCF. Answering each of these questions involves both conceptual and measurement problems, which we discuss below.

Which Chinese Universities Are Associated with MCF?

Assessing which Chinese universities are involved in MCF is difficult, in no small part because it is often unclear what "military-civil fusion" entails and how Chinese entities implement it (see Box 1). Acknowledging these uncertainties, this section lays out our assumptions for which Chinese universities may be covered under the current interpretation of the Proclamation. We focus on universities because there is no publicly available data on Chinese students' past jobs or scholarships, even though the State Department may also block individuals based on their past or current professional affiliations or source of funding.

Box 1. What is “military-civil fusion,” and what role do universities play in it?

One issue with using “military-civil fusion” as an organizing concept for policy, such as visa screening, is that it is often unclear what “military-civil fusion” refers to — and, equally important, what it does *not* refer to. Different U.S. government statements and documents have used different definitions of MCF, or describe the concept so broadly that its boundaries are unclear (see Appendix A).

The problem is not limited to U.S. discussions. PRC policies often employ broad and ambiguous terms, conditions, and wording so they may be interpreted as Beijing sees fit.⁸ This has led to some confusion, however; several PRC government researchers in 2018 argued for more formal definitions of MCF and codification in legislation.⁹ Chinese writing on how to learn from American “military-civil fusion” cites dozens of U.S. policies as examples of MCF, some of which, such as the 1980 Bayh-Dole Act on university research commercialization, point to a very broad conception of MCF.¹⁰

Beyond definitional questions, it is hard to assess what MCF means in practice. Some U.S. analysts argue that “MCF initiatives permeate the entire [Chinese] scientific and technological landscape,”¹¹ but others say that “MCF must be recognized as a desired end-state, rather than a reflection of the current condition of the Chinese technology and innovation ecosystem.”¹² Policy documents provide a valuable window into the CCP’s hopes and intentions, but they do not necessarily reflect reality on the ground. Even if a consensus definition of MCF emerges, operationalizing that definition for the purpose of policy implementation requires deep knowledge of what is happening in practice. So far, most empirical analyses of MCF have focused on the private sector, not on universities.¹³

Table 1 lists the 11 Chinese universities that we consider most likely to be covered by the Proclamation. It is composed of two groups:

- The **Seven Sons of National Defense** (国防七子 or 国防七校) are the seven Chinese universities under the supervision of the Ministry of Industry and Information Technology (MIIT).¹⁴ These institutions are ostensibly civilian universities—as opposed to official People’s Liberation Army (PLA) academies—but they have historically maintained strong connections to the Chinese defense industry and the PLA. Many of their graduates go on to work for state-owned defense enterprises or the military.¹⁵ Several recent U.S. government publications have specifically mentioned the Seven Sons as core to MCF.¹⁶
- The U.S. Department of Commerce **Bureau of Industry and Security’s (BIS) Entity List** includes the names of people and entities subject to certain export license requirements, restrictions, and sanctions. Typically, institutions on the Entity List are closely affiliated with a foreign military, implicated in human rights abuses, or act in some other manner opposed to U.S. policy. At the time of the

Proclamation, six non-military Chinese universities were on the Entity List, four of which are also members of the Seven Sons. In December 2020, BIS added the remaining three Seven Sons universities and two additional non-military universities to the Entity List.

Table 1. Chinese universities that are likely to be included as affiliated with “military-civil fusion.”

University	Seven Sons	BIS Entity List
Beihang University (北京航空航天大学)	X	X (2001)
Harbin Institute of Technology (哈尔滨工业大学)	X	X (2020)
Beijing Institute of Technology (北京理工大学)	X	X (2020)
Northwestern Polytechnical University (西北工业大学)	X	X (2012)
Nanjing University of Science and Technology (南京科技大学)	X	X (2020)
Nanjing University of Aeronautics and Astronautics (南京航空航天大学)	X	X (2020)
Harbin Engineering University (哈尔滨工程大学)	X	X (2020)
University of Electronic Science & Technology of China (电子科技大学)		X (2012)
Sichuan University (四川大学)		X (2012)
Beijing University of Posts and Telecommunications (北京邮电大学)		X (2020)
Tianjin University (天津大学)		X (2020)

Note: Years in parentheses denote when Chinese universities were added to the Entity List.

The universities in Table 1 have been the focus of most English- and Chinese-language coverage of the Proclamation, and of the few prior in-depth analyses of Chinese universities’ role in MCF.¹⁷ Our analysis suggests the number of graduates from these universities who continue their studies at U.S. universities is in the low to mid-thousands. This assessment is consistent with reporting by *The New York Times* and Reuters that there would likely be 3,000 to 5,000 individuals affected per year.

Table 1 omits PLA universities, such as the National Defense University of Technology (NUDT, 国防科学技术大学), as these universities are known to be directly affiliated with the military.¹⁸ Chinese media reports have also speculated that five Chinese universities on the BIS “Unverified List” would be covered by the Proclamation.¹⁹ Appendix B provides data on these universities.

How Many Chinese Students Come to the United States from These Universities?

We found two sources — one from China, and one from the United States — that could help assess how many Chinese students come to the United States after studying at universities of potential concern: (1) Chinese university employment reports and (2) the National Science Foundation’s Survey of Earned Doctorates (NSF SED).

Chinese university employment reports. Chinese universities publish employment reports that detail what their students do after graduation. All provide information on how many students continue their studies abroad, and some provide information on the specific study abroad locations.²⁰ Table 2 includes data from the employment reports of the eleven Entity List universities, including all Seven Sons. We estimate that 2,847 students went on to study in the United States immediately after graduating from these eleven universities in 2019.

Table 2. Graduates from selected Chinese universities who do further study in the United States, 2019.

University	No. of Grads in 2019 ²¹	No. of Grads Continuing Ed. Abroad	No. of Grads Continuing Ed. in the U.S.
Beihang University	6,573	837	268 (32%)*
Harbin Institute of Technology	7,865	609	199 (33%)
Beijing Institute of Technology	7,349	785	251 (32%)*
Northwestern Polytechnical University	6,334	343	110 (32%)*
Nanjing University of Science and Technology	6,277	295	57 (19%)
Nanjing University of Aeronautics and Astronautics	7,241	2,264	724 (32%)*
Harbin Engineering University	5,843	233	70 (30%)
University of Electronic Science & Technology of China	8,575	1,054	317 (30%)
Sichuan University	15,257	1,047	289 (28%)
Beijing University of Posts and Telecommunications	6,422	667	313 (47%)
Tianjin University	8,373	670	249 (37%)
Total	86,109	8,779	2,847

Source: CSET analysis of Chinese university post-graduation employment reports.

* All employment reports include the total number of students who go abroad, but the number of graduates who go to the United States specifically is not always included. For universities where this data is missing, we estimate the number who go to the United States as 32% of all graduates who do continuing education abroad, the average proportion for the universities where data is available.

The numbers included in Chinese universities’ employment reports refer to their graduates’ activities directly after they receive their degrees. As such, these numbers may omit graduates from these universities who pursue further study in the United States after, for example, working at a company for a year. The 2,847 number is thus likely an underestimate (see “Summary” section below for more details).

Note that this data represents an annual “flow:” the number of students who begin study at a U.S. university in a given year. Because some students will complete multi-year degrees, the total “stock” of students present in the United States in a given year likely exceeds a single year’s flow. Graduates can enroll in one- or two-year master’s programs, or in five- to six-year Ph.D. programs.²² Appendix D discusses the difference between “flow” and “stock” in more detail.

NSF Survey of Earned Doctorates. A second data source that can be used to assess how many Chinese students may be affected by the Proclamation is the NSF's Survey of Earned Doctorates (SED). Each year, the SED surveys all U.S. Ph.D. graduates and asks a battery of questions, including the respondent's citizenship and the name of their undergraduate institution. It consistently has response rates over 90 percent. The latest year for which data is complete is 2017.²³

In total, 6,055 Chinese citizens who received a Ph.D. from a U.S. university and responded to NSF's SED survey in 2017. Of these Chinese Ph.D. graduates, 93 percent did their undergraduate degree in China, 4 percent in the United States, and 3 percent elsewhere in the world (including Hong Kong). Table 3 looks at the 5,624 Chinese Ph.D. graduates who did their undergraduate degree in China,* and lists the number of graduates for all Seven Sons and Entity List universities. We find that 546 Ph.D. graduates got their bachelor's degrees from Seven Sons and Entity List universities, or 10 percent of the total.

* Students who did their undergraduate outside of China are less likely to be affected by the Proclamation since they would have had fewer opportunities to be affiliated with an MCF-related institution.

Table 3. Chinese Ph.D. graduates from U.S. universities by Chinese undergraduate university, 2017.

Undergraduate Institution	No. of Ph.D. Graduates
All Chinese Universities	5,624 (100%)
Seven Sons and Entity List universities	546 (10%)
Beihang University	100
Tianjin University	94
Harbin Institute of Technology	92
Sichuan University	75
Beijing Institute of Technology	53
Beijing University of Posts and Telecommunications	40
University of Electronic Science & Technology of China	39
Northwestern Polytechnical University	25
Nanjing University of Aeronautics and Astronautics	23
Harbin Engineering University	(5)*
Nanjing University of Science and Technology	0

Source: NSF Survey of Earned Doctorates.

* Because fewer than 10 individuals from Harbin Engineering University appeared in the data, NSF privacy restrictions prevent us from publishing the actual number. We insert an estimate of 5, representing the midpoint of the possible range (1-9).

Although the Chinese university employment reports and the NSF SED data are not directly comparable, we infer from these datasets that the majority of students affected by the proclamation are master’s students. Based on NSF data, we estimate that there were around 820 newly enrolled Ph.D. students from Seven Sons universities in 2018.²⁴ Compared with the figures reported in Table 2 — which suggest around 2,850 Chinese graduates from these universities start at U.S. universities each year — it appears likely that around three-quarters of incoming Seven Sons and Entity List students enroll in master’s programs.

How Many of These Students Are in MCF-related Fields?

Chinese strategy and implementation documents related to MCF typically focus on technologies, not research fields. For example, the CCP’s 13th Five-Year Special Plan for S&T Military-Civil Fusion Development lists “intelligent

unmanned vehicles, biological crossover technology, advanced electronics, quantum technology, future networks, advanced energy, new materials, [and] advanced manufacturing” as examples of technologies in which China wants to “seize the commanding heights in international competition.”²⁵ A provincial MCF implementation document also includes nuclear, aerospace, and environmental protection technologies.²⁶

Due to the wide-ranging nature of such Chinese technology target lists, it is difficult to determine which academic research fields are relevant to the PRC’s military-civil fusion strategy. All the major STEM fields — mathematics and statistics, computer science, engineering, the life sciences, and the physical sciences — make important contributions to the technologies listed above.²⁷ As such, our best guess is that the Proclamation will bar affected students from all STEM fields.²⁸

Table 4, drawing on NSF SED data, shows that limiting the Proclamation to all STEM fields does little to reduce the number of potentially affected students at the Ph.D. level. Nearly all (95 percent) of the students who attended Seven Sons or Entity List universities got their U.S. Ph.D. degrees in STEM fields. The comparable number for all Chinese students who did their undergraduate degree in China (not shown in Table 4) is 85 percent (4,797 out of 5,624).

Table 4. Graduates from U.S. universities in STEM fields, 2017

	Total No. of Ph.D. Graduates	No. of Ph.D. Graduates in STEM Fields	% of Total in STEM
Students with Undergraduate Degree at Seven Sons or Entity List University	546	517	95%

Source: NSF Survey of Earned Doctorates. Social sciences are excluded from our definition of “STEM.”

At the master’s level, data on Chinese student enrollments — from both U.S. and Chinese sources — are unfortunately less granular. However, it seems likely that a much lower proportion (less than half) of Chinese students are in STEM fields at the master’s level (see Appendix D).

It Is Unclear How Many Researchers Will Be Affected

We have focused our analysis on students, i.e. those who would enter the United States on F visas. But the Proclamation also affects researchers who

rely on J visas. Unfortunately, too little information is available about this population to conduct a similarly in-depth assessment.

According to the Institute for International Education (IIE), there were about 48,000 “international scholars” from China at U.S. universities in the 2018-19 academic year.²⁹ However, no public data source we are aware of tracks these researchers’ prior educational or professional affiliations, or even their current fields of study.³⁰ Moreover, not all researchers rely on J visas; according to IIE data, around 71 percent of international scholars do.³¹ H-1B skilled worker visas (18 percent) and F1-OPT (5 percent) are the most common other categories. Researchers in visa categories other than J or F currently appear to be unaffected by the Proclamation.

Summary

In summary, we looked at two datasets to assess how many students per year come to study in the United States directly after graduating from one of the eleven Chinese universities that are on the BIS Entity List, including all members of the Seven Sons of National Defense (Table 1). We found that an estimated 2,850 came to the United States directly after graduating from these universities in 2019 (as seen in Table 2), of whom the majority are likely master’s students (as implied by Table 3). These 2,850 students would have likely all been blocked from entering the United States by the Proclamation.

However, as noted above, this 2,850 number does not include other groups of students who may be blocked by the Proclamation:

- students who went to one of these 11 universities but studied or worked elsewhere before enrolling at a U.S. university;
- students who are blocked based on a past private sector affiliation (e.g. who previously worked for a company involved in MCF) or who worked directly for the Chinese government, which we do not have data on;
- students with Chinese government funding (e.g. from the China Scholarship Council) who might, for that reason, be counted as associated with MCF;³² and
- students who attended another university or program that was blocked by the Proclamation but omitted in Table 2, such as the Chinese universities on the BIS Unverified List (see Appendix B).

We therefore consider 2,850 a *lower bound* on the number of students likely to be blocked by the Proclamation per year.* The actual number is almost certainly higher.

We think it is likely that the annual number of affected students falls somewhere between 3,000 and 5,000.† This estimate is consistent with anonymous official sources quoted by *The New York Times* and Reuters, who said 3,000 to 5,000 individuals would be affected by the Proclamation.³³ Given the many sources of uncertainty, however, this is not a high-confidence estimate. When putting this estimate in context below, we provide background data that is sufficiently detailed for others who disagree with our analysis to re-do our calculations using different numbers.

Putting the Numbers of Affected Students in Context

If we estimate between 3,000 and 5,000 students would be blocked under the Proclamation each year, how does that compare to the overall flow of Chinese students to the United States? This question seems simple, but answering it poses some difficulties. In mathematical terms, we previously focused on assessing who may be affected: the *numerator*. We now ask what proportion of potentially affected students are in fact affected, which also requires knowing the *denominator*. Just as there are issues in estimating the numerator, it is not straightforward to determine the appropriate denominator.

The overall number of Chinese students in the United States is approximately 370,000. Compared to this population, 3,000 to 5,000 students is only around 1 percent. This comparison, and this 1 percent number, is what U.S.

* Note that our method of estimating the number of students affected by the Proclamation counts as “blocked” both (1) students who apply for a U.S. visa and are rejected; and (2) students who would have applied for a U.S. visa if the Proclamation had not been adopted but who, now that the Proclamation is in place, will refrain from applying because they expect their application to be denied. Many (perhaps most) “blocked” students will be deterred by the Proclamation from applying to U.S. universities in the first place, and will therefore belong to group (2).

† For example, CSET analysis of Chinese university post-graduation employment reports finds that Huawei is the most common employer of graduates from China’s best universities. Many students also work at other companies linked by the U.S. government to MCF. If some of those students would later apply for U.S. graduate school, they would be blocked under the Proclamation. Similarly, some Seven Sons and/or Entity List graduates could have worked elsewhere before coming to the United States, which would lead to their exclusion from Table 2 and our 2,850 lower bound. Our 3,000 to 5,000 range estimate assumes between 150 and 2,150 students who are not captured in our datasets will be blocked by the Proclamation each year.

government officials have emphasized when they've discussed the Proclamation's impact.³⁴

However, this comparison is not necessarily the right one. First, the Proclamation only applies to graduate students, and, as we noted above, most likely only to those in STEM fields. Second, our analysis focuses on the annual number of Chinese applicants who are likely to be blocked by the Proclamation. For this paper, then, it is more appropriate to compare our estimates to the number of new Chinese enrollments.

Table 5 presents this comparison. It shows the Proclamation will likely block between 9 and 15 percent of new Chinese graduate enrollments per year, or between 16 and 27 percent when looking only at STEM programs. Appendix C reviews how we did these calculations.

Table 5. Number of students affected by the Proclamation compared to annual new Chinese graduate enrollments.

Number of Students Affected (<i>Est.</i>)	Comparison Group	Number of Students in Comparison Group	Percent of Comparison Group Affected
3,000 – 5,000	Estimated annual new Chinese graduate enrollments	34,471	9% – 15%
	Estimated annual new Chinese graduate enrollments (STEM only)	18,732	16% – 27%

Note: See Appendix C for methodology and sourcing. Estimated annual new enrollments are for fall 2019.

In Appendix D, we provide additional analysis on the total number of Chinese graduate students currently in the United States, both overall (around 130,000) and in STEM specifically (around 76,000). Total current enrollments are not an appropriate reference group for our estimate, which focuses on annual new enrollments. However, the totals are a useful reference group (1) for assessing the Proclamation's *initial* impact, which may be higher than its future *annual* impact because the initial impact also includes students currently enrolled in multi-year degrees who have their visas revoked; and (2) for assessing the possible scope of stricter visa policies that have been proposed.³⁵ Appendix D discusses these questions in more detail.

We emphasize that this discussion is based on historical enrollment data. Projections about the Proclamation's impact are confounded by possible

future changes in enrollment trends. For example, political tensions and COVID-19-related developments are likely to have an impact on Chinese student applications going forward.³⁶ These complications mean estimates of the number of future students who are affected (the numerator) and the total applicant pool (the denominator) face additional uncertainty. This uncertainty is one of the reasons that State Department officials have declined to publicly speculate on the number of students they expect to be affected.³⁷ Our estimate should therefore be interpreted with caution.

Conclusion

The text of the White House's Proclamation left many questions about the U.S. government's approach to Chinese student and researcher visas unanswered. Elsa Kania, an expert on China's military-civil fusion policy, has called the Proclamation's framing of the MCF issue "fairly vague and rather questionable."³⁸ This vagueness is likely a feature, not a bug. It provides agencies and consular staff flexibility in the visa screening process, which is helpful when the target—in this case, the Chinese government—constantly changes its tactics.* At the same time, vagueness can mask disagreements about policy, prevent debate, or stymie oversight.

In light of the Proclamation's broad language, most assessments have focused on questions around interpretation and implementation. For example, as Anja Manuel and Kathleen Hicks recently argued in *Foreign Affairs*:

"Narrowly defined, [the Proclamation] makes perfect sense. It is essential to strictly limit access to some research programs in order to protect national security. Broadly interpreted, however, the visa move could affect thousands and thousands of Chinese students and researchers who have no relationship at all with the PLA. Encouraging a substantial brain drain from the United States to China or other markets seeking to attract the best and the brightest will only undermine U.S. competitiveness."³⁹

Other researchers worry that the Proclamation's level of discretion "could lead to a lot of error," including the possibility that it "miss[es] lots of

* Prior to the Proclamation, the State Department argued it had inadequate authorities to deny visas to Chinese students and researchers that it considered potential risks. See remarks and responses to questions for the record by Deputy Assistant Secretary of State Edward Ramotowski at the U.S. Senate Judiciary hearing "Student Visa Integrity: Protecting Educational Opportunity and National Security," June 6, 2018, available at <https://www.judiciary.senate.gov/meetings/a-thousand-talents-chinas-campaign-to-infiltrate-and-exploit-us-academia>.

programs at Chinese universities that do defense work or classified research.”⁴⁰

This paper provides a data-driven assessment of the Proclamation’s implementation and impact. We find that between 3,000 and 5,000 students are likely to be blocked per year—*if* the Proclamation is applied mainly to graduates from the 11 Chinese universities that are on the Entity List, including all seven members of the “Seven Sons of National Defense.” This estimate equals between 16 and 27 percent of all new Chinese graduate enrollments in U.S. STEM programs per year. If “military-civil fusion” is defined more broadly to include other civilian universities, the Proclamation’s impact would be much larger. Our assessment is based on policies and statements issued under the Trump administration; it is unknown whether the Biden administration will maintain or amend the Proclamation.

This paper does not take a position on the efficacy of the Proclamation’s approach to visa policy; the data we present are necessary but not sufficient for a comprehensive policy assessment. We do hope the paper will help inform detailed and nuanced policy conversations about the Proclamation’s approach. Such conversations are a prerequisite for a U.S. government policy that balances risks and benefits while countering the Chinese government’s efforts to exploit democratic countries’ openness and acquire technology from abroad. We identify several specific questions that would benefit from more data and debate:

- **Impact on researchers.** China experts and university officials argue that researchers on average pose higher technology transfer risks than students.⁴¹ However, we were unable to assess the Proclamation’s likely impact on researchers because available data on international researchers at U.S. universities is much less detailed than data on international students. Federal agencies and researchers should make it a priority to fill this gap.
- **Delineation of MCF-related fields.** On the basis of broad MCF target technology lists, we inferred that the Proclamation’s definition of “MCF-related” fields is likely to include all STEM fields. But this is a low-confidence assessment; we were unable to find detailed assessments of which research fields are included in or excluded from China’s MCF-related efforts. Future studies could look at whether it is feasible, and desirable, to define MCF’s boundaries more narrowly or broadly than STEM.
- **Finer-grained “entity” measures.** In this study, we looked primarily at data on universities. However, finer-grained assessments may be

possible. Certain schools, departments, or labs at Chinese universities that are not members of the Seven Sons or on the Entity List are known to do military work.⁴² Future studies should dig into these layers below the university level. Likewise, more research should be done on students at Seven Sons universities. These universities are widely seen as elite universities in China, and it is unknown to what extent students are thinking about MCF considerations when they enroll there.⁴³ More thinking is needed to assess the level of risk associated with such students. Similarly, more work should be done on specific Chinese scholarship programs.⁴⁴

- **Distinguishing between master’s and Ph.D. students.** The Proclamation targets “graduate students” as a single category, but there are important differences between Ph.D. and master’s students, including their financial contributions and costs and the level of their training.⁴⁵ The analysis presented in this paper suggests that around three quarters of affected students are master’s students, but this estimate is uncertain because data sources only rarely distinguish between master’s and Ph.D. students.⁴⁶ Federal agencies should distinguish, where possible, between master’s and Ph.D. students in data collection and publication,^{*} and analysts should do more in-depth work on the similarities and differences between these two groups.

^{*} For example, the Department of Homeland Security could, without requiring any new data collection, distinguish between master’s and Ph.D. students (instead of lumping them together under “graduate students”) in its SEVIS Data Mapping Tool; see “SEVIS Data Mapping Tool,” Study in the States, <https://studyinthestates.dhs.gov/sevis-data-mapping-tool>.

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Appendix

A. Definitions of Military-Civil Fusion

As discussed in Box 1, one of the issues with using “military-civil fusion” for the purpose of policy is that the concept does not have a single clear definition. The Proclamation defines China’s “military-civil fusion strategy” as “actions by or at the behest of the PRC to acquire and divert foreign technologies, specifically critical and emerging technologies, to incorporate into and advance the PRC’s military capabilities.” Other U.S. government sources define military-civil fusion differently, and/or emphasize different elements. Examples include:

- **China Aerospace Studies Institute (U.S. Air Force):** “[MCF] hopes to achieve a state of ‘deep fusion’ through the integration of the two essential building blocks: the ‘military’ and the ‘civil.’ The ‘military’ includes every aspect of the national defense and force building endeavor, including armed forces, national defense technology, industry, facilities, mobilization, education, resources, as well as the major operational domains. The ‘civil’ refers to fields in the economic and social system that are closely related to national defense and force-building, such as the national science and technology and industrial system, the national talent education and training system, the national social services system, the national emergency management system, as well as emerging domains and nascent technological areas such as maritime, space, cyberspace, and artificial intelligence that are closely linked to the generation of ‘New Type Combat Capabilities’.”⁴⁷
- **Department of Defense:** “MCF encompasses six interrelated efforts: (1) fusing the China’s defense industrial base and its civilian technology and industrial base; (2) integrating and leveraging science and technology innovations across military and civilian sectors; (3) cultivating talent and blending military and civilian expertise and knowledge; (4) building military requirements into civilian infrastructure and leveraging civilian construction for military purposes; (5) leveraging civilian service and logistics capabilities for military purposes; and, (6) expanding and deepening China’s national defense mobilization system to include all relevant aspects of its society and economy for use in competition and war.”⁴⁸
- **State Department:** “The goal of MCF is to give the CCP the most advanced military in the world by 2049, the centennial of its takeover in China. MCF aims to make any technology accessible to anyone

under the PRC's jurisdiction available to support the regime's ambitions. Yes, this is in part about economic power, but it is also, quite centrally, about augmenting Beijing's military power."⁴⁹

- **U.S.-China Economic and Security Review Commission:** "The Chinese government's military-civil fusion policy aims to spur innovation and economic growth through an array of policies and other government-supported mechanisms, including venture capital (VC) funds, while leveraging the fruits of civilian innovation for China's defense sector. The breadth and opacity of military-civil fusion increase the chances civilian academic collaboration and business partnerships between the United States and China could aid China's military development."⁵⁰
- **White House:** "Beijing's Military-Civil Fusion (MCF) strategy gives the PLA unfettered access into civil entities developing and acquiring advanced technologies, including state-owned and private firms, universities, and research programs. Through non-transparent MCF linkages, the United States and other foreign companies are unwittingly feeding dual-use technologies into PRC military research and development programs, strengthening the CCP's coercive ability to suppress domestic opposition and threaten foreign countries, including United States allies and partners."⁵¹

While all these statements on MCF emphasize concerns of a broadly similar nature, they do not clearly delineate risks in a way that allows researchers to understand what specific entities the U.S. government considers "in" or "out" of the MCF system. For example, the Proclamation's text targets entities that divert foreign technologies into the PRC's military capabilities. The State Department document quoted above, however, says MCF means "*any* technology accessible to *anyone* under the PRC's jurisdiction" could be used for military purposes. Moreover, the CASI and DOD definitions do not mention technology transfer from abroad as a component of MCF, focusing instead on purely domestic dynamics.

We emphasize these differences as a source of analytical difficulty for this paper, not to pass judgment on policy. Internal, operational definitions of MCF may well be consistent. As we note in the Conclusion, it is not surprising the U.S. government maintains a level of public ambiguity and uncertainty with respect to the Proclamation's implementation. Such ambiguity can help prevent the Chinese government from circumventing the Proclamation, and preserves leeway for U.S. officials to target entities and individuals of concern.

B. Enrollments from Other Relevant Chinese Universities

In the body of this Brief, we focused on Chinese universities that are (a) members of the “Seven Sons of National Defense” and/or (b) on the BIS “Entity List” as the most likely targets of the Proclamation. This section reviews data on two other relevant categories of universities: those on the BIS “Unverified List” and those that send most graduates to the United States.

Chinese Universities on the BIS Unverified List

The BIS “Unverified List” is a list of entities that have not complied with BIS requests but are not seen as sufficiently risky to be put on its Entity List.⁵² The five Chinese universities on the Unverified List have not been mentioned in U.S. media coverage of the Proclamation, but they have been noted in Chinese sources.⁵³ Tables 6 and 7 present data based on employment reports and NSF surveys for the five Chinese universities on the Unverified List, comparable to the data presented in Tables 2 and 3 in the main body.

Table 6. Graduates from selected Chinese universities who do further study in the United States, 2019.

University	Total No. of Grads in 2019	No. of Grads Continuing Ed. Abroad	No. of Grads Continuing Ed. in the U.S.
Xi'an Jiaotong University	7,532	669	267 (40%)
Tongji University	7,535	925	277 (30%)
Renmin University	6,876	887	254 (29%)
Guangdong University of Technology	11,371	326	33 (10%)
Nanchang University	11,089	340	43 (13%)
Total	44,403	3,147	874

Source: CSET analysis of Chinese university post-graduation employment reports.

Table 7. Chinese Ph.D. graduates from U.S. universities by Chinese undergraduate university, 2017.

Undergraduate Institution	No. of Ph.D. Graduates
All Chinese Universities	5,624 (100%)
Universities on the BIS Unverified List	219 (4%)
Xi'an Jiaotong University	76
Tongji University	71
Renmin University	55
Nanchang University	12
Guangdong University of Technology	(5)*

Source: NSF Survey of Earned Doctorates.

* Because fewer than 10 individuals from Guangdong University of Technology appeared in the data, NSF privacy restrictions prevent us from publishing the actual number. We insert an estimate of 5, representing the midpoint of the possible range (1-9).

Chinese Ph.D. Students' Most Common Undergraduate Institutions

Table 8 lists the ten Chinese universities that were the most common undergraduate institutions for Chinese graduates from U.S. Ph.D. programs. These ten universities include seven of China's most elite "C9" university league.* About 2,300 (41 percent) of all Chinese university graduates in our NSF data got their bachelor's degrees at one of these ten institutions.⁵⁴

Table 8 thus shows the potential impact of adopting a broader definition of MCF for the purpose of visa screening. Past research has found military-affiliated labs at the universities listed in Table 8, such as Tsinghua University.⁵⁵ If graduates from these and similar universities are also blocked under the new policy, the Proclamation would thus plausibly block more than half of all incoming Chinese Ph.D. students (similar data for master's students is not available).

* The C9 league is commonly referred to as "China's Ivy League." Its members are Tsinghua University, Beijing (Peking) University, Fudan University, Shanghai Jiao Tong University, University of Science and Technology of China, Zhejiang University, Nanjing University, Xi'an Jiaotong University, and Harbin Institute of Technology (which is on the Entity List).

Table 8. Chinese Ph.D. graduates from U.S. universities by Chinese undergraduate university, 2017.

Undergraduate Institution	No. of Ph.D. Graduates
All Chinese Universities	5,624 (100%)
10 Chinese universities with most U.S. Ph.D. graduates	2,297 (41%)
Beijing University	417
University of Science & Technology of China	335
Tsinghua University	316
Zhejiang University	229
Nanjing University	193
Shanghai Jiaotong University	185
Huazhong University of Science and Technology	178
Wuhan University	166
Nankai University	144
Fudan University	134

Source: NSF Survey of Earned Doctorates.

C. Comparing the Number of Affected Students to New Annual Chinese Enrollments

In Table 5, we compared our estimates of the number of Chinese students affected by the Proclamation to the annual number of new Chinese graduate enrollments. This section explains the source and method we used for this comparison.

Table 9 shows that 34,471 new Chinese graduate students enrolled at U.S. universities in fall 2019, according to data from the Council of Graduate Schools. No data source that we know of tracks annual new Chinese graduate STEM enrollments specifically (CGS does not publish field data broken out by nationality), so the number of new STEM enrollments has to be estimated.⁵⁶ We estimate that 18,732 of the 34,471 new graduate enrollments in fall 2019 were in STEM programs, with the vast majority of non-STEM enrollments being at the master’s level (e.g. in business or other professional programs).⁵⁷

Table 9. New Chinese graduate student enrollments at U.S. universities, fall 2019.

	Number of Chinese Graduate New Enrollments		
	Overall	Master's	Ph.D.
STEM (<i>est.</i>)	18,732	12,583	6,149
Total	34,471	27,237	7,234

Source: Council of Graduate Schools.⁵⁸ For methodological details on the STEM estimate, see note 57.

D. Comparing the Number of Affected Students to Total Current Chinese Enrollments

Many discussions of the number of students affected by the Proclamation have compared that number to the total number of Chinese students at U.S. universities, which is around 370,000. One problem with this comparison is that, of those 370,000 students, about 148,900 are undergraduates and 17,200 are in non-degree programs, and are thus by definition exempt from the Proclamation.* As Table 10 shows, only around 130,000 are graduate students, and only a subset of those graduate students are in STEM fields. Graduate students in non-STEM fields are also likely to be exempt from the Proclamation.

* An additional 70,000 were participants in the optional practical training (OPT) program, a program that allows international graduates to work in the United States between one and three years. While still on an F visa, OPT participants are no longer taking classes at universities. Some OPT participants may also have been affected by the Proclamation if they were previously affiliated with a targeted Chinese entity and had studied in a graduate STEM program. Note that Table 10 does not include OPT participants. For enrollment numbers across student categories, see Feldgoise and Zwetsloot, "Estimating the Number of Chinese STEM Students."

Table 10. Total number of Chinese graduate students enrolled at U.S. universities, AY2018/19.

	Number of Enrolled Chinese Graduate Students		
	Overall	Master's (<i>est.</i>)	Ph.D. (<i>est.</i>)
STEM	76,060	40,473	35,587
Total	129,440	<i>not estimated</i>	<i>not estimated</i>

Source: Science and Engineering Indicators (via DHS SEVIS); NSF Survey of Graduate Students and Postdoctorates in Science and Engineering. For methodological details, see Feldgoise and Zwetsloot, "Estimating the Number of Chinese STEM Students in the United States," Appendix B.

A second problem with comparing the number of students affected to the total number of currently enrolled students is that this total is not necessarily an appropriate comparison group. In this paper, we focused on estimating the number of *new* Chinese applicants who would be blocked under the Proclamation *per year*. Comparing this number to the *total* number of *current* enrollments is apples-to-oranges.

However, the data in Table 10 can still be useful in other ways: first, for assessing the Proclamation's total initial impact, and second, for assessing how many Chinese students would be affected under proposed visa restrictions that go beyond the Proclamation.

Assessing the Proclamation's Initial Impact

The Proclamation's *initial* impact may be larger than its *annual* impact in subsequent years if it is applied retroactively to students who are enrolled in multi-year programs. In its first year, the Proclamation will impact two groups of Chinese students: (1) those who apply (or would have applied) to enter a U.S. STEM graduate program; and (2) those were already enrolled in U.S. STEM programs when the Proclamation was issued, for example STEM Ph.D. students who were in their third year when the Proclamation was issued. Students in group (1) will see their future visa applications denied, whereas students in group (2) will see their already-issued visas revoked. After the visas of those in group (2) are revoked in the first year, the Proclamation's annual impact is limited to visa denials for individuals in group (1) in subsequent years.

As noted above, in this paper, we focused our analysis on the first group. Analyzing the Proclamation's initial impact would also require estimating

what proportion of currently enrolled Chinese students attended Seven Sons/Entity List universities or are likely to have their visas revoked under the Proclamation on other grounds. For that analysis, the numbers listed in Table 10 *would* be an appropriate comparison group.

Assessing the Potential Scope of Wider Restrictions

The second way in which knowing the total number of current Chinese students is useful is for assessing the potential scope of visa policy proposals that go beyond the Proclamation we focus on in this paper. Senator Tom Cotton, for example, has argued that the U.S. government should block all Chinese graduate students from studying STEM fields in the United States.⁵⁹ If such policies include retroactive visa revocations, they could impact all Chinese graduate students currently studying at U.S. universities (Table 10).

Endnotes

¹ “Proclamation on the Suspension of Entry as Nonimmigrants of Certain Students and Researchers from the People’s Republic of China,” Executive Office of the President, May 29, 2020, <https://www.whitehouse.gov/presidential-actions/proclamation-suspension-entry-nonimmigrants-certain-students-researchers-peoples-republic-china/>.

² Yangyang Cheng, “This Land Is Not Your Land,” *SupChina News*, June 25, 2020, <https://supchina.com/2020/06/25/this-land-is-not-your-land/>.

³ Edward Wong and Julian E. Barnes, “U.S. to Expel Chinese Graduate Students With Ties to China’s Military Schools,” *The New York Times*, May 28, 2020, <https://www.nytimes.com/2020/05/28/us/politics/china-hong-kong-trump-student-visas.html>; Matt Spetalnick and Humeyra Pamuk, “U.S. Planning to Cancel Visas of Chinese Graduate Students: Source,” *Reuters*, May 28, 2020, <https://www.reuters.com/article/us-usa-china-students/us-planning-to-cancel-visas-of-chinese-graduate-students-sources-idUSKBN2342AX>. Note that news reports talk about students being “expelled,” but a student whose visa is revoked would not automatically be subject to deportation. Visas are travel documents that allow noncitizens to travel to a port of entry to seek admission to the United States. A student without a valid visa could still maintain their right to be present in the United States, typically referred to as their “legal status” (or just “status”). If the State Department revokes a student’s visa, that student could not re-enter the country after leaving. However, so long as the student remains in the United States, the Department of Homeland Security would have to initiate separate removal proceedings before they could be expelled. Removal proceedings are rare and subject to judicial review. See Stuart Anderson, “Inside Trump’s Immigration Order to Restrict Chinese Students,” *Forbes*, June 1, 2020, <https://www.forbes.com/sites/stuartanderson/2020/06/01/inside-trumps-immigration-order-to-restrict-chinese-students/>. Our analysis in this paper focuses on the likely number of new visa applicants blocked by the Proclamation, not on current students, so this question does not affect our analysis; see Appendix D for more discussion.

⁴ Humeyra Pamuk, “U.S. Revokes More Than 1,000 Visas of Chinese Nationals, Citing Military Links,” *Reuters*, September 9, 2020, <https://www.reuters.com/article/us-usa-china-visas-students/u-s-revokes-more-than-1000-visas-of-chinese-nationals-citing-military-links-idUSKBN26039D>.

⁵ Tawanda W. Johnson, “APS Files FOIA Request in Response to Revocation of Visas for Chinese Students,” *APS News*, October 16, 2020, <https://aps.org/publications/apsnews/updates/foia.cfm>.

⁶ Office of the Spokesperson, “Briefing on Limiting the CCP’s Ability to Steal U.S. Technologies and Intellectual Property,” U.S. Department of State, June 2, 2020, <https://www.state.gov/briefing-with-senior-state-department-officials-on-u-s-limiting-the-peoples-liberation-armys-ability-to-use-nonimmigrant-visa-programs-to-illicitly-acquire-u-s-technologies-an/>. The Deputy National Security Advisor described the Proclamation as a “surgical approach”; David Brunnstrom and Matt Spetalnick, “U.S. Targets Only One

Percent of Chinese Students over Security: White House Official," Reuters, September 30, 2020, <https://www.reuters.com/article/us-usa-china-students/u-s-targets-only-one-percent-of-chinese-students-over-security-white-house-official-idUSKBN26M41X>.

⁷ Office of the Spokesperson, "Briefing on Limiting the CCP's Ability."

⁸ Besides MCF, Chinese policies such as the National Intelligence Law and the Hong Kong National Security law have been called out for their ambiguity. See, e.g., Samantha Hoffman and Elsa Kania, "Huawei and the Ambiguity of China's Intelligence and Counter-Espionage Laws," *The Strategist*, September 13, 2018, <https://www.aspistrategist.org.au/huawei-and-the-ambiguity-of-chinas-intelligence-and-counter-espionage-laws/>.

⁹ Translation of "Characteristics of, and Lessons from, the U.S. Legal System for Military-Civil Fusion" (Center for Security and Emerging Technology, August 5, 2020), <https://cset.georgetown.edu/research/characteristics-of-and-lessons-from-the-us-legal-system-for-military-civil-fusion/>: "A clear definition is the prerequisite for advancing military-civil fusion with pooled resources and efforts. An infinitely expanded definition will not be practical. To advance military-civil fusion development, we must first clearly define the concept of military-civil fusion."

¹⁰ See, e.g., Zhou Fei and Zhang Zhiqiang, "Characteristics of, and Lessons from, the Development of Deep Military-Civil Fusion in the U.S. Innovation System" [美国创新体系军民深度融合发展特点及启示], *Defense Technology Review* (国防科技), October 2018, 70-80, <http://ir.las.ac.cn/bitstream/12502/10229/1/%E7%BE%8E%E5%9B%BD%E5%88%9B%E6%96%B0%E4%BD%93%E7%B3%BB%E5%86%9B%E6%B0%91%E6%B7%B1%E5%B%A6%E8%9E%8D%E5%90%88%E5%8F%91%E5%B1%95%E7%89%B9%E7%82%B9%E5%8F%8A%E5%90%AF%E7%A4%BA.pdf>; and Wang Luhao and Hu Lingjia, "Policy Changes in the United States Civil-Military Integration Strategy: An Analysis Based on the Policy Text" [美国军民融合战略的政策变迁: 给予政策文本的分析], *Journal of UESTC* (Social Sciences Edition) [电子科技大学学报(社科版)], February 2019, 30-36, 75, <https://www.ixueshu.com/document/b6a0a2e89f6b9322f7d67e60d0695624318947a18e7f9386.html>. Full CSET English-language translations of these documents are available to other analysts on request.

¹¹ Emily de la Bruyere and Nathan Picarsic, "How to Beat China's Military-Civil Fusion," *The American Interest*, June 22, 2020, <https://www.the-american-interest.com/2020/06/22/how-to-beat-chinas-military-civil-fusion/>.

¹² Elsa B. Kania and Lorand Laskai, "Myths and Realities of China's Military-Civil Fusion Strategy," *Center for a New American Security*, January 28, 2021, <https://www.cnas.org/publications/reports/myths-and-realities-of-chinas-military-civil-fusion-strategy>.

¹³ For example, the China Aerospace Studies Institute's 140-page report contains only two pages focused on non-PLA universities; see Alex Stone and Peter Wood, "China's Military-Civil Fusion Strategy" (China Aerospace Studies Institute, June 2020), <https://www.airuniversity.af.edu/CASI/Display/Article/2217101/chinas-military-civil->

[fusion-strategy/](#); see also Marcel Angliviél de la Beaumelle, Benjamin Spevack, and Devin Thorne, “Open Arms: Evaluating Global Exposure to China’s Defense-Industrial Base” (C4ADS, October 17, 2019), <https://www.c4reports.org/open-arms>; Greg Levesque and Mark Stokes, “Blurred Lines: Military-Civil Fusion and the ‘Going Out’ of China’s Defense Industry” (Pointe Bello, December 2016), https://static1.squarespace.com/static/569925bfe0327c837e2e9a94/t/593dad0320099e64e1ca92a5/1497214574912/062017_Pointe+Bello_Military+Civil+Fusion+Report.pdf.

¹⁴ “Introduction to the Seven Sons of National Defense” [国防七校的介绍], Jiangsu Admissions Examination Network [江苏招生考试网], April 20, 2016, <https://web.archive.org/web/20170225103359/http://www.js-edu.cn/n/416096.html>.

¹⁵ Alex Joske, “The China Defence Universities Tracker: Exploring the Military and Security Links of China’s Universities” (Australian Strategic Policy Institute, November 25, 2019), <https://www.aspi.org.au/report/china-defence-universities-tracker>; Ryan Fedasiuk and Emily Weinstein, “Universities and the Chinese Defense Technology Workforce” (Center for Security and Emerging Technology, December 2020), <https://cset.georgetown.edu/research/universities-and-the-chinese-defense-technology-workforce/>.

¹⁶ Office of the Secretary of Defense, *Military and Security Developments Involving the People’s Republic of China 2020*, (Washington, DC: Department of Defense, 2020), 22, <https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF>.

¹⁷ The most prominent studies are Joske, “The China Defence Universities Tracker”; and Glenn Tiffert (ed.), “Global Engagement: Rethinking Risk in the Research Enterprise” (Hoover Institution, July 2020), <https://www.hoover.org/global-engagement-rethinking-risk-research-enterprise>. The Seven Sons were also mentioned in Angliviél de la Beaumelle et al., “Open Arms,” 21-22; and Wood and Stone, “China’s Military-Civil Fusion Strategy,” 82-83.

¹⁸ NUDT has been on the Entity List since February 2015. The other Chinese university on the Entity List is Xinjiang Police College. We also exclude the Chinese Academies of Sciences and Engineering.

¹⁹ Emily Weinstein and Dahlia Peterson, “Assessing Chinese Reactions to New U.S. Visa Policies on Chinese Students and Researchers” (Center for Security and Emerging Technology, June 2020), <https://cset.georgetown.edu/research/assessing-chinese-reactions-to-new-u-s-visa-policies-on-chinese-students-and-researchers/>.

²⁰ For more details on this data source, see Fedasiuk and Weinstein, “Universities and the Chinese Defense Technology Workforce.”

²¹ The total number includes bachelor's, master's, and Ph.D. graduates.

²² In 2017, the median duration of U.S. doctoral programs was 5.8 years in the life sciences, 5.7 in the physical and earth sciences, 5.7 in mathematics and computer science, and 5.3 years in engineering; see <https://nces.nsf.gov/pubs/nsf19301/assets/data/tables/sed17-sr-tab031.pdf>.

²³ For more background on NSF SED, see <https://www.nsf.gov/statistics/srvydoctorates/>; NSF SED micro-data is not public and was accessed through a CSET license.

²⁴ Ph.D. degrees take a long time to complete; the 2017 graduating cohort that we have NSF data on mainly enrolled between 2010 and 2012. There were 546 Ph.D. students with Seven Sons or Entity List undergraduate degrees in this cohort, but, due to enrollment growth, more recent cohorts from these universities are probably larger. Between 2012 and 2018, the number of Chinese graduate students enrolled at U.S. universities increased from around 50,000 to 76,000, an increase of around 50 percent. If this 50 percent increase also held for Ph.D. students from Seven Sons and Entity List, there would have been around 820 newly enrolled Ph.D. students from these universities in 2018. For the 50 percent growth number and a discussion of the data gaps on Chinese enrollments in the United States, see Jacob Feldgoise and Remco Zwetsloot, "Estimating the Number of Chinese STEM Students in the United States" (Center for Security and Emerging Technology, October 2020), <https://cset.georgetown.edu/research/estimating-the-number-of-chinese-stem-students-in-the-united-states/>.

²⁵ A full translation of the five-year plan is available from CSET at "Translation: The '13th Five-Year' Special Plan for S&T Military-Civil Fusion Development" (Center for Security and Emerging Technology, June 2020), <https://cset.georgetown.edu/research/the-13th-five-year-special-plan-for-st-military-civil-fusion-development/>.

²⁶ "Notice on Issuing the "Administrative Measures for the Establishment of a Military-Civil Fusion Industry Demonstration Base in Hubei Province" [关于印发《湖北省军民融合产业示范基地创建 管理办法》的通知], Office of the Military-Civil Fusion Development Committee of the Hubei Provincial CCP [中共湖北省委军民融合发展委员会办公室], April 15, 2019, <https://archive.vn/NqJ0w>.

²⁷ This definition of "STEM" excludes the social sciences.

²⁸ This assessment is also supported by the seemingly broad nature of the State Department's "Technology Alert List," which is used by consular officers to screen visa applicants. The current TAL is not public, but older versions are available online. The most recent (2002) version lists dozens of fields and technologies, including broad categories such as "biochemistry," "artificial intelligence," "chemical engineering," and "data fusion." Combined, these cover most if not all STEM fields; see U.S. Department of State, "Technology Alert List," August 2002, available at <https://www.bu.edu/isso/files/pdf/tal.pdf>.

²⁹ “International Scholars: Leading Places of Origin,” Institute for International Education Open Doors, <https://opendoorsdata.org/data/international-scholars/leading-places-of-origin/>.

³⁰ IIE does track field of study for international scholars as a whole—around 77 percent of scholars are in STEM fields—but that data is not China-specific; see “International Scholars: Major Field of Specialization,” Institute for International Education Open Doors, <https://opendoorsdata.org/data/international-scholars/major-field-of-specialization/>. It is also not possible to use J visa data to study the number of researchers because the J visa category is used by many professions that do not involve research, such as au pairs. Public J visa data does not disaggregate visa applicants or holders by professional category.

³¹ “Open Doors: 2018,” Institute for International Education, print report, Table 4.1. This data is not broken out by nationality and is thus not China-specific.

³² Christopher A. Ford, the Assistant Secretary of State for International Security and Nonproliferation, wrote in a background paper in a wake of the Presidential Proclamation that the State Department has been looking at the China Scholarship Council “with increased concern in recent years”; see Christopher A. Ford, “Technology Transfers to the PRC Military and U.S. Countermeasures: Responding to Security Threats with New Presidential Proclamation,” *Arms Control and International Security Papers* 1, no. 9 (June 5, 2020), Office of the Under Secretary of State for Arms Control and International Security, <https://www.state.gov/wp-content/uploads/2020/06/T-paper-Visa-Policy-Final-3.pdf>. The U.S.-China Economic and Security Review Commission, in its 2020 annual report, also singled out CSC-like programs for scrutiny in its recommendations on visa policy; see *2020 Annual Report to Congress* (Washington, DC: U.S.-China Economic and Security Review Commission, 2020), 537, <https://www.uscc.gov/annual-report/2020-annual-report-congress>.

³³ Wong and Barnes, “U.S. to Expel Chinese Graduate Students”; Spetalnick and Pamuk, “U.S. Planning to Cancel Visas.” *The New York Times* and Reuters articles did not specify whether the anonymous official sources who told them that 3,000 to 5,000 students would be affected by the Proclamation were referring to an *annual* number or not. Our estimates are consistent with an interpretation of this range as an *annual* impact. Appendix D discusses the possibility that the Proclamation’s *initial* impact is higher than this range.

³⁴ Brunnstrom and Spetalnick, “U.S. Targets Only One Percent.”

³⁵ See, e.g., Gregg Re, “Tom Cotton Suggests Chinese Students Shouldn’t Be Allowed to Study Sciences in the US,” *Fox News*, April 26, 2020, <https://www.foxnews.com/politics/tom-cotton-suggests-chinese-students-shouldnt-be-allowed-to-study-sciences-in-the-us>.

³⁶ Yifan Yu, Cheng Ting-Fang, Lauly Li, and Coco Liu, “Trump and COVID Force Chinese Students to Rethink the US,” *Nikkei Asia*, September 2, 2020,

<https://asia.nikkei.com/Spotlight/The-Big-Story/Trump-and-COVID-force-Chinese-students-to-rethink-the-US>.

³⁷ State Department officials have said they are “unable to say exactly what that number is going to be because we can’t predict how many individuals will actually be applying.” See Office of the Spokesperson, “Briefing on Limiting the CCP’s Ability.”

³⁸ Yojana Sharma, “Chinese Students, Researchers with ‘Military Links’ Barred,” *University World News*, June 3, 2020, <https://www.universityworldnews.com/post.php?story=20200603185019349>.

³⁹ Anja Manuel and Kathleen Hicks, “Can China’s Military Win the Tech War?,” *Foreign Affairs*, July 29, 2020, <https://www.foreignaffairs.com/articles/ united-states/2020-07-29/can-chinas-military-win-tech-war>.

⁴⁰ Remarks by University of Michigan professor Mary Gallagher at a panel by the Penn Project on on the Future of U.S.-China Relations, “New Perspectives on US-China Relations: Research, Education, & Academic Freedom,” October 9, 2020, available at <https://web.sas.upenn.edu/future-of-us-china-relations/panel-discussions/>.

⁴¹ Remco Zwetsloot, “US-China STEM Talent Decoupling: Background, Policy, and Impact” (Johns Hopkins University Applied Physics Lab, October 2020), <https://www.jhuapl.edu/assessing-us-china-technology-connections/publications>. Recent research security cases under the Department of Justice’s China Initiative almost exclusively involve researchers and professors rather than students; see <https://www.justice.gov/opa/information-about-department-justice-s-china-initiative-and-compilation-china-related>.

⁴² Office of the Secretary of Defense, *Military and Security Developments*, 23; Joske, “The China Defence Universities Tracker”; Tiffert, *Global Engagement*, 107.

⁴³ Weinstein and Peterson, “Assessing Chinese Reactions.”

⁴⁴ The China Scholarship Council administers several different scholarship programs, as do other entities. For an overview, see Ryan Fedasiuk, “The China Scholarship Council: An Overview” (Center for Security and Emerging Technology, July 2020), <https://cset.georgetown.edu/research/the-china-scholarship-council-an-overview/>; Anastasya Lloyd-Damjanovic and Alexander Bowe, “Overseas Chinese Students and Scholars in China’s Drive for Innovation (Washington, DC.: U.S.-China Economic and Security Review Commission, October 2020), <https://www.uscc.gov/research/overseas-chinese-students-and-scholars-chinas-drive-innovation>.

⁴⁵ See discussion and sources in Zwetsloot, “US-China STEM Talent Decoupling.”

⁴⁶ Feldgoise and Zwetsloot, “Estimating the Number of Chinese STEM Students.”

⁴⁷ Stone and Wood, "China's Military-Civil Fusion Strategy," 8.

⁴⁸ Office of the Secretary of Defense, *Military and Security Developments*, 18.

⁴⁹ Christopher A. Ford, "The PRC's 'Military-Civil Fusion' Strategy Is a Global Security Threat," U.S. Department of State, March 16, 2020, <https://www.state.gov/the-prcs-military-civil-fusion-strategy-is-a-global-security-threat/>.

⁵⁰ "Emerging Technologies and Military-Civil Fusion," *2019 Annual Report to Congress* (Washington, DC: U.S.-China Security and Economic Review Commission, November 2019), 205, <https://www.uscc.gov/annual-report/2019-annual-report-congress>.

⁵¹ National Security Council, "United States Strategic Approach to the People's Republic of China," White House, May 26, 2020, 7, <https://www.whitehouse.gov/articles/united-states-strategic-approach-to-the-peoples-republic-of-china/>.

⁵² Bureau of Industry and Security, "Entity List FAQs," Department of Commerce, https://www.bis.doc.gov/index.php/2011-09-12-20-18-59/export-and-reexport-faqs/cat/33-entity-list-faqs#faq_148, says: "The Unverified List is a list of parties that have not cooperated with BIS during post-shipment verification checks. The presence of a party on the Unverified List in a transaction is a "red flag" that must be resolved before proceeding with the transaction."

⁵³ Weinstein and Peterson, "Assessing Chinese Reactions."

⁵⁴ This finding is consistent with past research that suggests the United States by and large attracts China's most elite students; see, e.g., Patrick Gaule and Mario Piacentini, "Chinese Graduate Students and U.S. Scientific Productivity," *Review of Economics and Statistics* 95, no. 2 (May 2013), https://doi.org/10.1162/REST_a_00283.

⁵⁵ Office of the Secretary of Defense, *Military and Security Developments*, 23; Joske, "The China Defence Universities Tracker"; Tiffert, *Global Engagement*, 107.

⁵⁶ Most data sources on international and Chinese students in the United States track total enrollments or number of graduates, not the number of new entrants. For a review of data sources, see Feldgoise and Zwetsloot, "Estimating the Number of Chinese Students."

⁵⁷ The Council of Graduate Schools, our source for new enrollments from China, does not publish data on Chinese students' fields of study. This means the STEM-specific number of enrollments has to be estimated. We made these estimates as follows:

- First, as noted in our discussion of Table 4, we know that approximately 85 percent of all Chinese Ph.D. graduates in 2017 were in STEM fields. We assume this ratio also holds for new enrollments. This means we estimate 6,149 new STEM enrollments at the Ph.D. level (85 percent of 7,234 new Ph.D.s).

- Second, we have to estimate the percentage of master's enrollments that are in STEM fields. To do so, we can combine our knowledge about Ph.D. students with the total enrollment numbers from Table 10. Assuming that 85 percent of Ph.D. students are in STEM fields implies that total (STEM plus non-STEM) Ph.D. enrollments in 2018/19 was 41,867. Subtracting this number from total Chinese graduate enrollments (129,440) suggests that total master's enrollments (STEM plus non-STEM) was 87,573 that year. We already knew that STEM-specific master's enrollment was 40,473. Comparing that number to total enrollments (87,573) suggests that 46.2 percent of Chinese master's students enroll in STEM fields. Applying this percentage to the overall new master's enrollment from the Council of Graduate Studies (27,237), we infer that 12,583 new Chinese master's enrolled in STEM degrees in Fall 2019.
- Finally, to estimate the total number of new Chinese STEM graduate enrollments, we simply add the master's and Ph.D. estimates together to arrive at $6,149 + 12,583 = 18,732$.

⁵⁸ Enyu Zhou, Radomir Ray Mitic, Christian P. L. West, and Hironao Okahana, "International Graduate Applications and Enrollment: Fall 2019" (Council of Graduate Schools, February 2020), Table B3, [https://cgsnet.org/sites/default/files/civicrm/persist/contribute/files/CGS Fall 2019 International Report.pdf?v=1](https://cgsnet.org/sites/default/files/civicrm/persist/contribute/files/CGS%20Fall%202019%20International%20Report.pdf?v=1).

⁵⁹ Re, "Tom Cotton Suggests Chinese Students Shouldn't Be Allowed to Study Sciences in the US."