Center for Research Security & Integrity

ARE RESEARCH SECURITY POLICIES IN THE US WORKING?

A Case Study on Research Collaborations with PRC Defense Laboratories and US Federally Sponsored Research

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ABBREVIATIONS

AFOSR	(US) Air Force Office of Scientific Research
AFRL	(US) Air Force Research Laboratory
ARO	(US) Army Research Office
ASPI	Australian Strategic Policy Institute
BICE	Beijing Institute of Control Engineering
BIS	(US) Department of Commerce Bureau of Industry and Security
BIT	Beijing Institute of Technology
CAEP	China Academy of Engineering Physics
CALT	China Academy of Launch Vehicle Technology
CASC	China Aerospace Science and Technology Corporation
CASI	(US Air Force) China Aerospace Studies Institute
CAST	China Academy of Space Technology
CCP	Chinese Communist Party
CETC	China Electronics Technology Group Corporation
CMC	Central Military Commission
CRSI	Center for Research Security & Integrity
CSU	Central South University
DoD	(US) Department of Defense (now the Department of War)
DoE	(US) Department of Energy
DTRA	Defense Threat Reduction Agency
HIT	Harbin Institute of Technology
HPSTAR	Center for High Pressure Science and Technology Advanced Research
IAPCM	Beijing Institute of Applied Physics and Computational Mathematics
NIH	(US) National Institutes of Health
NNSFC	National Natural Science Foundation of China
NRSICC	National Research Security, Integrity, and Compliance Center
NSF	(US) National Science Foundation
NSPM-33	National Security Presidential Memorandum-33
NWPU	Northwestern Polytechnical University
ONR	(US) Office of Naval Research
ORNL	Oak Ridge National Laboratory
PLA	People's Liberation Army
PLAAF	People's Liberation Army Air Force
PRC	People's Republic of China
SASTIND	State Administration of Science and Technology Industry for National Defense
SBIR	Small Business Innovation Research
SECURE	Safeguarding the Entire Community in the US Research Ecosystem
SKLPM	State Key Laboratory of Powder Metallurgy
SKLSP	State Key Laboratory of Solidification Processing
STTR	Small Business Technology Transfer
UNM	University of New Mexico
UTK	University of Tennessee, Knoxville

EXECUTIVE SUMMARY

In January 2021, the first Trump Administration issued National Security Presidential Memorandum-33 (NSPM-33), which established new policies on research security and integrity, largely in response to growing concerns about the malign influence of the People's Republic of China (PRC) over US fundamental research. Implementation of NSPM-33 was further expanded under the Biden Administration and sought to create new policies and processes to strengthen protections of US government-supported R&D against foreign government interference and exploitation.

The House Select Committee on China released several reports starting in 2024 that identified extensive research collaborations and partnerships between US universities and PRC defense-linked research institutions involving research (then) funded by the Departments of Defense and Energy. The reports surveyed PRC entities that are commonly known to conduct defense research or support its military industrial base and argued that the US government has failed to implement meaningful policy changes or mitigation strategies to safeguard critical technology research.

This study takes a similar approach but focuses on a narrower subset of US research collaborations with PRC entities that unambiguously pose critical risks to US national security, based on surveys of scientific literature published from January 2019 through July 2025. Specifically, this study examines the extent to which US institutions have engaged with national-level laboratories the PRC designates as defense laboratories and quantifies the amount of federal research dollars provided to the US entities.

The authors of this study recognize that distinguishing a national defense laboratory in China from other national or provincial laboratories that support defense research may, in practice, be a semantic exercise. There are many other Chinese laboratories that extensively engage in defense research, run classified programs, and/or support or partner with the People's Liberation Army (PLA) and state-owned defense enterprises. The PRC's military-civil fusion policies further blur the lines between defense research organizations and civilian academic institutions, and it is unclear what criteria the PRC uses to officially label an entity a defense laboratory. Exhaustively surveying all of China's defense-supporting research organizations and their international partnerships far exceeds the scope of this study, which is limited to examining identifiable PRC laboratories (usually referred to as "state key laboratories") that the

PRC itself designates as defense key laboratories.

The study identified 45 PRC defense laboratories that have coauthored research with US institutions, including public and private universities *and* federal research facilities like national laboratories run by the Departments of Energy and Defense. The data from the collected corpus of articles show that **at least $943.5 million in federal research funding has been allocated to US research that involved collaborations with PRC defense laboratories since 2019.** This amount understates the total federal dollars involved, as some research grants and facility contracts lacked clarity on actual amounts allocated to the identified research.

Analysis of scientific publications and publicly available information on federal research grants and contracts indicates that PRC defense laboratories partnered on research funded by the US National Science Foundation (NSF), Department of Energy (DoE), Department of Defense (DoD), and the National Institutes of Health (NIH). This should come as no surprise, given that many STEM fields are increasingly dual-use in nature. **Nevertheless, it is quite significant that nearly 72 percent of the federal funding came from the NSF.** While the NSF's research dollars largely focus on early-stage fundamental research, the partnering PRC entities identified in this study have a clear interest in defense (including weapons) applications.

Some of this study's key findings include:

- Nearly 1,800 articles published from January 2019 through July 2025 included US collaborations with PRC defense laboratories. Of these publications, 313 specifically acknowledge US federal funding. Yet these collaborations represent only a small subset of PRC entities that comprise its defense R&D and industrial base.
- About one-third of all articles included US collaborations with just three PRC defense laboratories that focus on materials science disciplines specifically for defense aerospace applications, some of which support hypersonic weapons R&D.
- Several of the PRC laboratories are part of weapons design and production facilities, or partner with state-owned defense conglomerates that develop and produce weapons and their delivery systems.
- Ten DoE national laboratories have had researchers collaborating with PRC defense laboratories.
- Several of the US universities funded by the NSF that make up the Safeguarding the Entire Community in the US Research Ecosystem (SECURE) Center are some of the most prolific producers of research involving collaborations with PRC defense laboratories.
- A sampling of surveyed articles receiving federal funding support involves research on directed energy systems, energetic materials, radar and sensing, AI, flexible electronics, and high-performance computational physics. These are critical technology fields that can fundamentally

change future military and warfighting capabilities, yet PRC defense laboratories are directly benefiting from this research.

Simple due diligence checks on many (but not all) of the PRC laboratories identified in the collected corpus, using basic Internet searches and sources like the Australian Strategic Policy Institute's "Defense Universities Tracker" launched in 2019, would show that these are defense research organizations. This suggests that US institutions have either failed to conduct basic due diligence before engaging with these PRC defense laboratories or have chosen to ignore the risks. However, disparities exist between English- and Chinese-language information on PRC entities; most of the defense laboratories in the dataset remove the terms "defense" or "national defense" from their official English titles, which can complicate due diligence and risk assessment efforts. This study provides detailed profiles of four of the PRC defense laboratories that collaborate the most with US institutions and includes an appendix with basic information on all 45 defense laboratories, including all known Chinese- and English-language name variants and their parent organizations.

The coauthors of this study recognize the limitations of focusing on published literature. Statistics on coauthorships are snapshots in time and provide little insight into the nature of the research engagements or partnerships. There is a lack of information on whether such collaborations were part of formal cooperative agreements or to what extent the PRC provided financial or personnel resources to the US collaborating institution (partly due to US academia's lack of transparency). Additionally, research-to-publication timelines vary significantly and may represent research activities and collaborations that took place several years ago.

To address some of these limitations, this study presents case studies on some collaborations involving specific US institutions, their PRC partners, the research disciplines, and the federal funding amounts and objectives. While the focus is only on collaborations reflected in the literature from January 2019 through July 2025, we found examples of a history of substantial, *ongoing* partnerships with PRC defense laboratories. Given that some federal grants identified in our dataset remain active, i.e., their performance periods have not yet expired as of the date of publication of this study, it is probable that further collaborations have continued but are not yet reflected in published research.

US institutions and federal research facilities' critical-risk collaborations with entities supporting China's defense R&D are significant and continue unabated. *This raises a fundamental question: if collaborating with PRC defense laboratories is not considered an unacceptable risk that should be restricted, then what is?* **Federal funding agencies and academia have failed to meaningfully safeguard the security and integrity of US research** that NSPM-33 has sought to achieve. Consequently, this study recommends:

1. Congress should pass the Securing American Funding and Expertise from Adversarial Research Exploitation Act of 2025 (SAFE Research Act).

The SAFE Research Act would close yawning loopholes that allow largely unrestricted collaborations with PRC entities, even defense research laboratories surveyed in this study. The legislation would prohibit STEM research funding for individuals and institutions that collaborate with *specific* foreign adversary-controlled entities that pose a national security risk. Additionally, the US government should add all the PRC laboratories identified in this study to relevant restricted entities lists.

2. The US government should create a new, centralized federal research security and integrity center.

Policymakers should support the establishment of a new government entity, notionally referred to as the National Research Security, Integrity, and Compliance Center (NRSICC), that consolidates all US government efforts on research security and integrity policy development, vetting, due diligence, and grant and contract compliance monitoring and enforcement. For instance, all applications and related documents pertaining to fundamental research grants, cooperative agreements, and contracts awarded by federal agencies should be housed at the NRSICC. All due diligence would be conducted by this single federal entity with a unified risk assessment standard and mitigation framework, rather than the current piecemeal approach where each agency conducts its own risk assessments (if at all), with differing methodologies, standards, and data sources.

The NRSICC should also coordinate and implement all federal policy changes to be implemented by funding agencies; develop and deploy training programs to build expertise among data analysts and risk assessors in both government and academia; and provide due diligence and risk assessment support to research institutions receiving federal research funding.

3. The US government and allied nations should incentivize new approaches to safeguarding research and innovation.

Safeguarding research and innovation and upholding (and enforcing) common standards of transparency, integrity, reciprocity, and ethics are too large and complex for a single organization, or even a single nation, to undertake. Governments of liberal democracies should support the creation of consortia of public and private organizations that combine their respective capabilities to address knowledge gaps that hamper research security efforts and increase scholarship on issues beyond national security, including integrity, economic competitiveness, and a broader understanding of how knowledge is transferred, diverted, and applied by nation-state actors like China that undermine national interests. This should be followed by coordinated efforts to create policies that impose real consequences for institutions and individuals that violate norms of integrity, trust, and transparency.

1. Rethinking US Research Security Policies

A. Introduction

Governments and research institutions around the world face increasing risks when partnering with China on scientific and engineering research, especially in areas deemed critical to the national and economic security of their respective countries. China's research ecosystem is vast and complex, and designing strategies and policies that navigate these risks while maximizing opportunities represents significant challenges for both individual institutions and governments. There is a lack of consensus, even among close US allies, on determining risk levels and whether certain engagements, exchanges, or partnerships with People's Republic of China (PRC) entities should be restricted or, at a minimum, not supported by taxpayers. The nature of our scientific ecosystem, which has been largely free and open by design, slows attempts to significantly change research security policies and practices.

Today, the US and many of its key allies have failed to adapt to a contradictory reality: one of the most significant contributors to and participants in the global scientific enterprise is also our greatest adversary and strategic rival; one of the world's largest and technologically advanced economies is also one of the most oppressive authoritarian regimes in history, with a primary objective of dominating and displacing the US technologically and militarily to reshape the world order and to preserve Chinese Communist Party (CCP) interests.

The House Select Committee on China released reports starting in 2024 that identified extensive research collaborations and partnerships between US universities and PRC defense-linked research institutions. These studies focused primarily on recent collaborations involving recipients of US Department of Defense (DoD)[a] and Department of Energy (DoE) funding, and how the PRC partners are exploiting the research in critical technology areas that advance China's military modernization. The reports showed that much of the research that is published, though considered fundamental, is intended for specific military applications – such as quantum sensing, nuclear science, explosion science, hypersonics, and directed energy weapons – or involves dual-use fields like nuclear and high-energy physics, semiconductors, and AI and autonomy. The reports focused on recent US–China research collaborations, examining articles published between June

[a] We use Department of Defense or DoD throughout this study as all compiled information (e.g., scientific publication bibliographic data and research grant data) uses DoD and was collected prior to the name change to the Department of War under the second Trump Administration.

2023 and June 2025. The reports found that over 50 percent of surveyed publications crediting DoD or DoE funding were conducted in partnership with entities affiliated with China's defense research and industrial base. The reports argued that the DoD and DoE have failed to implement any meaningful policy changes or mitigation strategies to safeguard critical technology research.[1]

Creating clear research security policies and procedures by the federal government or at individual research institutions remains a challenge when it comes to identifying and mitigating risks associated with research engagements with PRC entities. Indeed, there are thousands of PRC research institutions, and many are engaged in critical, cutting-edge science and technology R&D. China's military-civil fusion policies and programs seek to integrate defense and commercial endeavors on a national scale, which drawn to its logical conclusion would suggest that any PRC institution engaged in scientific and engineering research may be supporting its military. However, the reality is naturally more complex, as research institutions' capabilities and mandates to support PRC defense programs vary widely.

B. Purpose and Content of This Study

Assessing risks associated with every PRC entity that supports its vast defense R&D ecosystem is a daunting task. Nevertheless, it appears that US research institutions have been unable or unwilling (or perhaps both) to address this problem. In preparing congressional testimony, this study's primary author collated data on articles published January 2019 through January 2025 and found that US institutions coauthored approximately 27,000 articles with PRC institutions affiliated with the military or supporting defense research.[2] He exhorted allied nations to, first and foremost, draw clear redlines where partnerships and exchanges with specific PRC entities should be proscribed by default; namely, PRC research institutions or subdivisions that are directly part of the military, subordinate to defense state-owned enterprises, or officially designated as national defense organizations.[3] These entities pose a high risk to national security, and any sharing of resources, knowledge, or other formal or informal partnerships directly undermines our national interests.

The sheer size of that collected data makes in-depth analysis of these collaborations, such as the specific PRC entities and research disciplines involved, extremely difficult. **This study takes a narrower approach by focusing on US collaborations with a subset of PRC entities tied to its defense R&D ecosystem: national-level laboratories (often referred to as "state key laboratories") that the PRC government officially designates as national defense laboratories.** They serve the development needs of the People's Liberation Army (PLA) and defense industries, which in turn are designed to counter US military superiority and repel or deter US efforts to deny or degrade PRC military actions in the Asia-Pacific theater or other regions of strategic interest to China.

This study proceeds on the premise that collaboration with such entities poses some of the most critical risks to US national security, regardless of whether the research is considered fundamental or intended for civilian purposes. **The study examines the extent to which US institutions have engaged with these PRC defense laboratories over the last five-plus years and quantifies the amount of federal research dollars provided to the US entities.** This includes funding from the National Science Foundation (NSF), DoE, DoD, and the National Institutes of Health (NIH). Through analysis of bibliographic metadata and supplemental due diligence research, this study offers:

- Key statistics on collaborations and the US and PRC entities involved
- Basic profiles (missions, research areas, oversight bodies) of four PRC defense laboratories that have the most extensive collaborations with US institutions
- Analyses of federal funding sources acknowledged in the publications, including aggregation of total dollar amounts awarded by agency, award topics, recipient institutions, etc.
- Case studies and examples of noteworthy collaborations or partnerships between specific US entities and PRC defense labs
- Recommendations for federal agencies, Congress, and the research community
- A list of all PRC defense laboratories identified, their English- and Chinese-language name variants, and their parent organizations (in Appendix A)
- Statistics on other nations' collaborations with the identified PRC defense laboratories (in Appendix B)
- Detailed discussion of the study's research methodologies (in Appendix C).

Scope and Limitations

There remains a fair amount of opacity regarding China's defense research ecosystem, given its sensitive nature. However, the US Air Force's China Aerospace Studies Institute (CASI) and Georgetown University's Center for Security & Emerging Technology have both produced useful guides on China's state key laboratory system.[4] As such, we limit our discussion to describing the four types of national-level laboratories that the Center for Research Security & Integrity (CRSI) has assessed as being designated by the PRC government as defense laboratories. These include:

a) **Defense Science & Technology Key Laboratories [国防科技重点实验室]:** These laboratories were established by the State Administration for Science & Technology Industry for National Defense (SASTIND) and the PLA organ now named the Equipment Development Department of the Central Military Commission. SASTIND is responsible for much of

China's defense R&D outside the PLA, especially within civilian institutions as part of China's military-civil fusion efforts.

b) **Defense Core Discipline Laboratories [国防重点学科实验室]:** These laboratories are mostly housed within the "Seven Sons of National Defense" universities, focusing on specific defense technology disciplines. The CASI study suggests (but cannot confirm) that these labs may rank lower administratively than state key laboratories; however, we argue that they function similarly in mission and scope to state key laboratories and thus warrant inclusion. Regardless, the PRC government clearly designates them as defense laboratories.

c) **Ministry of Education "Type B" Key Laboratories:** these key laboratories are the only ones not supervised by a PRC military-affiliated organ. Although run by the Ministry of Education (MoE), these key laboratories are certified as principally engaged in national defense research to address the nation's defense science and technology development needs, including military weapons and equipment.[5]

d) **State Key Laboratories whose official titles omit the term for "national defense" [国防] but are nonetheless supervised by SASTIND:** These laboratories must be considered defense laboratories as their primary mission is to build R&D programs that support China's defense industry. They likely have similar functions and missions to "defense core discipline" laboratories.

SASTIND's implementation of military-civil fusion policies fundamentally centers around combining civilian R&D and resources with military ones in both directions; military technologies can help develop commercial sectors, and vice versa.[b] Many of the defense laboratories identified in this study conduct research in civilian fields. Nevertheless, as designated defense laboratories, developing military applications is a primary objective. This means that US collaborators must assume that these PRC laboratories are mandated to develop potential military applications to all research they conduct, even in seemingly innocuous fields like environmental sciences and renewable energy, where some US partners appear to be involved.

Differentiating between an officially designated national defense laboratory in China and other national or provincial laboratories that support defense research is arguably, in practical extensively engage in defense research, run classified programs, and/or support or partner with the PLA and defense state-owned enterprises. It is unclear why many of these other laboratories lack an official defense designation.

[b] SASTIND also co-administers at least 58 civilian universities in the PRC that prioritize the integration of civilian and defense research.

According to the CASI study, China has initiated a reorganization of its national-level laboratory system, in which both civilian state key laboratories and defense key laboratories will become part of a new national key laboratory structure that will further blur their civilian and military functions and obfuscate military-affiliated or defense laboratories. That remains to be seen, and, for simplicity, **this study covers only officially designated defense laboratories that collaborate with the US. However, it is important to recognize that the risks of engaging or collaborating with other key laboratories excluded from this study can be as high as those of the entities covered in this study.**

Research Methodology

The authors of this study compiled a list of over 200 PRC state key laboratories known or suspected of being a defense laboratory from various sources and collated all observed English- and Chinese-language name variants for these laboratories. That list formed the basis for running queries in the publication database *Dimensions* in order to aggregate bibliographic metadata on scientific and engineering articles published between January 2019 and July 2025, and to focus on the most recent publications. Data were extracted from publications that listed at least one coauthor affiliated with a US-based institution and one coauthor from one of the PRC defense key laboratories, which resulted in approximately 2,000 records.[c]

Supplemental due diligence was conducted on each of the PRC defense-affiliated laboratories appearing in the dataset to independently verify that each laboratory is officially designated as a national-level defense laboratory (i.e., one of the four types of defense laboratories discussed above).[d]

The bibliographic metadata was analyzed to identify publications that acknowledge US government funding. The final result is a subset of data containing 45 PRC defense laboratories (out of the 200 candidate laboratories) that collaborated with the US and acknowledged US federal funding. A list of these 45 laboratories, their Chinese- and English-language name variants, their parent organizations, and the information sources indicating their defense designations is provided in Appendix A.

Bibliometric analyses were performed to compile statistics on US coauthoring organizations and the PRC defense laboratories. Bibliographic data on publications are admittedly a crude measure, as they provide little insight into the nature of the collaborations taking place, which may

[c] Excluded from the corpus of publication metadata are articles involving more than 15 coauthors. In those cases, it is assumed that the large number of contributing authors makes it unlikely that U.S partnering institutions had any meaningful exchange or collaboration with individual authors at the PRC defense laboratories.

[d] In some cases, the authors of this study were unable to find any Chinese source indicating that a laboratory was officially designated as a defense laboratory, despite its involvement in defense research. An example of one such laboratory is discussed in Appendix C.

be informal. As such, supplemental research was conducted on some articles to create case studies on specific collaborations.

Additionally, grant or contract codes for US federal funding sources listed in the acknowledgments fields of the article metadata were cross-referenced with data on usaspending.gov to identify additional information, such as dollar amounts obligated, periods of performance, project descriptions, and recipient institution(s).

A more detailed discussion of the methodologies, processes, and challenges associated with the data collection and analysis conducted for this study is provided in Appendix C.

Limitations and Caveats

The fundamental research underlying the literature in our collected corpus of bibliographic metadata covers a range of theoretical and applied disciplines. This study does not assess specific advances, technology readiness levels, or related technical analyses. However, some articles are highlighted to illustrate military applications that the research supports, and the serious risks to national security posed by such collaborations.

Additionally, the dollar figures aggregated and discussed in this study do not provide a complete accounting of all US federal funding involved in the identified collaborations. *This study understates the amount of federal funding involved in high-risk collaborations* due to limits on publicly available grant or contract information. Financial data used in this study depended on a) publication coauthors fully disclosing details on all research grants or contracts involved and b) the accuracy of financial reporting on the usaspending.gov website. For instance:

- Some articles do not acknowledge funding sources but may still include US government sources; others credit US funding but do not specify the grant number or code. Several grants lacked information from publicly available sources.
- These figures are estimates and may understate actual amounts obligated and disbursed due to discrepancies in financial reporting timelines by grantee institutions and the federal funding agencies, and the administration of the usaspending.gov website that aggregates grant and contract information.

A second, more critical factor relates to scoping limitations. **This study focuses on a small subset of PRC national-level laboratories designated as defense laboratories that have collaborated with US institutions receiving federal funding.** The PRC operates hundreds of other laboratories in China – including state key laboratories, state-owned enterprise-run laboratories, Chinese Academy of Sciences key laboratories, and provincial-level key laboratories – that *also* conduct defense research to varying degrees. Identifying every laboratory to assess their level of support to China's military or defense industry far exceeds the scope of this study. The aforementioned House Select Committee on China reports and testimony by this study's primary coauthor show that US research institutions collaborate extensively with some of these other known PRC entities.

Thus, policymakers should not conclude that the figures presented here accurately reflect the total amount of government outlays to US institutions collaborating with PRC defense research institutions.

Finally, the authors of this study make no claims that any of the named US entities engaged in any illegal activity. While further inquiry is warranted on some of these collaborations, those efforts should focus on assessing damage to national security and/or federal grant or contract compliance concerns, not criminal investigations.

C. Key Findings

All collated data used in this study were derived from US collaborations with 45 identified PRC defense key laboratories. The full dataset includes all publications involving any US coauthorship with these 45 PRC laboratories; the smaller dataset, which served as the basis for the case studies and federal grants analysis discussed in this study (see Table 1), focused on a subset of publications explicitly acknowledging DoD, DoE, NSF, or NIH funding. It is possible, but cannot be verified, that there are additional articles that involved research supported by federal agencies but were not acknowledged in the individual articles. Additionally, information on 10 grants credited in publications was not available at the time of drafting this study; thus, those dollar amounts were excluded from the totals listed in Table 2.

Table 1: Datasets Analyzed – Articles Published January 2019–July 2025

Total number of publications involving US and PRC defense key laboratory coauthorship (referred to as the full corpus in this study)	1,793
Total number of publications crediting US federal funding	313
Total number of PRC defense key laboratories with US coauthorship	45

Table 2: US Funding Sources Acknowledged in Articles Published January 2019–July 2025

US Funding Agency	Total Research Funding Amounts on Grants Acknowledged in Publications
National Science Foundation	$676,529,622
Department of Defense	$95,765,331
Department of Energy	$88,343,054
National Institutes of Health	$82,861,698
Total federal research funding (excludes facility contracts)	**$943,499,705**

Data from the collected corpus of articles show that *at least* $943.5 million in federal research funding has been allocated to US researchers and institutions collaborating with PRC defense laboratories since 2019. This number excludes contracts (especially from the DoE) to operate facilities like national laboratories and an Air Force fellowship program that are also credited in publications. The articles that simply credit a DoE laboratory facility contract do not provide insights into the specific scale, intent, and oversight of research support. PRC defense laboratories have partnered on research funded by the NSF, DoE, and NIH, not just the DoD. This is unsurprising, given that many STEM fields are increasingly dual use**. Nevertheless, it is quite significant that nearly 72 percent of federal funding sources came from the NSF.** While much of the NSF's research funding is allocated toward theoretical and early-stage fundamental research, the partnering PRC entities identified in this study have a clear interest in defense (including weapons) applications.

Table 3: Top 15 US Institutions Coauthoring Highest Number of Articles with PRC Defense Laboratories That Acknowledge Federal Funding

US Organization	Number of Articles
University of Tennessee, Knoxville	56
Princeton University	21
Argonne National Laboratory	19
Pennsylvania State University	14
Lawrence Berkeley National Laboratory	13
University of Colorado, Boulder	12

Georgia Institute of Technology	9
University of California, Berkeley	9
University of Pennsylvania	9
Ames Laboratory	8
Brookhaven National Laboratory	8
Texas A&M University	8
University of Rochester	8
Iowa State University	7
North Carolina State University	7

Table 4: Top 15 Universities Coauthoring Highest Number of Articles with PRC Defense Laboratories (Full Corpus)

US Organization	Number of Articles
University of Tennessee, Knoxville	88
University of Delaware	74
Pennsylvania State University	69
Georgia Institute of Technology	62
Princeton University	57
Texas A&M University	49
University of Houston	42
University of California, Berkeley	41
Massachusetts Institute of Technology	39
Dartmouth College	38
University of Michigan	37
North Carolina State University	29
University of Texas at San Antonio	29
Northeastern University	28
Northwestern University	28

Tables 3 and 4 show that some US universities have extensive research collaborations with the identified PRC defense laboratories. However, we lack any insight into whether such collaborations

were part of formal cooperative agreements or whether the PRC provided financial or personnel resources to the collaborating US institution.

Given the extensive efforts by federal agencies to raise awareness on the national and economic security risks to research posed by adversarial nations like China starting around 2019, combined with mandated research security training for academia and the creation of research security offices at many universities, we expected to see a decline in the number of published collaborations with PRC defense laboratories in 2024–2025. That does not appear to be the case. Only a modest reduction in the number of coauthored publications is observed for articles published in 2024, the most recent full-year data that were available at the time of this study's drafting. Additionally, the number of articles published in 2025 (as of July) is on pace to be comparable to 2024 levels.

Federal research facilities have also collaborated with PRC defense laboratories. Researchers affiliated with 10 of DoE's national laboratories have collaborated with PRC defense laboratories. In particular, the Argonne, Lawrence Berkeley, Brookhaven, SLAC National Accelerator, and Oak Ridge National Laboratories each have affiliated researchers who have published 10 or more articles with PRC defense labs since 2019. Additionally, researchers from the US Naval Research Laboratory, the Army Research Laboratory, and the National Institute of Standards and Technology have also coauthored several publications with PRC defense laboratories.

Only two of the 45 laboratories surveyed in this study use the term "defense" or "national defense" in any of the English-language name variants observed: The PLA Air Force Engineering University's Key Laboratory for National Defense Science and Technology on Plasma Dynamics and Harbin Institute of Technology's National Key Laboratory of Science and Technology for National Defense on Advanced Composites in Special Environments. The majority are referred to as "national" or "state key" laboratories. This obfuscation is deliberate to avoid international scrutiny and friction regarding these entities' collaborations with US and other foreign partners. Sources like the Defense Universities Tracker by the Australian Strategic Policy Institute (ASPI)[6] and a study by CASI[7] have provided information on many (but not all) of these laboratories and provided evidence of their national defense designations. However, the ASPI and CASI studies did not become available until 2019 and 2022, respectively.

Nevertheless, basic due diligence by US academic institutions and their federal sponsors should, at a minimum, have raised concerns. DoE- and DoD-run laboratories, in particular, have more robust research security and counterintelligence functions and resources than academic institutions, making these findings troubling.

The PRC defense labs that have collaborated the most with US institutions are shown in Table 5. **US collaborations with just these four PRC laboratories make up nearly 37 percent of the full corpus.** These PRC laboratories and their US partnerships are profiled in Section III of this study.

Table 5: PRC Defense Laboratories Collaborating the Most with the US

English Name of PRC Defense Laboratory	Parent Institution	Number of Articles Crediting US Federal Funding	Number of Articles (Full Corpus)
State Key Laboratory of Powder Metallurgy	Central South University	80	285
State Key Laboratory of Solidification Processing	Northwestern Polytechnical University	49	213
State Key Laboratory of Advanced Welding and Joining	Harbin Institute of Technology	25	102
National Key Laboratory of Computational Physics (a.k.a. Laboratory of Computational Physics)	Institute of Applied Physics and Computational Mathematics (China Academy of Engineering Physics)	22	62

The first three laboratories listed in Table 5 are principally engaged in material science research specifically intended for military applications, especially defense aerospace and hypersonic weapons. Indeed, the welding laboratory at the Harbin Institute of Technology is jointly operated by China's primary missile design and production facility, known as the China Academy of Launch Vehicle Technology. The National Key Laboratory of Computational Physics is housed within the 9th Institute of China's nuclear and advanced weapons research and production complex. This entity, officially known as the Institute of Applied Physics and Computational Mathematics, conducts nuclear weapons modeling and simulation as one of its core competencies.

The University of Tennessee, Knoxville has been the most prolific in terms of published research with PRC defense laboratories. The majority of these collaborations were between a senior faculty member at the University of Tennessee, who has led numerous NSF- and DoD-funded research programs for at least two decades, and a research group at Central South University's State Key Laboratory of Powder Metallurgy. These collaborations appear to have originated before 2010. This demonstrates that a few key personnel at US universities can play an outsized role in terms of the scope and quality of high-risk partnerships with PRC entities.

The PRC has obfuscated the Stake Key Laboratory of Powder Metallurgy's defense laboratory designation; no (current) authoritative sources explicitly link "national defense" terminology to this laboratory. Nevertheless, due diligence on the laboratory (profiled in Section III of this study)

reveals its core mission of supporting the PLA, particularly in defense aerospace research. Many of the coauthors at Central South University who frequently collaborate with the University of Tennessee are part of a research team associated with the powder metallurgy laboratory and have led PRC defense research programs, some of which are classified.

Other articles surveyed in the collected corpus that acknowledge funding from the US Navy, Air Force, NSF, and DoE involve research on directed-energy systems, energetic materials, radar and sensing, AI, flexible electronics, and high-performance computational physics. While some articles, especially those that credit DoD funding, are clearly intended for defense and weapons development, other articles supported by NSF and DoE focus on civilian technologies, such as automotive radars. Nevertheless, the PRC collaborators are clearly pursuing military applications of the same research, including radar deception-jamming techniques.

US universities funded by the NSF (via a cooperative agreement) to build the Safeguarding the Entire Community in the US Research Ecosystem (SECURE) Center and its corresponding analytics program[c] – which are tasked with leading national efforts in research security policies, programs, and risk management – have extensive engagements with PRC defense laboratories. Six out of the 11 US universities that are part of the NSF-funded SECURE Center have researchers who coauthored at least 10 publications with PRC defense laboratories. Among them, Texas A&M University researchers have published the most: 49 articles since 2019.

The NSF is simultaneously the largest federal funder of US research involving PRC defense laboratories, the lead agency for national research security capacity building through the SECURE Center, and the sponsor of institutions leading the SECURE Center that are among the most prolific collaborators with these entities. This convergence points to a systemic failure of the NSF's risk governance model, not incidental exposure.

We conclude that neither academia nor federal agencies have effective policies to safeguard research from China's exploitation or restrict collaborations with even the most critical risk entities in China. It also shows that the DoD, DoE, NSF, and, to a lesser extent, the NIH, lack meaningful research security policies and are either unaware of or ignore the activities and partnerships of grantee institutions.

[c] The NSF's Safeguarding the Entire Community in the US Research Ecosystem (SECURE) Center is a "non-government, independent entity formed to address foreign government interference, support security-informed decision-making, and serve as a conduit that connects research community stakeholders with one another and with US government (USG) agencies via NSF" (www.secure-center.org).

2. Key Statistics and Data Analysis

This section presents key statistics derived from bibliographic metadata obtained from *Dimensions* and federal funding information available on usaspending.gov. Tables 6–8 focus on the subset of articles that acknowledged receiving US funding support; the latter tables examine the full corpus of publication data on all US research collaborations with the identified PRC defense laboratories.

Table 6 lists each US institution that has affiliated researchers who collaborated with at least one of the 45 PRC defense key laboratories *and* acknowledged US federal funding support. The articles were published from January 2019 through July 2025. Note that the totals in this table exceed the number of unique articles (313), as some articles name coauthors affiliated with more than one US institution.

Table 6: List of US Entities Coauthoring Publications with PRC Defense Laboratories Crediting US Federal Funding

US Organization	Number of Articles	US Organization	Number of Articles
University of Tennessee, Knoxville	56	General Motors Global R&D Center	2
Princeton University	21	National Institute of Standards and Technology	2
Argonne National Laboratory	19	Northeastern University	2
Pennsylvania State University	14	Oregon State University	2
Lawrence Berkeley National Laboratory	13	Purdue University	2
University of Colorado, Boulder	12	SLAC National Accelerator Laboratory	2
Georgia Institute of Technology	9	State University of New York at Stony Brook	2
University of California, Berkeley	9	State University of New York at Buffalo	2
University of Pennsylvania	9	University of Alabama	2
Ames Laboratory	8	University of California, Riverside	2
Brookhaven National Laboratory	8	University of California, Santa Barbara	2

Texas A&M University	8	University of Delaware	2
University of Rochester	8	University of Texas at San Antonio	2
Iowa State University	7	University of Utah	2
North Carolina State University	7	Boise State University	1
Brown University	6	Bruker Nano	1
Johns Hopkins University (1 from Applied Physics Laboratory)	6	California State University, Fresno	1
Oak Ridge National Laboratory	6	California State University, Los Angeles	1
University of Houston	6	Carnegie Mellon University	1
University of South Carolina	6	Carnegie Science	1
Wayne State University	6	City University of New York	1
Massachusetts Institute of Technology	5	CSTI Associates, LLC	1
Rice University	5	CUNY, Staten Island	1
Stanford University	5	Doane University	1
University of Colorado, Denver	5	Florida State University	1
University of Idaho	5	George Mason University	1
University of Michigan	5	Hope College	1
University of Nebraska, Lincoln	5	Innovative Scientific Solutions, Inc.	1
University of Wisconsin, Madison	5	Lawrence Livermore National Laboratory	1
Dartmouth College	4	Louisiana State University	1
Harvard University	4	Marquette University	1
National Renewable Energy Laboratory	4	Michigan State University	1
Naval Research Laboratory	4	Missouri University of Science and Technology	1
Northwestern University	4	National Institute of Biomedical Imaging and Bioengineering	1

Rensselaer Polytechnic Institute	4	NCO Technologies	1
Rutgers University	4	Northern Illinois University	1
University of California, Los Angeles	4	NSF Science and Technology Center for Engineering Mechanobiology at Washington University at St. Louis	1
University of California, Santa Cruz	4	Stevens Institute of Technology	1
University of Texas, Austin	4	St. John's University	1
Arizona State University	3	Syracuse University	1
Army Research Laboratory	3	University of California, Irvine	1
California Institute of Technology	3	University of California, Merced	1
Case Western Reserve University	3	University of California, San Diego	1
Los Alamos National Laboratory	3	University of Central Florida	1
Ohio State University	3	University of Chicago	1
Pacific Northwest National Laboratory	3	University of Denver	1
Temple University	3	University of Maine	1
University of Arkansas	3	University of Massachusetts Amherst	1
University of California, Davis	3	University of Minnesota	1
University of Connecticut	3	University of Missouri	1
University of Florida	3	University of Nevada, Las Vegas	1
University of Illinois, Urbana-Champaign	3	University of New Mexico	1
University of North Texas	3	University of Texas, Arlington	1
University of Washington	3	Vanderbilt University	1
Boston University	2	Worcester Polytechnic Institute	1
Colorado School of Mines	2	Yale University	1

Federal Funding

Table 7 aggregates the total dollars awarded by each funding agency acknowledged. Most articles that credited US funding provided grant or contract codes. Those codes were searched in usaspending.gov to retrieve dollar amounts, periods of performance, and other pertinent information. Note that the totals in this table exceed the 313 unique articles because some articles acknowledged more than one federal funding source.

Table 7: US Funding Sources Acknowledged in Publications

US Funding Agency	Number of Articles	Total Funding Amounts
National Science Foundation	172	**$676,529,622**
Department of Energy (research grants)	126	**$88,343,054**
Department of Energy (facility contracts)		$246,931,612,523
National Institutes of Health	11	**$82,861,698**
Navy	19	$12,128,569
Army	48	$11,690,898
Air Force[f]	22	$62,058,347
Defense Threat Reduction Agency	5	$9,887,517
Department of Defense (totals)	87	**$95,765,331**
Total US government research funding (excluding DoE facility contracts)		**$943,499,705**

- The NSF is by far the largest funder of research to US institutions collaborating with PRC defense laboratories, accounting for over 71 percent of the identified federal funding. Many of the NSF grants are part of large, multi-year awards structured as virtual centers or national research ecosystems comprising consortia of universities, laboratories, and industry partners. Examples include NSF Science and Technology Centers, Materials Research Science and Engineering Centers, Engineering Research Centers, National Nanotechnology Coordinated

[f] One article credited the Air Force Science & Technology Fellowship Program, but the grant number corresponds to the entire five-year program totaling $69.8 million in obligations and was thus excluded in our totals.

Infrastructure hubs, and national cyberinfrastructure platforms such as ACCESS.[8] The ACCESS program states, "The national research cyberinfrastructure ecosystem is essential to computational- and data-intensive research and plays a critical role in ensuring US leadership, economic competitiveness and national security."[9] These awards are designed to create shared national research infrastructure, train the next generation of scientists and engineers, accelerate technology transition and commercialization, and foster collaborative scientific ecosystems for economic competitiveness and national security.

- There were 33 DoE research grants totaling $88,343,054. The remaining funding acknowledged in the publications refers to 14 DoE contracts to operate facilities, including some of the national laboratories. Research grants were separated from the facility contracts for that purpose, as including the total $247 billion in DoE awards would be misleading. Public information on eight grants was missing; thus, the aggregate dollar figures in this study *understate* actual amounts awarded by DoE.

- Some of the DoD funding was also excluded from the calculations. Information was missing for three awards. One appears to be a project of the Army Research Laboratory. The Air Force Science & Technology Fellowship Program was also excluded from the total dollar amounts, as only one article cites the entire $69 million program rather than the portion allocated to the researcher(s) who coauthored it. That program is a national fellowship initiative that offers postdoctoral and senior-level scientists and engineers the opportunity to conduct independent research alongside Air Force researchers at Air Force research institutions such as the Air Force Research Laboratory (AFRL).[10]

- The Air Force funding included in the calculations is associated with the Air Force Defense Research Sciences Program, a basic research funding effort managed by the Air Force Office of Scientific Research (AFOSR). AFOSR solicits unclassified proposals in a wide range of scientific and engineering disciplines that are foundational to future Air Force and US Space Force capabilities. The goals include maintaining technological superiority in areas relevant to national defense, preventing technological surprise from adversaries, and complementing the broader national research effort by supporting fundamental inquiry at universities, industry laboratories, and research organizations. Awards under this program lay the groundwork for transformational technologies – from novel materials and quantum systems to advanced computation and sensing – that can later transition into defense applications, train and retain scientific talent, and sustain US leadership in critical technology domains.[11]

Statistics From the Full Corpus of Articles

All research collaborations with PRC defense laboratories by US institutions are very troubling, even if they did not involve (or acknowledge) federal funding. As such, this study also compiled data and information on the full corpus of 1,793 articles involving US–PRC coauthorship. Tables 8 and 9 are derived from the full corpus.

Table 8: US Organizations Coauthoring 10 or More Articles with PRC Defense Laboratories (Full Corpus)

US Organization	Number of Articles
University of Tennessee, Knoxville	88
University of Delaware	74
Pennsylvania State University	69
Georgia Institute of Technology	62
Princeton University	57
Texas A&M University*	49
University of Houston	42
University of California, Berkeley	41
Massachusetts Institute of Technology	39
Dartmouth College	38
University of Michigan*	37
North Carolina State University	29
University of Texas at San Antonio	29
Northeastern University*	28
Northwestern University	28
Argonne National Laboratory	27
Stevens Institute of Technology	27
Purdue University	26
Brown University	25
Lawrence Berkeley National Laboratory	25
University of Nebraska	23
University of Wisconsin	23
University of Connecticut	22
University of Texas at Austin	22

Ohio State University	21
Syracuse University	21
University of California, Davis	21
Johns Hopkins University	20
University of California, Los Angeles	19
Iowa State University	18
State University of New York at Buffalo	18
University of Colorado, Boulder	18
University of Utah	18
University of Rochester	17
Brookhaven National Laboratory	16
Harvard University	16
Rice University	16
Stanford University* (including SLAC National Accelerator Laboratory)	16
University of North Texas	16
University of California, San Diego	15
Oak Ridge National Laboratory	13
Rutgers, The State University of New Jersey	13
University of Colorado, Denver	13
University of Illinois, Urbana-Champaign	13
University of Maryland	13
University of Kentucky	12
University of Washington*	12
Arizona State University	11
Case Western Reserve University	11
University of California, Irvine	11
University of Missouri*	11
University of Alabama	10
University of South Carolina	10

All of the entities listed in Table 8 reveal a troubling pattern of substantial research partnerships with PRC defense laboratories, many of which are likely informal.[g] Note that the universities marked with an asterisk (*) have contracts with the NSF to operate the SECURE Center and its corresponding analytics program to enhance research security across the US. Additionally, Table 9 lists all federally sponsored or operated research facilities that have had researchers collaborate with PRC defense laboratories.

Table 9: US Government-Sponsored Facilities' Collaborations with PRC Defense Laboratories (Full Corpus)

US Government-Sponsored Facilities	Number of Articles
Argonne National Laboratory	27
Lawrence Berkeley National Laboratory	25
Brookhaven National Laboratory	16
Oak Ridge National Laboratory	13
Ames Laboratory	8
Los Alamos National Laboratory	7
National Institute of Standards and Technology	5
National Renewable Energy Laboratory	4
Pacific Northwest National Laboratory	4
US Naval Research Laboratory	3
Army Research Laboratory	2
Johns Hopkins University Applied Physics Laboratory	2
SLAC National Accelerator Laboratory	2
Lawrence Livermore National Laboratory	1

Many personnel at these facilities require maintaining a security clearance. Some personnel, especially at the Army and Navy laboratories, are US government employees. Presumably, these laboratories have more resources than most academic institutions dedicated to security (physical, cyber, insider threat, etc.), research security, and counterintelligence functions. While some publications crediting DoE-funded research (or facilities) involve materials science disciplines for energy storage (e.g., batteries) or fusion energy, it would be dangerous to assume that the PRC partners similarly prioritize or focus exclusively on civilian applications.

[g] We speculate that many of the collaborations that resulted in published research probably involved specific individuals and not part of an institutional agreement or partnership between the US and PRC parties. Details of such agreements, if any, are rarely disclosed publicly by US academia.

3. Profiles of Select PRC Laboratories

Table 5 (in Section I) lists the PRC state key laboratories with the most extensive research collaborations with US institutions based on the collected corpus of publication data. This section describes four of these laboratories, highlighting their missions, organizational hierarchies, and select collaborations with US entities. **A total of 663 articles (37 percent of the full corpus) involve US collaborations with just these four PRC defense laboratories.** While this study focuses on US interactions, these four laboratories also collaborate internationally, especially with key US allies within NATO and the Five Eyes alliance.[h]

A. Central South University State Key Laboratory of Powder Metallurgy

The State Key Laboratory of Powder Metallurgy (hereafter SKLPM) at China's Central South University (粉末冶金国家重点实验室) is the most active collaborator with US institutions. The full corpus contained 285 articles coauthored by SKLPM personnel and US institutions since 2019, of which 80 articles also credit US government funding. This is one of just a few laboratories in our dataset that the *PRC does not appear to publicly acknowledge as being a national defense laboratory*. Both the official Chinese and English names refer to it only as a "state key laboratory." In fact, only one Mandarin-language source was observed to use the "national defense" term: a scientific publication in which the coauthors referred to it as a national defense laboratory (discussed below). Despite this lack of a formal defense designation by the PRC, **we assess that SKLPM is in fact a national-level defense laboratory and thus warrants inclusion in our dataset.** Given that SKLPM has enjoyed extensive international research collaborations and partnerships over several decades, this lack of a formal defense association is almost certainly intentional to avoid international scrutiny. The following is a *sampling* of information (predominantly from Chinese-language sources) on the SKLPM's history, mission, key leadership, and activities that show its defense affiliation.

The current "about us" page on SKLPM's website describes its mission as "serving major national strategies and economic construction" to meet "critical needs in new materials," and that the laboratory has "provided hundreds of special powder metallurgy materials for China's key strategies."[12] By contrast, an archived version of the same page from 2019 contains a similar statement but uses the term "national defense" instead of "strategies," stating first that it serves "national defense construction" (before the term "economic construction"). The description also

[h] Appendix B offers basic statistics on other nations' involvement with the PRC defense laboratories identified in this study.

states that the laboratory's provision of hundreds of special powder metallurgy materials was developed for "national key projects and strategic weapons" (实验室立足于服务国家重大国防和经济建设对新材料的重大需求, 为我国重点工程和战略武器提供了上百种特种粉末冶金材料).[13]

This noteworthy change in language is almost certainly intentional to obfuscate SKLPM's primary mission and avoid international scrutiny. Indeed, other pages on the "about us" section of the laboratory's current website have removed all information on its organizational structure or its academic committee. Those pages appear blank, at least from North American (Internet) points of presence. Figure 1 shows a screenshot of the blank page on SKLPM's organizational structure. While it is possible that the laboratory is simply intending to update its website and the blank information on its "about us" page is temporary, the more plausible explanation is deliberate obfuscation, given the removal of defense and weapons terms from previous web page iterations.

Figure 1: Screenshot of SKLPM's blank web page on its organizational structure[14]

SKLPM's website does describe some of its research areas and key projects it has undertaken.[i] Much of the material science research is described as having applications in aerospace. An article profiling SKLPM also noted, "The development of new aerospace friction materials is one of the key research directions of the laboratory…in accordance with the needs of national defense and economic construction."[15] A sampling of the research areas includes:

- Materials in extreme environments research
- Atmospheric sintering and activated sintering technology for powder metallurgical materials
- Spark plasma sintering discharge plasma sintering technology
- Innovative powder preparation, forming, and densification technologies

[i] Section IV includes a case study on SKLPM's research collaborations with the University of Tennessee, Knoxville that offers additional evidence of some of the defense research the laboratory conducts.

- Advanced powder metallurgy refractory metals and their high-temperature resistant composites
- Multiscale and multiphase composite powder metallurgical materials
- High-performance titanium and magnesium alloys
- Graphene, carbon nanotubes, and other low-dimensional nanocarbon materials and devices
- Ablation-resistant Carbon-carbon (C/C) composites
- Specialty fibers and their composites.[16]

A study by a Spanish think tank analyzing China's hypersonics programs noted SKLPM's significant contributions in this field. It highlighted a news announcement from China's official news agency Xinhua that SKLPM achieved a breakthrough in ceramic coatings needed for hypersonic vehicles and that it discovered a material that can withstand temperatures of up to 3,000 degrees Celsius.[17]

SKLPM's Origins and Leadership

SKLPM was founded in 1989, originating from a previous defense-affiliated laboratory established in 1960 called the "New Materials Laboratory" (新材料实验室). Both this previous laboratory and SKLPM were founded by a scientist named Huang Peiyun[j] (黄培云), whom PRC media describes as one of the key scientists involved in China's first atomic weapons and missile development programs. At the New Materials Laboratory, Huang Peiyun led research teams that were tasked with "carrying out missions" by "departments and divisions of the defense ministry," according to an article by Tsinghua University commemorating Huang's life in 2012.[18] After Huang founded SKLPM, the new laboratory very likely continued receiving taskings from the PRC defense establishment, as the article highlighted SKLPM's "significant contributions to the development of China's atomic bombs, missiles, satellites, and radars."

Huang Peiyun appeared to have trained Huang Boyun (黄伯云, no apparent familial relationship to Huang Peiyun) at Central South University (CSU). Huang Boyun was the first director of SKLPM after returning from the US in 1988.[19] It is unclear when Huang Boyun stepped down as director, but media sources referred to him as director through 2010. Huang Boyun was also the founder and a key leader of the National Defense Science and Technology Key Laboratory of Lightweight High-Strength Materials (轻质高强国防科技重点实验室),[20] another defense laboratory housed in the same CSU division known as the Powder Metallurgy Research

[j] This study uses the PRC naming convention of listing surname first, followed by the given name, which corresponds to the order of the Chinese characters in a person's name. International journal articles often list Chinese surnames last like Western conventions. When this study's endnotes cite a journal article using the Western style, Chinese surnames are placed in all capitals to avoid confusion.

Institute,[k] and shares some personnel with SKLPM. Additionally, the current director of the lightweight materials laboratory is Liu Wensheng (刘文胜), who previously published articles under his affiliation with SKLPM.[21]

The current director of SKLPM is Zhou Kechao (周科朝), who also serves as vice president of CSU. Zhou has worked on research funded by the Central Military Commission's Equipment Development Department.[22] Additionally, Zhou was one of the CSU hosts for a 2017 visit by then-PLA Air Force (PLAAF) Deputy Commander Zhang Honghe (张洪贺) to SKLPM and its parent Powder Metallurgy Institute. Zhang was accompanied by the Deputy Director of PLAAF's Equipment Development Department. The PLA leaders were briefed on the national defense research conducted at CSU and SKLPM.[23] Figure 2 shows SKLPM Director Zhou briefing the PLAAF leaders. This visit by senior PLAAF officers strongly suggests that SKLPM is conducting research for China's Air Force.

Figure 2: Image of SKLPM Director Zhou Kechao briefing PLA Air Force leadership

In 2015, Zhou attended a meeting on the PLA's quality assurance program for units that produce weaponry and military equipment. The meeting was attended by the deputy director of the PLAAF's Hunan Representative Office. At that time, the representative office reported to the PLA's General Armament Department,[l] and its function was to liaise with the defense industry. That meeting suggests that Zhou was one of the key points of contact at CSU, working closely with the PLA on weapons procurement and production.[24]

[k] CSU's Powder Metallurgy Institute openly describes its significant involvement in defense R&D, conducting basic and applied research that has supported aeronautics, spaceflight, weapons, ships, electronics, and the nuclear industry. It obtained a research and production license for "weapons and equipment" in early 2002 (https://pmri.csu.edu.cn/yjygk/yjyjj.htm).

[l] After a major reorganization, the PLA's General Armament Department became known as the Equipment Development Department.

Finally, only one source was observed to refer to SKLPM as a national defense laboratory: a 2018 article published in Mandarin in a domestic PRC journal listed the authors' affiliation as being: "中南大学粉末冶金国防重点实验室," (CSU National Defense Key Laboratory of Powder Metallurgy). No other PRC publication was observed to use this name variant containing the term for national defense. We speculate this was probably an accidental disclosure of the laboratory's alternate name used internally at CSU (all of the coauthors are affiliated with SKLPM) or intended solely for domestic PRC audiences, rather than a typographical error. The article describes a process for preparing "C/C-SiC Composites," which are materials that can function at high temperatures and are actively pursued for aerospace purposes.[25]

SKLPM–US Collaborations

SKLPM has collaborated extensively with US institutions over the last five-plus years, involving public and private universities and US government laboratories. Understanding the nature of these research partnerships goes beyond the scope of this study, but further investigation is warranted. Here, we provide statistics on US entities that collaborate the most with SKLPM and offer a few examples of articles that demonstrate the critical risks associated with such collaborations.

Over 70 US institutions have published research with SKLPM since 2019. Table 10 lists the US public and private universities that have collaborated the most with SKLPM based on the number of articles (US government facilities are listed separately in Table 11).

Table 10: US Universities Collaborating the Most with SKLPM (Full Corpus)

US University	Number of Articles
University of Tennessee, Knoxville	59
Dartmouth College	38
Georgia Institute of Technology	17
University of Utah	17
University of Rochester	13
Pennsylvania State University	12
University of Michigan	9
Ohio State University	6
University of Nebraska	6
University of California, San Diego	5
University of California, Santa Cruz	5
University of Washington	5

Section IV provides a case study on the University of Tennessee, Knoxville's collaborations with PRC defense laboratories, especially SKLPM, given the very large number of articles involved. The University of Tennessee has collaborated with PRC defense laboratories more than any other US institution, and two-thirds of its collaborations are with SKLPM alone. Two examples of articles below show SKLPM collaborating with other PRC military research entities alongside Dartmouth College and Stanford University.

Example 1

An article published in July 2024, titled "Effect of Annealing on Microstructure and Properties of AlCoCuFeTi High-entropy Alloy Fabricated by Arc Melting," appeared to involve research funded by the PRC and predominantly conducted in China, with one researcher from Dartmouth College providing some support. The PRC coauthors are all affiliated with either SKLPM or the National Key Laboratory of Marine Corrosion and Protection housed at the Luoyang Ship Material Research Institute.[26] We highlight this article partly because it shows that SKLPM is involved in other defense research areas in addition to aerospace: in this case, material sciences for naval applications.

While understanding SKLPM's defense ties required extensive due diligence, a cursory Google search will produce results indicating that the Luoyang Ship Material Research Institute is part of the China Shipbuilding Industry Corporation[m] and is commonly referred to as the 725th Research Institute. Although the translation is poor, the description on the English-language website of the 725th Research Institute makes clear that it is part of a defense firm that develops naval weapons and equipment.[27]

Furthermore, the 725th Research Institute was placed on the Department of Commerce Bureau of Industry and Security (BIS) Entity List in late 2020 with a presumption of denial designation. While fundamental research collaborations are typically not subject to US export control rules set by the Commerce Department, such a designation indicates that the US government has determined that this division of a PRC state-owned defense enterprise poses a very high risk to US national security. This article's manuscript was submitted to the publisher for review in mid-December 2023, three years *after* the 725th Research Institute was placed on the Entity List. This suggests that Dartmouth College has no concerns about working with PRC military research facilities.

[m] After a merger, the China Shipbuilding Industry Corporation has become part of the China State Shipbuilding Corporation.

Example 2

An article published in September 2023 was coauthored by a postdoctoral researcher from Stanford University who claimed a dual affiliation with the Center for High Pressure Science and Technology Advanced Research (HPSTAR). The other coauthors were affiliated with several divisions of the Beijing Institute of Technology – such as its Chongqing Institute of Microelectronics and Microsystems and the School of Aerospace Engineering – as well as SKLPM and the Beijing Computational Science Research Center.[28] Both HPSTAR and the Beijing Computational Science Research Center are subordinate divisions of the China Academy of Engineering Physics, China's principal nuclear (and advanced weapons) research and production complex. The Beijing Institute of Technology is known in China as both a "Seven Sons of National Defense" and "Seven Sons of Ordnance Industry" school, i.e., it is principally engaged in defense research and supporting China's defense industry and the PLA. All these PRC organizations except SKLPM are on the BIS Entity List.

The research in this article is funded solely by PRC sources, one of which is referred to as the "173-JCJQ Program." This program code appears in other English articles with several name variants, such as the "Basic Strengthening 173 Program," "National Defense Science and Technology 173 Program Technical Field Fund Project," "National Defense Science and Technology 173 Program of China," "173 Program for Technology," or "173 Program – Key Program for Basic Reinforcement by the Central Military Commission."[29] In Chinese, it is most commonly known as "国防科技 173 计划" (National Defense Science and Technology 173 Program). This 173 Program was created by the Science and Technology Committee of the China Central Military Commission (the party organ overseeing the PRC military) and appears to be managed by SASTIND. The program funds rapid commercialization projects in defense science and technology areas; funding for individual projects ranges from several hundred thousand to three million renminbi for up to three years.[30]

Further inquiry would be necessary to determine the level of involvement of the Stanford postdoctoral researcher. Nevertheless, this collaboration raises questions about why Stanford would hire this individual, who is affiliated with China's nuclear weapons complex, or why that individual would be allowed to collaborate with a PRC defense laboratory and a key defense research university while at Stanford.

Table 11 lists the US government laboratories that also had researchers collaborating with SKLPM. All but the Army Research Laboratory are part of the DoE's national laboratory system.

In many cases, the materials science research conducted by these US laboratories may focus primarily on potential civilian and commercial applications, such as energy storage technologies. Addressing economic security concerns arising from partnering with the PRC is beyond the scope of this study, given the party-state's goals of dominating and displacing the US in critical

technology fields. Nevertheless, SKLPM engages in both military and civilian technology development.

Table 11: US Federal Research Facilities Collaborating with SKLPM (Full Corpus)

US Government Research Facilities	Number of Articles
Argonne National Laboratory	11
Oak Ridge National Laboratory	5
Ames Laboratory	2
Army Research Laboratory	2
Brookhaven National Laboratory	2
Lawrence Berkeley National Laboratory	1

B. Northwestern Polytechnical University's State Key Laboratory of Solidification Processing

Similar to SKLPM, the State Key Laboratory of Solidification Processing (凝固技术国家重点实验室) housed at Northwestern Polytechnical University (NWPU) does not use the term "national defense" in its official Chinese or English name. Nevertheless, PRC government sources confirm the laboratory is directly supervised by SASTIND.[31] An archived version of NWPU's website discussing the university's role in material sciences research makes it clear that the State Key Laboratory of Solidification Processing (SKLSP) is a defense laboratory. It states, "SKLSP is subordinate to the national defense system," and both that archived version and the current web page of SKLSP describe the laboratory's function as to "primarily serve major materials technology needs for defense in aerospace fields."[32]

SKLSP's main research areas are modern solidification theory, precision molding of materials, and advanced materials for aerospace. The laboratory also lists the following "key research areas to meet national defense needs": ceramic-based ultra-high-temperature composites; carbon-based ultra-high-temperature composites; and refractory metal matrix self-composites.[33] The laboratory also states it conducts research on infrared and high-temperature stealth materials, which are obviously intended for military applications.

Table 12 lists the US universities that have collaborated with SKLSP on at least five articles since 2019 based on the full corpus of publications. Table 13 includes all US government-sponsored facilities that have coauthored articles with SKLSP.

Table 12: US Universities Collaborating the Most with SKLSP (Full Corpus)

US University	Number of Articles
University of Delaware	36
Pennsylvania State University	21
North Carolina State University	18
Texas A&M University	14
University of Tennessee, Knoxville	10
Massachusetts Institute of Technology	9
University of North Texas	9
Northwestern University	6
Harvard University	5
Johns Hopkins University	5
University of California, Berkeley	5
University of Illinois at Urbana-Champaign	5

Table 13: US Federal Research Facilities Collaborating with SKLSP (Full Corpus)

US Government Research Facilities	Number of Articles
Los Alamos National Laboratory	5
Argonne National Laboratory	3
Brookhaven National Laboratory	3
Lawrence Berkeley National Laboratory	3
National Renewable Energy Laboratory	3
Oak Ridge National Laboratory	3
Pacific Northwest National Laboratory	2
Army Research Laboratory	1
Johns Hopkins University Applied Physics Laboratory	1
SLAC National Accelerator Laboratory	1

Article Examples

The collected corpus of articles shows that researchers at North Carolina State University have collaborated substantially with NWPU's SKLSP. Much of this collaboration appears to involve North Carolina State University's aerospace engineering department in materials science research intended for aerospace and defense applications. Further investigation is recommended to determine whether some of this research may also have hypersonics applications.

Table 14 lists a sampling of articles whose research has clear defense applications, but also demonstrates that the US DoD, NSF, and the state of North Carolina have all provided funding support. State-level funding included the Analytical Instrumentation Facility (AIF) at North Carolina State University (jointly funded by NSF and the state of North Carolina) and the "NC State Faculty Research and Professional Development Fund." One of the articles notes that the AIF is a member of the North Carolina Research Triangle Nanotechnology Network, a site in the National Nanotechnology Coordinated Infrastructure.[34]

Table 14: Sampling of Articles with Defense Aerospace Applications and Collaborations with SKLSP

Article Title	Coauthor Affiliations	US Funding Sources
"Ultrahigh-Temperature Ceramic-Polymer-Derived SiOC Ceramic Composites for High-performance Electromagnetic Interference Shielding"[35]	State Key Laboratory of Solidification Processing (SKLSP) and Shaanxi Province Key Laboratory of Fiber Reinforced Light Composites Materials, Northwestern Polytechnical University (NWPU); Department of Mechanical and Aerospace Engineering, Analytical Instrumentation Facility (AIF), North Carolina State University	State of North Carolina; National Science Foundation (NSF)
"A Skin Layer Made of Cured Polysilazane and Yttria Stabilized Zirconia for Enhanced Thermal Protection of Carbon Fiber Reinforced Polymers (CFRPs)"[36]	SKLSP and Shaanxi Province Key Laboratory of Fiber Reinforced Light Composites Materials, NWPU; Department of Mechanical and Aerospace Engineering, North Carolina State University	Office of Naval Research; NSF; State of North Carolina; NC State Faculty Research and Professional Development Fund
Multifunctional Ceramic Composite System for Simultaneous Thermal Protection and Electromagnetic Interference Shielding for Carbon Fiber-Reinforced Polymer Composites"[37]	SKLSP; Department of Mechanical and Aerospace Engineering, North Carolina State University	Office of Naval Research; NSF; State of North Carolina

"Synergistic Effect of the Mesoporosity-turbostratic Carbon on the Six-fold Piezoresistivity Improvement of Pristine Polymer Derived SiC Pyrolyzed at High Temperature"[38]	SKLSP and Shaanxi Province Key Laboratory of Fiber Reinforced Light Composites Materials, NWPU; Department of Mechanical and Aerospace Engineering, North Carolina State University	Army Research Office; Air Force Office of Scientific Research (AFOSR); NSF; State of North Carolina

This table illustrates another overlooked issue that is also not addressed in this study due to scoping limitations: *federal taxpayer dollars are not the only investments at risk; state-funded research initiatives and/or facilities can also be involved*. Additionally, there are economic security or competitiveness risks associated with many of the aerospace research collaborations between US institutions and SKLSP. NWPU is overseen by the PRC Ministry of Industry and Information Technology and SASTIND and has extensive partnerships with PRC industry, especially state-owned defense enterprises. NWPU has a responsibility to implement PRC military-civil fusion policies and transfer its research and technologies for both commercialization and weaponization purposes.

C. Harbin Institute of Technology's State Key Laboratory of Advanced Welding and Joining

The State Key Laboratory of Advanced Welding and Joining (先进焊接与连接国家重点实验室) is housed at the Harbin Institute of Technology (HIT), another "Seven Sons of National Defense" university that has military engineering academy origins and maintains a primary mission of supporting China's defense industry and the PLA. Like NWPU's solidification laboratory, this laboratory also omits the term "national defense" from its official English and Chinese names but nonetheless is directly supervised by SASTIND according to the PRC Ministry of Science and Technology.[39] The majority of the publications in the collected corpus use this name for coauthor affiliations. However, the laboratory has changed its organizational structure and official name, and thus we expect to see future publications more often use its new title: the State Key Laboratory of Precision Welding & Joining of Materials and Structures (材料结构精密焊接与连接全国重点实验室).

The laboratory's reorganization is quite significant: it was jointly formed by HIT, the China State Shipbuilding Corporation's Bohai Shipyard (中国船舶集团渤海造船厂), and the China Aerospace Science and Technology Corporation's (CASC's) Capital Aerospace Machinery Co. (中国航天科技集团首都航天机械公司). Both the China State Shipbuilding Corporation and CASC are large, state-owned defense conglomerates; the former serving as China's primary producer of vessels, weapons, and equipment for the PLA Navy, and the latter involved in all aspects

of China's defense (and some civilian) aerospace needs. These firms are on numerous US and EU sanctions or export control lists.

The CASC subsidiary that helps run this HIT welding lab, the Capital Aerospace Machinery Co. (首都航天机械公司), is one of at least eight companies directly subordinate to the China Academy of Launch Vehicle Technology (CALT) (中国运载火箭技术研究院), based on organizational charts[n] of CALT.[40] CALT is a subsidiary of CASC and, according to Western sources, the PRC's "largest, most important organization for the research, development, and production of space launch vehicles, liquid-fueled surface-to-surface missiles, and solid-fueled surface-to-surface and submarine-launched ballistic missiles." The academy produces short- and medium-range ballistic missiles and intercontinental ballistic missiles (ICBMs).[41] CALT also produces China's Long March rockets, used for both civilian and military purposes. For instance, in October 2020, the Long March 2C rocket reportedly carried three military signals intelligence satellites into orbit.[42] CALT also produces the Dongfeng series of ICBMs, now equipped with multiple independent nuclear warheads able to strike Western Europe and the United States.[43]

According to its website, the welding laboratory has "played a vital role in defense sectors such as aerospace, aviation, maritime navigation, and nuclear power, as well as in the development of the national economy." The laboratory claims to have made "major scientific and technological achievements, for manned spaceflight, domestic aircraft carriers, nuclear submarines, large aircraft, and aircraft engines," among other technologies like nuclear power, rail transportation, and integrated circuits.[44] Note that the current version of the laboratory's website removed all information on its research areas, and the last patents and publications listed were from 2016.

This HIT laboratory does conduct research in civilian areas, and some of the collaborations with US institutions appear to be focused on seemingly innocuous fields like environmental sciences and renewable energy. *Nevertheless, as a laboratory supervised by SASTIND and now jointly run by HIT and two of China's largest state-owned defense conglomerates, including its principal missile design academy, US and other foreign partners must assume the welding laboratory will seek military applications for any research it conducts.*

The full corpus contains 102 articles involving US institutions and the HIT welding laboratory. Table 15 lists the US universities with the most collaborations, and Table 16 lists the US government laboratories that had researchers coauthoring articles.

[n] CALT's current website appears to have removed all organizational charts, but at least two different versions of them are retrievable from archived webpages. Both versions list the Capital Aerospace Machinery Co. as a "unit directly subordinate" to CALT.

Table 15: Top US Universities Collaborating with HIT's State Key Laboratory of Advanced Welding and Joining (Full Corpus)

US University	Number of Articles
University of Houston	12
Pennsylvania State University	10
University of Pennsylvania	10
University of Michigan	7
University of Wisconsin	7
Missouri University of Science and Technology	5
University of Kentucky	5

Table 16: US Federal Research Facilities Collaborating with HIT's State Key Laboratory of Advanced Welding and Joining (Full Corpus)

US Government Facility	Number of Articles
Ames Laboratory	4
Argonne National Laboratory	3
Brookhaven National Laboratory	2
Naval Research Laboratory	2
Oak Ridge National Laboratory	1

Article Examples

Table 17 lists six articles where the majority of coauthors are affiliated with HIT divisions, including the welding laboratory. These articles only name two foreign (non-China-based) researchers: one individual holding joint positions at Italy's University of Padova and Pennsylvania State University, and another affiliated with Germany's Darmstadt University of Technology. These articles are highlighted for several reasons.

First, all of these articles relate to research on silicoboron carbonitride (SiBCN) ceramics, which most articles describe as well suited as "advanced structural-functional materials for high-temperature, harsh environments" and having "excellent high-temperature stability, mechanical strength and oxidation resistance as well as tunable functional properties." While these ceramic materials may be useful in a variety of civilian applications, they are also intended for defense and aerospace purposes. Several of the coauthors of these articles have written that SiBCN materials

have been "proven to be the primary choice for high-temperature applications, including propulsion systems and components in aerospace vehicles."[45]

Second, it is unknown to what extent the two non-China-based researchers contributed to the research in these articles published in 2024 and 2025. The researcher affiliated with the University of Padova holds an adjunct faculty position at Pennsylvania State University. Further inquiry would be needed to determine whether any of Pennsylvania State University's resources (facilities, salary, graduate students) supported this coauthor's contributions to these six articles. The same question applies to the Germany-based coauthor; however, four of the six articles credit funding support from the German federal research funder Deutsche Forschungsgemeinschaft (DFG) on a program titled "MatCom-ComMat: Materials Compounds from Composite Materials for Applications in Extreme Conditions." Although this study focuses on US collaborations with PRC defense laboratories, these articles show that other nations are sometimes also involved.[o]

Table 17: Sampling of Articles on silicoboron carbonitride (SiBCN) Ceramics Coauthored by US-, Italy-, and Germany-based Coauthors and Harbin Institute of Technology (HIT) Welding Laboratory

Article Title	Coauthor Affiliations	Noteworthy Funding Sources
"Three-dimensional PDC-SiBCN Network in MA-SiBCN Ceramics: Toughening-reinforcing Effect and Oxidation Barrier"[46]	Institute for Advanced Ceramics; Key Laboratory of Advanced Structural-Function Integrated Materials and Green Manufacturing Technology; School of Materials Science and Engineering; State Key Laboratory of Advanced Welding and Joining (all HIT); Pennsylvania State University and University of Padova; Darmstadt University of Technology	Heilongjiang Natural Science Fund for Young Scholars; Heilongjiang Touyan Team Program; Advanced Talents Scientific Research Foundation of Shenzhen; Beijing Engineering Research Center of Efficient and Green Aerospace Propulsion Technology and Advanced Space Propulsion Laboratory of BICE
"Heterogeneous Oxidation Involving Different Atomic Clusters in Sintering-free Amorphous SiBCN Ceramic with MA@PDC-SiBCN Structure"[47]	Same as above	Same as above
"Heterogeneous Oxidation Behavior and Kinetic Mechanisms of SiBCN Ceramic with Structure of MA-SiBCN Coated by PDCs-SiBCN"[48]	Same as above	Heilongjiang Natural Science Fund for Young Scholars; Heilongjiang Touyan Team Program; Advanced Talents Scientific Research Foundation of Shenzhen; Deutsche Forschungsgemeinschaft

[o] Appendix B briefly discusses other country collaborations with the 45 PRC defense laboratories examined in this study.

"Heterogeneous Oxidation of Different Atomic Clusters in Amorphous SiBCN Ceramic Associated with Phase Separation"[49]	Same as above	Same as above
"Oxidation Behavior of Amorphous and Nanocrystalline SiBCN Ceramics – Kinetic Consideration and Microstructure"[50]	Institute for Advanced Ceramics; Key Laboratory of Advanced Structural-Function Integrated Materials and Green Manufacturing Technology; School of Materials Science and Engineering; State Key Laboratory of Advanced Welding and Joining; Chongqing Research Institute (all HIT); Pennsylvania State University and University of Padova; Darmstadt University of Technology	Same as above
"Comparative Study on the Microstructure Evolution and Crystallization Behavior of Precursor-derived and Mechanical Alloying Derived SiBCN"[51]	Institute for Advanced Ceramics; Key Laboratory of Advanced Structural-Function Integrated Materials and Green Manufacturing Technology; School of Materials Science and Engineering; State Key Laboratory of Advanced Welding and Joining; Chongqing Research Institute (all HIT); Second Military Representative Office of the [People's Liberation Army] Air Force; Pennsylvania State University and University of Padova; Darmstadt University of Technology	Same as above

With the exception of one article, all of the China-based coauthors work at HIT, and most are associated with more than one HIT laboratory and research institute. Two of the articles credit funding from the "Advanced Space Propulsion Laboratory of BICE" and one article lists an additional coauthor from the "Second Military Representative Office of the [PLA] Air Force."

The PRC coauthors may have intentionally obfuscated details on this "BICE" funding source. BICE refers to the Beijing Institute of Control Engineering, a subsidiary of the China Academy of Space Technology (CAST), which in turn is known as CASC's 5th Academy. BICE is sometimes referred to as the 502nd Research Institute. BICE claims to be among the "world's most advanced" developers of technologies for space propulsion, satellite attitude and orbit control, spacecraft escape rescue control, lunar probe orbit control, manual and automatic rendezvous and docking technology, and re-entry and return control, and has deployed "control and propulsion systems on most of China's satellites, programmed systems, and airships, including the Chang'e satellite."[52] BICE and its parent CAST were added to the BIS Entity List in 2022 due to their support of China's military and defense industry.

Given these entities (in addition to the welding laboratory) are all directly subordinate to, or partner with, PRC defense aerospace industries, any level of support from foreign collaborators on this research listed in Table 17 should be considered an unacceptable risk. It is plausible that this research may lead to the development of new missiles or supporting weapon systems that can be used against the US and its allies in any armed conflict. (Section IV includes another example of defense research collaboration with HIT's welding laboratory that also involves US federal funding.)

D. National Key Laboratory of Computational Physics of the Institute of Applied Physics and Computational Mathematics

The National Key Laboratory of Computational Physics, also referred to as the Laboratory of Computational Physics in English-language publications, is an officially designated "National Defense S&T [Science & Technology] Key Laboratory," according to two authoritative PRC sources. This laboratory is housed at the Beijing Institute of Applied Physics and Computational Mathematics (北京应用物理与计算数学研究, hereafter IAPCM), also known as the China Academy of Engineering Physics (CAEP) 9th Institute. Most English-language publications that are coauthored by IAPCM researchers omit any mention of its parent organization CAEP, China's nuclear and advanced weapons research, development, and production complex.

Most references to the computational physics laboratory in English and Chinese simply refer to it as a state (or national) key laboratory. However, a section of IAPCM's website that provides a chronological history of the institute mentions that in 1992, the "National Defense Science and Technology Key Laboratory of Computational Physics" (计算物理国防科技重点实验室) was created.[53] Additionally, a biography posted on a Chinese Academy of Sciences website profiling IAPCM's Deputy Director Mo Zeyao (莫则尧) indicates that Mo also serves as the director of this computational physics laboratory and uses the official Chinese name that includes "defense science and technology." The biographical information on Mo stated that he has formed, trained, and led a "defense science and technology innovation team" focusing on "weapons physics, inertial confinement fusion, and other major national scientific projects."[54]

IAPCM focuses on a range of research fields, such as theoretical physics, particle and nuclear physics, plasma physics, condensed matter physics, laser physics, fluid mechanics, and applied and computational mathematics.[55] It was established in 1958 and originally served as a theoretical research and design unit for developing nuclear weapons. The institute has since expanded to include the development of conventional weapons, high-performance computing, and fusion energy.[56] By 2016, IAPCM had received 149 "military weapons and equipment science and technology progress awards" and 90 national "defense key science and technology achievement

awards."[57] IAPCM is on the BIS Entity List with a presumption of denial designation on all items. It is also on a list of foreign institutions engaging in problematic activity per stipulations of Section 1286 of the National Defense Authorization Act for Fiscal Year 2019 (Public Law 115-232).

CAEP is China's primary nuclear weapons R&D and production complex supervised by the Central Military Commission (CMC) and comprises 12 main institutes, numerous laboratories, and dozens, if not hundreds, of commercial firms. While CAEP focuses on nuclear weapons, it also researches microwaves and lasers for nuclear fusion ignition and directed-energy weapons and technologies related to conventional weapons.[58] Given that CAEP is overseen by the CMC with a mission to research, develop, and produce nuclear and other advanced weapons and supporting components, collaborating institutions must assume CAEP will seek weapons applications from any research it conducts or funds, even in areas considered theoretical or fundamental in nature. Many of CAEP's divisions are on the BIS Entity List (including IAPCM). Any science and technology research collaboration with CAEP represents critical risks to national security.[p]

The full corpus contains 62 articles involving US institutions and the IAPCM's computational physics laboratory. Table 18 lists the US institutions collaborating the most, suggesting an ongoing or substantial collaborative relationship with the IAPCM laboratory. Table 19 lists the number of the US government laboratories' collaborations separately.

Table 18: Top US Universities Collaborating with IAPCM's Laboratory of Computational Physics (full corpus)

US University	Number of Articles
Princeton	24
Brown University	14
Pennsylvania State University	4
Rutgers	3

[p] In some instances, engagements with CAEP may serve US national interests, such as promoting nuclear non-proliferation or stockpile safety measures. However, most of those areas should not involve science and engineering research, and certainly not in fields that can enhance CAEP's capabilities in weapons design and production.

Table 19: US Government Facilities Collaborating with IAPCM's Laboratory of Computational Physics (full corpus)

US Government Facility	Number of Articles
National Institute of Standards and Technology	3
Argonne National Laboratory	2
Lawrence Berkeley National Laboratory	2
Pacific Northwest National Laboratory	1

The research areas pursued by US universities and federal laboratories may have been intended for civilian purposes, and some of the research may be more theoretical in nature. CAEP's involvement, however, renders useless the notion that any collaboration with China would be innocuous. For instance, some of the articles coauthored by Brown University researchers involve computational techniques in radiation hydrodynamics, which coauthors describe as important in inertial confinement fusion – a key area in both fusion energy and nuclear weapons development.

The 22 articles acknowledging US government funding were published between 2019 and 2023. However, Brown, Pennsylvania State, Princeton, and Rutgers universities continued to publish articles in 2024 and 2025 with IAPCM's defense laboratory. Additionally, several of the articles involving coauthors affiliated with Princeton University credit both PRC funding sources and grants from the DoE, Office of Naval Research (ONR), and NSF.

An example illustrating how the PRC's research interests diverge from those of their US partners is an article coauthored by researchers from the University of California, Berkeley; Lawrence Berkeley National Laboratory; Princeton University; Peking University; and the IAPCM defense laboratory. The research involved developing an AI-based simulation system that can model the behavior of extremely large and complex materials.[59] US funding came from the DoE, ONR, and NSF; PRC funders included the National Natural Science Foundation of China (NNSFC), the National Key Research and Development Program of China, the Beijing Academy of Artificial Intelligence, and a gift from PRC firm iFlytek to Princeton University. The US funding was intended to advance foundational tools for computational modeling and simulation, enabling the use of high-performance computers (supercomputers) to study complex physical and chemical systems more accurately and at much larger scales than before.

Coauthor Wang Han (王涵), affiliated with IAPCM's defense laboratory, conducts research on shock behavior in metals, extreme-condition materials modeling, warm dense matter, high-pressure phase changes, and large-scale molecular dynamics that are directly relevant to explosives, detonation physics, plasma environments, and other military applications, including nuclear weapons.[60] [61]

Additionally, that article example is just one of 11 published between July 2020 and January 2023 coauthored by Princeton University researchers and acknowledging a gift to Princeton from the PRC firm iFlytek. All of the articles also credit DoE funding, and nine credit the ONR. In 2019, the US government placed iFlytek on the BIS Entity List for export control purposes due to the firm's support to China's surveillance and public security apparatus.[62]

Princeton University's partnership with iFlytek may not have violated export control rules. However, a *Reuters* report in June 2019 discussed iFlytek's collaborations with US universities (probably in response to the firm's addition to the BIS Entity List). The report noted that iFlytek's 2018 annual report mentioned "strategic cooperation" with Princeton in the areas of applied and computational mathematics, but the report was abruptly removed from the company's website. A Princeton representative confirmed to *Reuters* that iFlytek had made "a gift to support basic research conducted by one faculty member," but claimed there was no strategic cooperation agreement.[63]

Regardless, given the US government's finding in 2019 that iFlytek poses national security risks, that IAPCM's defense laboratory was also a partner, and that the research was supported by the DoE and the Navy, we question why the US government provided funding to this research. Because research-to-publication timelines are typically measured in years, some research published after 2019 may simply have resulted from a one-time grant from iFlytek. However, a cursory survey of separate publications *collected outside of our corpus* (including articles that do not involve PRC defense laboratories) shows that US institutions, including Princeton, Stanford University, and the University of Washington, *have continued to coauthor research with or credit funding from iFlytek,* including articles published as recently as September 2025.[64]

4. Case Examples of Critical-Risk Collaborations and Federally Funded Research

The previous section surveyed the four PRC defense laboratories with which US institutions have collaborated most frequently. Those collaborations represent nearly 40 percent of the articles in our corpus. As data on coauthorship from publications provide little insight into the nature of the research engagements or partnerships, this section presents case studies that examine more closely the research activities of some US institutions.

First, through bibliometric analysis and supplemental due diligence, we examine the University of Tennessee, Knoxville's partnerships with PRC defense laboratories, which are the most extensive and thus warrant additional scrutiny. Second, we provide additional case examples of articles involving federal research funding that have clear defense applications and represent some of the most critical risks to national security. Many of these examples include funding from the DoD, indicating the research is intended to enhance the capabilities, operations, or weapons systems of the US military. A lack of regulatory oversight or security safeguards has allowed these engagements to take place to the detriment of US national (and economic) security.

A. University of Tennessee, Knoxville Collaborations

University of Tennessee, Knoxville (hereafter UTK) coauthored the most publications with PRC defense laboratories, both within the full corpus (88 articles) and the subset of articles that acknowledge US federal funding (56 articles). UTK's publications crediting US funding are more than double the number of any other US institution coauthoring research with PRC defense laboratories. The PRC defense laboratories with which UTK researchers have coauthored appear in Table 20. *This section is limited to a subset of publications that credit US government funding.* This narrower scope is not intended to suggest that other collaborations that do not involve or credit US government funding are benign or low risk.

Table 20: UTK Articles with PRC Defense Laboratories Crediting US Federal Funding

PRC Defense Laboratories Coauthoring with UTK and US Federal Funding	Number of Articles
State Key Laboratory of Powder Metallurgy, Central South University	44
State Key Laboratory of Solidification Processing, Northwestern Polytechnical University	5
National Laboratory for Precision Hot Processing of Metals, Harbin Institute of Technology	4
State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology	2
Science and Technology on Advanced High Temperature Structural Materials Laboratory, Beijing Institute of Aeronautical Materials, Aero Engine Corp of China	1

UTK's most extensive collaborations are with Central South University's (CSU's) powder metallurgy laboratory (SKLPM), accounting for 44 out of the 55 articles in the corpus *that credit US government funding*. This concentration of research outputs is not coincidental. While this study focuses on a recent snapshot in time, it should come as no surprise that some of the examined research collaborations have a much longer history and continue unabated. As early as 2004, Oak Ridge National Laboratory (ORNL), a long-standing partner of UTK, maintained deep institutional and personnel ties to CSU that almost certainly facilitated these research pipelines.

A CSU announcement revealed (then) ORNL Director James Wadsworth's direct role in strengthening US research partnerships. During his tenure as ORNL Director (2003 to 2007), Dr. Wadsworth delivered a keynote address at the Chinese Materials Science Forum in 2004 and later accepted an appointment as an Honorary Professor at CSU in 2005.[65] CSU explicitly credited this appointment with expanding research collaboration between ORNL and CSU. From 2007 to 2008 Dr. Wadsworth served as Battelle's Vice President for Global Laboratory Operations, and from 2009 to 2018 he served as Battelle's President and Chief Executive Officer.[66] According to a 2009 announcement by the China National Intellectual Property Administration (CNIPA), Dr. Wadsworth was involved in the establishment of 360ip, an international intellectual property investment, fund management, advisory, and technology commercialization organization formed by Battelle. The CNIPA announcement highlighted the creation of the joint venture "360ip-CSU," and described it as a breakthrough in intellectual property commercialization and a formalized Battelle–CSU commercialization channel.[67]

In 2010, CSU announced that Dr. Wadsworth was awarded China's Friendship Award, the highest honor conferred by the PRC government on foreign experts who have made significant contributions to China's scientific and technological innovation and international scientific cooperation.[68] The award was presented by Premier Wen Jiabao at the Great Hall of the People in

Beijing. The award announcement stated that over the preceding several years, ORNL – through its partnership with UTK – recruited and trained 15 doctoral students and five visiting scholars from China's Southeast University and sent more than 30 US-based materials science researchers, including C. T. Liu, Peter Liaw, and T. G. Nieh, to conduct research at CSU.[69]

CSU's announcement also noted that Dr. Peter Liaw was one of the key UTK professors who was introduced into CSU's research ecosystem. This study's collected corpus shows that Dr. Liaw was the most prolific coauthor with PRC defense laboratories of any US scientist, being named on 54 articles, 42 of which involved CSU's SKLPM and support from the NSF or the Army Research Office (ARO).

Dr. Liaw has served as Professor and Ivan Racheff Chair of Excellence in the Department of Materials Science and Engineering at UTK since 1993. His research involves mechanical behavior, non-destructive evaluation, biomaterials, and the processing of high-temperature alloys, and ceramic-matrix composites and coatings.[70] Dr. Liaw has served as Director of the NSF Integrative Graduate Education and Research Training Program, the NSF International Materials Institutes Program, and the NSF Major Research Instrumentation Program.[71] His currently funded projects are listed in Table 21.[72]

Table 21: Dr. Liaw's Active Research Grants

Funder	Research Title	Period of Performance
Department of Energy	Development of Low-Density Fe-Mn-Al Multi-Principal Element Alloys for Lightweighting Automobile Structural Components	08/11/2023–7/31/2027
National Science Foundation	Collaborative Research: Nanoscale Structural and Compositional Instability-Driven Ductility in Refractory High-Entropy Alloys	04/13/2022–11/30/2026
Air Force Office of Scientific Research	Thermodynamics of Strength and Ductility in Refractory Compositionally Complex Alloys	02/21/2023–08/14/2026
CFD Research Corporation	Tailoring Refractory Metal Alloys for Additive Manufacturing (Phase I)	10/11/2023–07/15/2026
Quantum Venture Inc.	Robotic Welding of High-Performance Nickel-Based Superalloy	01/30/2025–03/31/2026

Many of Dr. Peter Liaw's extensive collaborations with SKLPM, as reflected in the published articles, involve a core group of researchers from the Advanced Powder Metallurgy Materials Research and Development Team. The team's research focuses on diamond superhard composite materials, diamond functional composite materials, advanced powder-metallurgy technologies and methods, and high-performance materials, including titanium alloys, high-entropy alloys, high-

temperature alloys, and refractory alloys.[73] Team members have participated in numerous national-level PRC research programs, including projects under the 863 Program and 973 Program, as well as projects identified only by the designators "XX" or "XXXX."[74] China's 863 Program focused on applied research primarily intended for defense purposes. The PRC frequently uses "XX/XXXX" nomenclature to deliberately obscure the nature of the research, equipment, or program sponsors that are classified, highly sensitive, or tied to military and weapons-development programs. The following are a few examples of articles coauthored by Dr. Liaw and SKLPM's Advanced Powder Metallurgy Materials R&D team, along with their backgrounds.

An article published in 2022 on alloy-strengthening research was coauthored by Dr. Liaw, SKLPM's Liu Feng and Tan Liming, and researchers from the Hunan University State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body. Dr. Liaw acknowledged support from the NSF under awards DMR-1611180 and DMR-1809640.[75]

- Coauthor Liu Feng (刘锋) is a researcher and doctoral supervisor within CSU's Institute of Powder Metallurgy and SKLPM. His research focuses on powder metallurgy high-temperature alloys, oxide dispersion–strengthened alloys, additive manufacturing (3D printing), and new energy materials. Liu's work also includes (but is not limited to) AI–assisted materials design, ultra-pure high-temperature alloy parent-alloy melting, high-quality powder preparation and post-treatment, alloy toughening mechanisms, and preparation and application of nanostructure diffusion-strengthened alloys. Liu has led or undertaken major national-level PRC research projects, including those under the 863 Program and "XX equipment preliminary-research programs."[76]

- Another coauthor, Tan Liming (谭黎明), is an associate researcher and postgraduate supervisor at SKLPM. His research focuses on data-driven, high-efficiency design of high-temperature alloys and coating materials, powder metallurgy and additive manufacturing, and "the service behavior and performance of high-temperature materials under demanding conditions." Tan Liming has led and participated in provincial and national-level research projects, including a "XXXX preliminary research program."[77]

Another article published in 2023 and coauthored by UTK's Dr. Liaw, SKLPM, and the Advanced Powder Metallurgy Team involved research on laser smelting and additive manufacturing. SKLPM researchers included Liu Bin, Duan Heng, Cao Yuankui, and He Junyang, along with researchers from the Hunan University's State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body. Dr. Liaw acknowledged support from the NSF under awards DMR-1611180 and DMR-1809640.[78]

- Liu Bin (刘彬) is a professor and doctoral supervisor, Vice President of the Powder Metallurgy Research Institute, and Director of the Nuclear Materials Branch of the Chinese Nuclear Society. His research focuses on intermetallic compounds, composite materials, powder

metallurgy, and thermal processing technologies.[79]

- Cao Yuankui (曹远奎) is an associate professor at CSU focusing on advanced metallic materials research, including aerospace and biomedical titanium alloys and high-entropy alloys. He has presided over multiple research projects, including "XX Unit Technology preliminary research projects."[80] This likely refers to an unnamed PLA unit engaged in classified research.

Although beyond the scope of this study and the collected corpus, a cursory survey of articles coauthored by Dr. Peter Liaw shows that he has collaborated with CSU and SKLPM-affiliated researchers since at least 2008 and has continued to publish with SKLPM through early 2026. Some of these publications acknowledge funding support from the ARO.

Additionally, Dr. Liaw has engaged in research collaborations with multiple high-risk PRC defense research entities, some of which appear on US government restricted-entity lists. For instance, in 2021, Dr. Liaw coauthored research with the China Academy of Ordnance Science (a subsidiary of state-owned defense conglomerate China North Industries Group Corporation, or NORINCO) on projects supported by NSF and ARO.[81] In 2025, Dr. Liaw coauthored an article with CAEP's Institute of Materials that credited NSF funding.[82] And most recently, Dr. Liaw published an article in January 2026 with researchers from SKLPM and the PLA's National University of Defense Technology.[83] Thus, Dr. Liaw appears to have maintained longstanding research relationships with known PRC defense entities while receiving federal funding support. This represents an abject failure by both the federal funders and UTK to recognize the critical research security risks such partnerships represent.

B. Case Examples of Other Collaborations on US-Funded Research in Weapons-Relevant Technologies

The following examples represent a small sampling of other collaborations posing critical national security risks and involve US government–funded research projects in advanced weapons-relevant technologies. This includes directed energy systems, energetic materials, radar and sensing, AI, flexible electronics, and high-performance computational physics, funded by the Navy, Air Force, NSF, and DoE. These research collaborations offer the PRC military exposure to sensitive US technical development and capabilities and illustrate the US government and academia's negligence in its responsibility to safeguard research in critical technology areas.

Example 1: US Navy–Funded High-Power Microwave Research and PRC Defense Research Institutions

An article published in October of 2019 in the collected corpus involved research supported by an approximately $400,000 ONR grant to the University of New Mexico's program on advanced high-power microwave research. The research in the article, titled "A 'Crab-like' 12-cavity Relativistic Magnetron with Diffraction Output Driven by a Transparent Cathode," was led by University of New Mexico (UNM) Principal Investigator and Distinguished Professor Edl Schamiloglu.[84] Dr. Schamiloglu is a recognized expert in high-power microwave technologies for the Department of Defense[85] and has led the university's multi-decade research in microwaves and high-power electronics, including the Air Force Research Laboratory-funded Directed Energy Center.[86]

The article lists coauthors affiliated with several PRC institutions that conduct defense research, including at least one official PRC defense key laboratory. These entities include Xi'an Jiaotong University, the Beijing Vacuum Electronics Research Institute, the University of Electronic Science and Technology of China, the State Key Laboratory of Complex Electromagnetic Environment Effects on Electronics and Information Systems (CEMEE) (电子信息系统复杂电磁环境效应国家重点实验室), and the "Science and Technology on High Power Microwave Laboratory"[87] (known in Chinese as the National Defense Science and Technology Key Laboratory on High-Power Microwave Technology – 高功率微波技术国防科技重点实验室). CEMEE resides within the Luoyang Electronic Equipment Test Center (洛阳电子器材检验中心) and, according to two Internet sources,[q] is reportedly a cover for PLA Unit 63880.[88]

Another concern is that the PRC provided funding for this research in addition to the ONR (grant no. N00014-19-1-2155). The article acknowledges funding support from CEMEE, the Shaanxi Provincial Government Surface Project, and the National Natural Science Foundation of China (NNSFC). It is clear that both the US and the PRC pursued this research for defense/military purposes. ONR's grant involved the "Ultra-High-Efficiency Relativistic Magnetron and Improved MILO Capabilities" program.[89] UNM documents, theses, and project abstracts link this grant to its long-standing magnetron work.[90] According to the ONR "Directed Energy Weapons (DEW) High Power Microwave (HPM) 6.1 Programs FY21 Annual Report," the project builds on almost two decades of UNM research into relativistic magnetrons, with notable breakthroughs in collaboration with the Naval Surface Warfare Center Dahlgren Division. This Navy program is intended to address asymmetric electronic threats to US forces, ranging from small drones and commercial off-the-shelf devices to potential attacks against high-value targets such as embassies and naval assets in contested waters.[91]

[q] We are unable to independently verify whether CEMEE is directly subordinate to a PLA unit or an officially designated defense key laboratory. As such, we excluded this laboratory from the list of 45 defense laboratories described in the study.

Example 2: US Navy and Defense Threat Reduction Agency-Funded Explosives and Biodefense Research with 'Seven Sons' Universities

Three articles identified in the corpus were funded by the DoD through a $2 million award from ONR on "High Energy Components"[92] and a $2.7 million award from the Defense Threat Reduction Agency (DTRA) on "Halogen-Containing Compounds for Neutralizing Biological Agents"[93] focused on explosives and biodefense research. Researchers from the University of Idaho, the US Naval Research Laboratory, and PRC defense laboratories at two of China's "Seven Sons of National Defense" universities, namely HIT and the Beijing Institute of Technology (BIT), collaborated on this research. The articles described compounds that push the boundaries of modern explosives and biocidal energetic materials: high explosives that are comparatively insensitive to heat, shock, or friction. The research involved the development of new compounds that are powerful and safer to store and handle, can function as explosives under extreme thermal conditions, and can be designed for systems that neutralize biological threats. This research was directed by Professor Jean'ne M. Shreeve in the University of Idaho's Department of Chemistry.[94] Shreeve was also the university's vice president for research for 12 years.[95]

- One article titled, "5-(4-Azidofurazan-3-yl)-1-hydroxytetrazole and Its Derivatives: From Green Primary to Secondary Explosives," listed two coauthors from the (US) Naval Research Laboratory, four coauthors from the University of Idaho, two of whom also claimed affiliations with the HIT State Key Laboratory of Advanced Welding and Joining and HIT's Research Center of Flexible Printed Electronic Technology, and another researcher from HIT's welding laboratory. HIT's welding laboratory is a defense laboratory and is profiled in Section III of this study. The research was funded by the ONR (no. N00014-16-1-2089) and DTRA (HDTRA1-15-1-0028) alongside China's Shenzhen Graphene Manufacture Innovation Center, other Shenzhen municipal funding, and the Thousand Talents Youth Plan.[96] Coauthor Yin Ping, affiliated with the University of Idaho in this publication, was supervised by Jean'ne M. Shreeve from 2012 to 2018 and then returned to China to work at BIT as a selectee of the "Overseas High-Level Young Talent Program," which likely refers to the overseas component of the Thousand Talents Plan.[97]

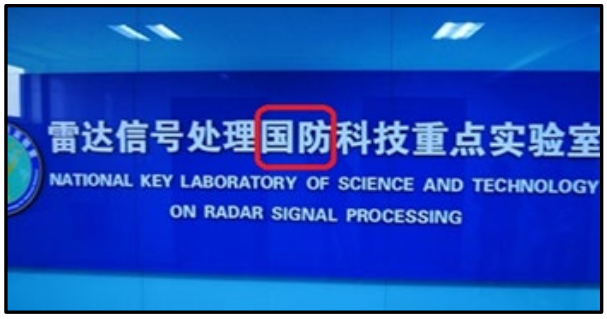
- Another article titled, "Sodium and Potassium 3,5-Dinitro-4-hydropyrazolate: Three-Dimensional Metal–Organic Frameworks as Promising Super-heat-resistant Explosives," included many of the same coauthors as the article discussed above, who are affiliated with HIT's State Key Laboratory of Advanced Welding and Joining and the Research Center of Flexible Printed Electronic Technology, the University of Idaho, and the Naval Research Laboratory. The same ONR and DTRA funding sources were acknowledged.[98]

- The third article titled, N,N'-Methylene-bridged Nitroiodoazoles: Biocidal Compounds with Enhanced Thermal Stability," listed researchers from the University of Idaho and several entities of BIT: the State Key Laboratory of Explosion Science and Technology (爆炸科学与技术国家重点实验室), the Experimental Center of Advanced Materials, the Chongqing Innovation Center, and the Yangtze Delta Region Academy. The article acknowledges the aforementioned ONR and DTRA grants as funders, as well as the NNSFC.[99] The BIT explosion science laboratory and the HIT welding laboratory (listed in the previous articles) are defense laboratories directly supervised by SASTIND.[100] Coauthor He Chunlin claimed affiliations with the University of Idaho and the BIT organizations. He was a postdoctoral fellow at the University of Idaho from 2011 through 2018 before returning to BIT in 2018 as a professor and doctoral supervisor recruited through the "Overseas High-level Talents Program (likely referring to the Thousand Talents Plan)." His faculty profile notes he has led and participated in multiple national PRC research projects, including a classified "XXX special project."[101]

Example 3: US Air Force–Funded Research on AI Target Tracking with a PRC Defense Radar Laboratory

This example involves a publication coauthored by Distinguished Professor Pramod Varshney from the Department of Electrical Engineering and Computer Science at Syracuse University and researchers from Xidian University's "National Key Laboratory of Radar Signal Processing" (雷达信号处理全国重点实验室). The laboratory's other Chinese name (雷达信号处理国防科技重点实验室, translated as the National Defense Science and Technology Key Laboratory of Radar Signal Processing) is still used in Chinese-language sources and scientific publications, even though it was changed in 2023 as part of the reorganization of China's state key laboratory system.[102] The laboratory's website appears to have removed all references to the laboratory being a defense key laboratory, with one exception: a 2011 news item includes a photo of the laboratory's sign, pictured in Figure 3, that uses the Chinese terms for "national defense" in its name (red frame added for this study), yet the English below it excludes them.[103]

Figure 3: Sign from the National Key Laboratory of Radar Signal Processing showing "national defense" in its title



The research in the article, titled "Long Short-term Memory-based Deep Recurrent Neural Networks for Target Tracking,"[104] was supported by an $800,000 Air Force Office of Scientific Research (AFOSR) grant (no. FA9550-16-1-0077) through the Dynamic Data Driven Application Systems program.[105] This research

involves AI-based target tracking and "situational awareness" with direct applications in military sensing. Xidian University is one of China's primary schools for military electronics and communications and is supervised by SASTIND and the large state-owned defense conglomerate, the China Electronics Technology Group Corporation. The PRC officially designates this radar laboratory as a national defense key laboratory, despite efforts to obfuscate this connection in English-language sources and scientific publications.

The article also acknowledges PRC funding sources, including the NNSFC, the Fundamental Research Funds for Central Universities, and the "Fund for Foreign Scholars in University Research and Teaching Programs (the 111 Project)." The 111 Plan (or Project) is a national-level PRC talent recruitment program that hires experts from overseas to help lead/guide research teams in China. Professor Varshney has held an "Honorary Guest Professor" position at Xidian University,[106] which is probably associated with the acknowledged 111 Plan (or Project) in the article. Professor Varshney's university profile states that his research "has been generously funded for over four decades by the Department of Defense."[107] The military applications of the underlying research include tracking maneuvering targets, supporting surveillance and reconnaissance, detecting small or hard-to-see aircraft, and improving missile tracking and fire-control systems.[108]

Example 4: NSF-Funded Automotive Radar Research with PRC Radar Defense Laboratory

Another article in the corpus involved researchers from Xidian University's National Laboratory of Radar Signal Processing. In this case, a University of Florida professor coauthored an article with three researchers from Xidian's defense radar laboratory, one of whom was also affiliated with the University of Science and Technology of China. The article, titled "Target Detection Exploiting Covariance Matrix Structures in MIMO Radar," acknowledged funding from the NSF alongside PRC national and provincial science foundation grants.[109]

The $270,000 NSF grant associated with this article involves "Enhanced Automotive Radar Coexistence and Performance."[110] While the research may have been intended for automotive applications, the work can improve the capabilities of military radar systems, including surveillance, target detection, resistance to jamming, and tracking for weapons and missile-defense systems. These same advances are widely adopted in defense radars because they allow more reliable detection and tracking in difficult or contested environments.[111] [112]

The PRC collaborators are clearly interested in military applications, given the involvement of a key defense radar laboratory and at least one of the PRC research funding sources: the National Science Foundation of China grant (no. 61571349) acknowledged in the article specifically states that research program seeks to develop "waveform design of vector OFDM [orthogonal frequency division multiplexing] radar in deception jamming scenarios."[113] Deception jamming scenarios

include disrupting radar lock-on to protect aircraft from missile-guided threats and self-protection scenarios where the jammer assumes the role of the target of interest and uses deception strategies to remain undetected.[114] In other words, the seemingly innocuous US research funded by NSF on automotive radar coexistence and performance is being used to enhance PRC military radar capabilities and electronic warfare domains.

Example 5: US Air Force–Funded Flexible Electronics Research Linked to PRC Defense Manufacturing Laboratory

Another article, whose research was supported by the US Air Force, involved Stanford University Professor Zhenan Bao and Yu-Qing Zheng, a researcher from the National Key Laboratory of Advanced Micro and Nano Manufacture Technology (微米/纳米加工技术国家级重点实验室). The paper, titled "Molecularly Designed and Nanoconfined Polymer Electronic Materials for Skin-like Electronics," involved research on making stretchable, skin-like electronic materials. The result is a new class of flexible plastics that maintains good electrical performance even while bending, stretching, and conforming to skin.[115]

The work acknowledges support from three Air Force Office of Scientific Research Stretchable Semiconductor grants (nos. FA9550-18-1-0143, FA9550-21-1-0413, and FA9550-25-1-0008) totaling $1.2 million.[116] [117] [118] PRC funding was also acknowledged, including the STI 2030-Major Project, the NNSFC, Fundamental Research Funds for the Central Universities, and the 111 Project. It is not clear whether one or both of the coauthors were funded through the 111 Project talent program. Yu-Qing Zheng was previously a postdoctoral researcher under Professor Bao at Stanford before returning to China and being appointed as a tenure-track assistant professor at Peking University's School of Integrated Circuits.[119]

Although presented as foundational materials science research, the work is supported by the Air Force and involved collaboration with a PRC defense laboratory. The National Key Laboratory of Advanced Micro and Nano Manufacture Technology is known by two Chinese names. One aligns with the English name as a national key laboratory; the other (微米/纳米加工技术国防科技重点实验室) uses the terms for "national defense science and technology" (国防科技).[120] This laboratory is jointly run by Peking University and Shanghai Jiao Tong University (there appears to be a branch at each university).

With support from the Air Force, Professor Bao's team designed the first semiconductor material that is electrically active, intrinsically stretchable, and fully biodegradable.[121] Citing Bao's research, the Air Force says these flexible electronics could have a number of new uses, including compact antennas, adaptive devices in aircraft bodies and missiles, flexible sensors that detect mechanical changes, and use in 360-degree air surveillance applications. The Air Force further noted that the ability to synthesize and integrate truly thin films of soft semiconductors enables wholly new applications to improve performance and reduce the size, weight, and power of defense and commercial systems.[122]

5. Conclusion and Recommendations

Federal agencies and academic institutions have largely been allowed to set their own policies on research security and integrity. While National Security Presidential Memorandum-33 (NSPM-33) revised guidelines and disclosure requirements for federal research grant recipients, including foreign affiliations and commitments, it was vague in some areas, such as a lack of specificity regarding the requirements of research security programs that universities must establish. **This study shows that US research security policies and programs to date have had little to no effect in safeguarding research, including federally funded research.** This study centers around the assumption that formal or informal engagements and research collaborations with official People's Republic of China (PRC) defense laboratories represent some of the most critical risks to US national security, equivalent to those associated with working directly with the PRC military.

This study, along with previous reports published by the Center for Research Security & Integrity (CRSI) and the House Select Committee on China, shows that high-risk collaborations between US institutions and federal research facilities with entities linked to China's defense R&D are widespread. We thus conclude that US universities are largely focused on regulatory compliance rather than safeguarding federally funded research; similarly, federal funding agencies largely ignore national security risks when disbursing research dollars. **This raises a fundamental question: if collaborating with PRC defense laboratories is not considered an unacceptable risk that should be restricted, then what is?**

Fundamental research in the US is subject to little regulatory oversight, which helps explain why US research institutions and their federal sponsors have done little to address and mitigate national security risks. For decades, the unrestricted nature of international scientific research collaboration was intentional and served the US well. This was largely because the most important players in the global scientific enterprise shared similar political systems, standards of scientific research, institutional autonomy, and academic freedom. That is no longer the case, as China, the world's most powerful authoritarian nation, has become deeply integrated into global STEM research.

US government policy currently has only two, narrowly defined restrictions on fundamental research collaborations with adversarial nations, particularly China. The first restriction (commonly referred to as the "Wolf Amendment") prohibits recipients of NASA research funding from collaborating with most PRC entities on a strictly bilateral basis. This only applies to research projects funded by NASA. Additionally, multilateral engagements in which the US, China, and a third country collaborate on research or hold conferences or other exchanges are not subject to this NASA restriction. The second restriction is a newer rule stipulated in Section 238 of the Fiscal Year 2025 National Defense Authorization Act (NDAA) that makes institutions ineligible for Department of Defense funding for fundamental research if the US institution collaborates with

a specific set of PRC entities and malign foreign talent programs named in accordance with other NDAA provisions (e.g., Section 1286 of the Fiscal Year 2019 NDAA).

All other sources of federal funding have no restrictions. US institutions are free to partner, establish cooperative programs, or collaborate on fundamental research with any PRC entity of their choosing, even those that are on the BIS Entity List for export controls or sanctioned by the US Treasury Department. As the House Select Committee on China explained, "The Commerce Department uses the Entity List to restrict designated persons (including companies and research institutions) that raise national security concerns from accessing certain sensitive goods, services, and technologies without a license…US academics who work with blacklisted PRC universities are not only legitimizing the blacklisted institution – they are helping that institution develop the sensitive technologies that the US is trying to prevent China from obtaining."[123]

No single actor is accountable for preventing high-risk research collaborations. Rather, the current US system creates a condition of structural irresponsibility: universities point to federal agencies and assert that they have complied with all applicable rules; funding agencies have argued that they do not manage or oversee research collaborations; and federal program managers are incentivized to prioritize scientific merit and the timely obligation of funds over national security risk. Responsibility for research security is thus diffused across institutions and funding agencies, ensuring that no actor is accountable for preventing high-risk collaborations.

It is important to note that this study only examined one aspect of how China exploits fundamental research for its military (and economic) advantage. China has a vast, state-directed technology acquisition apparatus that encompasses talent recruitment programs, military-civil fusion policies, industrial policies, lawfare, and a network of foreign partnerships. These mechanisms have enabled the PRC to acquire sensitive technologies and technical know-how, which it uses to compete directly with the US in critical technology areas and warfighting capabilities. *This makes the lack of adequate safeguards even more damaging than what is reflected here.*

Addressing Arguments Opposing Restrictions to Collaboration with PRC Entities

The scientific research community has used several, often related arguments to defend PRC collaborations that pose national security risks. Some of these arguments are listed below, followed by our rebuttals.

- Fundamental research is published, thus restricting any collaboration is pointless since the research will be shared. Any entity could use the published results in any fashion, and through this sharing, the science will be further enhanced and developed for everyone's benefit.

- In many cases, the researchers are focusing on a theoretical problem, or the research is at an early stage where any potential commercial or weapons applications are not realizable for the foreseeable future.

- The researchers involved in the collaboration are pursuing strictly civilian fields. Most STEM disciplines have the potential to be dual use, and anticipating potential future military uses is impractical. Placing restrictions on international collaborations and academic freedom would do more harm than good, as such restrictions stifle innovation. Nations that remain open will leap ahead of the US and undermine our technological and economic competitiveness.

- Collaborations are mutually beneficial. There are even benefits to the US government, especially the Department of Defense (DoD), in pursuing research collaborations with PRC defense research entities; we can gain insights into what the PRC organizations are researching, who the key players are, and in some cases, apply knowledge the PRC has gained in technologies or techniques that surpass our own capabilities.

First and foremost, publishing research results does not imply that the entire research life cycle is shared. The process of conducting scientific research requires extensive applied knowledge, technological expertise, and experience. Research publications typically do not include the raw data, pre-patented information, details of certain processes/techniques, etc. The know-how not captured in the resulting publications can be enormously valuable, and the practical knowledge and experience gained from conducting research often form the basis for breakthroughs and applications.

If all such knowledge and technologies could be obtained and replicated simply by reading published articles, there would be little need to engage in extensive research collaborations and international exchanges. China would not need to send hundreds of thousands of students (especially graduate students in STEM disciplines) to the US and other allied nations or create hundreds of talent programs designed to recruit experts from around the world if it could build on the research based solely on examinations of published literature.

Second, academic freedom and the value of open international scientific collaboration are often portrayed as sacrosanct, yet such reductive arguments lack nuance. Restricting *some* collaboration with *select* PRC entities does not equate to severing all international research ties. Furthermore, claims that collaboration is mutually beneficial ignore a fundamental asymmetry: US research institutions operate under norms of openness, disclosure, and academic freedom, while PRC defense laboratories (among many other PRC research institutions) operate within a closed, state-directed system that selectively withholds information, are mandated to support military-civil fusion efforts, classify downstream applications, and shield personnel and programs from scrutiny. This one-way transparency enables systematic exploitation rather than reciprocal exchange.

This study provides examples of how PRC entities are obfuscating their structures and missions. This lack of transparency violates the norms of academic openness, undermines trust, and complicates due diligence efforts.[r] **Neither US academic institutions nor the US government appears to consider transparency, integrity, and reciprocity issues as risk factors before engaging in collaborations with PRC organizations.**

Third, distinguishing between "fundamental" (which should remain unrestricted) and "applied" research offers little protection. Many of today's most consequential military technologies originated as theoretical concepts and basic research before advancing through normal scientific development pathways. By the time applications become apparent, the opportunity to protect the research has often already passed – especially when high-risk entities have participated throughout the research life cycle.

Similarly, understanding who your research partners are is essential to safeguarding research, regardless of whether that research is basic or applied, or intended for civilian or military use. The PRC is adept at exploiting or diverting seemingly innocuous research areas for potential military use. Fundamental research can have an outsized impact on national security. It is dangerous to assume that PRC defense research institutions treat such collaborations as purely theoretical activities. Under the PRC's military-civil fusion strategy, industrial planning regimes, and formally designated priority technology areas, research outputs – particularly in advanced materials and manufacturing – are systematically evaluated, absorbed, and transitioned into the defense industrial base. PRC entities do not compartmentalize US-enabled research from their military objectives; they integrate it.

Over 71 percent of the US government funding identified in this study came from the National Science Foundation (NSF), which supports basic scientific research. Some articles credit both DoD and NSF funding sources, showing that even the US military has an interest in defense applications of the fundamental research NSF supports. Given that the partnering PRC defense laboratories principally support China's military and defense industries, the US partners' intentions are largely irrelevant from a risk standpoint.

Furthermore, the purpose of DoD research funding, even within fundamental research domains, is not simply to advance abstract scientific knowledge, but to develop capabilities that support US warfighting capabilities and preserve technological superiority over adversaries. For instance, program managers at the Army Research Office, particularly those overseeing portfolios in advanced materials, additive manufacturing, and next-generation munitions, award grants to universities (e.g., the University of Tennessee, Knoxville) with the expectation that the resulting research will inform or enable future defense applications, such as advanced alloys, smelting processes, and manufacturing techniques critical to military systems. Collaborations with high-risk

[r] Another CRSI publication offers a detailed study on how PRC entities violate transparency and integrity risks and the harmful impact this has on international scientific collaborations (see: https://researchsecurity.org/wp-content/uploads/2024/09/CRSITransparencyIntegrity_web.pdf).

PRC entities undermine the strategic purpose of DoD-funded research and erode US technological and military advantage.

Last, it is true that the PRC has excelled in some scientific disciplines and engages in cutting-edge research that makes it a more attractive research partner than it was even a decade ago. However, our R&D and innovation ecosystem differs in critical ways from the PRC's, where the party-state directs efforts to absorb technologies from around the world (through licit and illicit means) and transfers them to commercial enterprises to compete with and displace foreign firms.

Furthermore, the PRC has not operated in a vacuum; *it has relied on and benefited extensively from international partnerships, specifically pursuing engagements with institutions worldwide that lead in critical technologies deemed a development priority by the PRC party-state*. The collected corpus used in this study focused on more recent collaborations, but other studies have shown that the US and its key allies have collaborated with PRC defense research entities for decades. These engagements also embed PRC defense research organizations and laboratories within global scientific networks, enhance their legitimacy and visibility, build durable training and talent pipelines, and improve their ability to attract resources and partners.

For instance, the DoD has expressed grave concern over the threat China's hypersonic weapons program now poses to our national security and regional security in the Indo-Pacific; yet US public and private institutions continue to work with PRC institutions that are known to support hypersonics research, such as missile design and production facilities and material science laboratories that conduct defense aerospace research. Moreover, the claim that the US, and especially the DoD, can learn from and benefit from collaborations with certain PRC defense research entities has not been substantiated in any demonstrable way. Most of the research collaborations with high-risk PRC entities are informal in nature; as such, the US government and oftentimes administrators at researchers' employing institutions are largely unaware that this collaboration is even taking place.

Grant program managers at federal funding agencies do not monitor the activities of funding recipients post-award for national security risks, nor do they conduct adequate due diligence to identify with whom grant recipients are working. Agencies often do not have complete information on all key personnel involved in the research associated with a specific grant. Given the lack of transparency (i.e., deliberate obfuscation of their activities) of many defense-affiliated research entities in China *and* the lack of due diligence by academia and the US government, how then are the US government and academic institutions learning from and sharing critical information on the activities of the PRC entities they collaborate with in any systematic fashion?

Recommendations

1. Congress should pass the Securing American Funding and Expertise from Adversarial Research Exploitation Act of 2025 (SAFE Research Act).

The SAFE Research Act will go a long way in closing yawning loopholes that allow largely unrestricted collaborations with PRC entities, even defense research laboratories surveyed in this study. The legislation would prohibit federal STEM research funding for individuals and institutions that collaborate with foreign adversary-controlled entities that pose a national security risk. It would also prohibit all DoD funding to any university that partners with specific foreign adversary-controlled entities. A process for exceptions or waivers is also stipulated, as there may be a few cases in which the US government has a particular interest in allowing a collaboration to proceed.[124]

The current framework, which allows individual agencies and universities to set their own policies on research security, has failed and thus necessitates new rules. Placing restrictions on taxpayer dollars will mitigate some of the risks. This legislation would also better align research security policies with US export control and sanctions regimes. A similar rule was introduced in Canada in 2024.[s] Harmonizing US research security policies with its neighbor, closest ally, and key research and trade partner is also important and can set a precedent for other allied nations to follow.

1a. Prior to new legislation, federal agencies should deny funding to any institution for future research grants, contracts, or cooperative agreements that would involve formal or informal collaborations with select entities of adversarial nations.

Scientific funding agencies should proactively take ownership of their awards using their administrative authorities, given the persistence of critical national security risks that remain unmitigated and the lengthy process of passing new legislation. They should update grant/contract terms and conditions, such as denying funding for new research projects based on the same criteria outlined in the SAFE Research Act.

[s] The Canadian government issued a policy that will deny federal funding for research grants if that research involves collaborations with specific PRC (and Russian and Iranian) institutions in specified critical technology fields. This policy on "Sensitive Technology Research and Affiliations of Concern" was established in the fall of 2024.

1b. The US government should add all of the PRC defense laboratories in Appendix A to restricted entity lists for the purposes of restricting federal funding.

Only six PRC defense laboratories are currently on the DoD's list of foreign institutions engaging in problematic activity as described in Section 1286 of the Fiscal Year 2019 NDAA.[125] The remaining laboratories identified in this study should be added to the DoD's list to ensure that federal funding is also not allocated to any US entity collaborating with these PRC organizations.

2. Create a Government-run National Research Security, Integrity, and Compliance Center.

Policymakers should support the establishment of a new government structure, notionally referred to as the National Research Security, Integrity, and Compliance Center (NRSICC), that consolidates all US government approaches to research security and integrity policy development, vetting, due diligence, risk assessments, and grant and contract compliance monitoring and enforcement.

New legislation, such as the SAFE Research Act, must be accompanied by consolidated compliance monitoring and support efforts. The NRSICC would create government-wide standards and processes for risk assessment and mitigation, investigations, and support to research institutions. The government has a responsibility to protect critical technology and mitigate malign foreign influence within our research ecosystem, yet current approaches have failed to do so. A sampling of reasons[t] includes:

- Government approaches to research security mitigation have largely been limited to pursuing criminal cases related to espionage, intellectual property theft, or false statements to federal agents. Most of the national security threats posed by China within fundamental research domains involve legal or extralegal activities that criminal statutes do not address.

- Similarly, government investigations related to research security are transactional and tactical in nature; little thought is given to strategic approaches to disrupt and dismantle national security threats. This is further hampered by a lack of expertise on the scale, scope, and complexity of research security threats (especially from the PRC). Yawning knowledge gaps persist, some of which originate from a devaluation and descoping of open-source intelligence within the Intelligence Community.

[t] For additional background on the problems and challenges facing both the US government and academia and failures of current approaches, see: "Fox in the Henhouse: The US Department of Defense Research and Engineering's Failures to Protect Taxpayer-funded Defense Research," House Select Committee on China, September 2024; and "Assessing the Threat to US Funded Research," testimony provided by Jeffrey Stoff for a hearing of the US House of Representatives Committee on Science, Space, and Technology – Investigations and Oversight Subcommittee, March 5, 2025.

- Vetting of foreign nationals *prior to* grant or contract award, if done at all, is insufficient: the PRC party-state targets, recruits, and co-opts individuals *after* they have expertise and access to critical research in the US (many of whom are US citizens). The US government has few resources or processes in place to monitor for national security risks *post-award* of a grant or contract.

- Program offices that award research grants or contracts to academia lack comprehensive tools, technical solutions, or capabilities to assess risk or screen grant applicants for potential national security concerns. These handicaps have led to inconsistent standards and practices for assessing risk and exploitation by individuals and institutions that can game the system in seeking grant or contract awards; one agency or subdivision may deny funding for a project on national security grounds, only to have another component approve the same project.

- Responsibility for conducting due diligence and risk assessments falls mostly on individual research institutions and faculty overseeing research projects. This is problematic as individuals and institutions lack sufficient information or subject matter expertise on China and its research ecosystem and the corresponding geostrategic risks. It also creates an unequal playing field where large, well-funded universities with facility clearances have far more research security resources at their disposal than smaller state schools.

The NRSICC should be established as a central government entity that has the authority to oversee all research security and due diligence functions for federal agencies that fund fundamental research. This would overcome the current challenges of siloed missions, information sharing and knowledge deficiencies, and inconsistent risk standards and vetting processes. Additionally, there would be substantial cost savings by removing duplicative efforts: due diligence and vetting functions of multiple agencies would be consolidated into a single organization.

The CRSI recommends the following lines of effort for the NRSICC. *Note that this is not an exhaustive list of functions or activities the center should undertake; rather, our focus is on key areas that will be essential to its success.*

A. Consolidated Data Analysis, Due Diligence, Risk Assessments, and Support to Investigations

All applications, periodic submission reports, and related documents pertaining to fundamental research grants, cooperative agreements, and Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) contracts awarded by federal agencies should be housed at

the NRSICC. This ensures that fundamental research due diligence is done by a single entity with a single set of risk assessment standards and mitigation framework.

- The NRSICC should create and manage a single list of foreign entities and programs that are sanctioned, violate export control laws, or represent national and economic security risks. This includes but is not limited to: foreign malign talent programs; foreign defense research and industrial base entities; entities involved in human rights abuses; and any other entity or program that engages in the transfer or diversion of human/intellectual capital, technology, or know-how to defense or ethically troubling activities.

- NRSICC analysts should conduct deep-dive due diligence research and analysis on government (fundamental) research grants and SBIR/STTR contracts to determine risk levels and recommend prohibitions/denials of funding.

B. Due Diligence and Risk Assessment Support to Academia and the Private Sector

The NRSICC's responsibilities must not be limited to compliance and enforcement functions. The US government needs to play a more active role in supporting our innovation ecosystem. It is unrealistic and inefficient to have universities identify and assess research security and integrity risks entirely on their own. The center should provide direct support to public and private institutions that have received or are applying for federal research grants, cooperative agreements, or SBIR/STTR contracts or grants.

Canada, the Netherlands, and the UK have established government offices (sometimes referred to as national points of contact) that assist universities in assessing risks to specific research partnerships. As government offices, they can tap into a variety of resources, including their intelligence agencies, to offer insights that academia cannot provide on its own. The NRSICC should function similarly and work with key allies to share information, create consistent risk assessment and mitigation standards, and develop or combine training programs for research-performing organizations.

C. Research Security and Integrity Policy Development and Training

The NRSICC needs to develop new government-wide policies on research security and integrity issues. In coordination with relevant agencies and White House offices, the NRSICC should develop and design policies that apply to all federal research grants and contracts in fundamental research domains. Policy development should include:

- Create or refine standardized application forms, periodic reports, and supporting documents on all federal research grants and SBIR/STTR awards to ease the compliance burden on awardees and to consolidate information on all grant and contract awards.

- Track information on and develop new policies in response to China's integrity and reciprocity failures affecting federal research investments. The NRSICC should create specific policies that impose costs on malign activities by the PRC (and other authoritarian nations) that violate commonly accepted values and norms related to scientific research.

- Build a collection and analysis program to close persistent knowledge gaps on PRC entities that pose risks to US national interests and oversee the process for nominating entities that would be restricted.

- Harmonize lists used in US export control and sanctions regimes with research security policies. Develop and refine due diligence and risk assessment methodologies and set standardized (government-wide) rules on federal award approval and denial decisions.

- Develop and deploy practical training programs to build expertise and competency on China among data analysts and risk assessors in both government and academia. Most research security training and conference activities have focused on raising awareness of threats and building institutional processes and procedures for improved governance. These efforts are important, but there is a scarcity of programs that focus on more granular topics, such as primers on PRC policies, programs, methods, and infrastructures that support malign influence and technology transfer activities.

3. The US government and allied nations should incentivize new approaches to safeguarding research and innovation. Civil society institutions should form consortia that combine their capabilities to address persistent knowledge gaps and develop new "research on research security" programs.

The proposed NRSICC can play a critical role within the US government in making research security policies and programs more effective. However, safeguarding research and innovation and upholding (and enforcing) common standards of transparency, integrity, reciprocity, and human rights or other ethical issues is too large and complex for a single organization, or even a single nation, to undertake. Governments of the G7, Five Eyes, NATO, Indo-Pacific allies, and other liberal democratic nations need to support the creation of consortia of public and private organizations that combine their respective capabilities to address knowledge gaps that undermine the effectiveness of research security efforts. Civil society entities, such as think tanks, NGOs, academic institutions, government-run laboratories, private sector firms with unique data or

analytic tools/services, and investigative journalists, should collaborate on specific projects focused on practical solutions, knowledge building, case studies, and data sharing.

US and EU governments have begun supporting research projects related to research security – sometimes referred to as "research on research security." These are important efforts that a consortium of organizations can support. However, (at least) US efforts to date are largely misguided and impractical. They primarily take an academic approach to research security challenges, such as exploring theoretical social and behavioral science domains. This cannot be the sole or primary approach. From the perspective of assessing the risks posed by China, safeguarding research from specific PRC threats to research collaborations is primarily an information/intelligence collection and analysis problem. "Research on research security" should address persistent knowledge gaps so that practitioners of research security are better equipped to advise faculty, administrators, and government policy and investigative arms on identifying and eliminating specific risks.

Relatedly, research security must be defined more broadly than it is in the US, which primarily views the problem through the lenses of espionage, intellectual property theft, or regulatory compliance. This approach is too narrow and tactical, and it overlooks many of the risks. The security of our R&D must also include issues of trust, integrity, economic competitiveness, and a broader understanding of how knowledge is transferred, diverted, and applied by nation-state actors like China.

More practical research projects should address areas lacking scholarship to better equip research security practitioners and policymakers. Key questions research projects should seek answers to include:

- How do PRC universities and laboratories integrate with PRC industry – both nominally private and state-owned enterprises? What are all of the university-owned commercial enterprises (or those in which universities have ownership stakes) in a given technology? Who runs those companies? How do PRC commercial sector interests and their ties to academia influence the research carried out, or even the content of published literature? To that end, to what extent does the PRC use academic research as an instrument of its industrial policy?

- What are all of the subsidiaries of PRC state-owned defense conglomerates that house research institutes and conduct defense R&D, or sponsor research at academic institutions? Similarly, what are all the national, provincial, or Chinese Academy of Sciences "key laboratories" that conduct defense research or partner with PRC military organizations (but are not officially designated as defense laboratories)?

- What (and where) are the centers of excellence in China in fields considered by the US and EU as critical or emerging technologies (e.g., quantum, biotechnology, semiconductors)? What laboratories or other divisions of research institutions are involved, and who are the key

leadership and research personnel? To what extent do these centers of excellence support the PRC's defense apparatus? What role and to what extent do international collaborations play?

- What does the PRC's public security and mass surveillance research base that enables human rights abuses look like? How do surveillance technology firms integrate with academia? Which entities supporting surveillance-related research collaborate or partner with foreign organizations?

- Have PRC data-sharing rules and restrictions negatively affected what can be included in publications? To what extent has the PRC restricted other nations' access to datasets, domestic scientific publications, etc., and who systematically tracks this?

- What does the life cycle of a research project involving international collaborations with the PRC look like? That is, who initially solicited the collaboration, and how did that originate? How is the research conducted across borders? Who is involved in the peer review of draft publications, and if some of those reviewers/evaluators are from the PRC, who are they and how did they become involved? Similarly, who are the publication's editors and editorial board members?

Each of these topical areas requires substantial research and analysis projects that are better suited to being carried out by a consortium of organizations, including academia. Additionally, building international partnerships on such projects would further enhance trust and buy-in from allied nations.

Appendix A: List of Identified PRC Defense Key Laboratories

The table that follows lists the 45 People's Republic of China (PRC) key laboratories that are officially designated as national defense laboratories based on the four categories outlined in Section 1B. **This list is limited to the defense laboratories that have collaborated with US organizations appearing in the collected corpus of articles (i.e., there are many other defense laboratories in China not included here).** The table includes all identified English and Chinese name variants, the parent institution (where the entity resides), and sourcing notes that indicate the entity is designated as a defense laboratory.

Observed Defense Lab Name(s) in Chinese; [Literal Translation]	Observed English Name(s) Appearing in Publications	Parent Entity [Chinese Name]	Sources Indicating Entity Is a National Defense Lab
先进高温结构材料国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Advanced High Temperature Structural Materials] / 先进高温结构材料重点实验室 [Key Laboratory of Advanced High Temperature Structural Materials]	Science and Technology on Advanced High Temperature Structural Materials Laboratory; National Key Laboratory of Advanced High Temperature Structural Materials	Beijing Institute of Aeronautical Materials, Aero Engine Corp of China (a subsidiary of Aviation Industry Corporation of China) [中国航空工业第一集团公司北京航空材料研究院]	The official Chinese name containing "national defense" appears on a list of National Defense Science and Technology Key Laboratories (http://www.ysygaokao.cn/ceelnfocxDetails.aspx?Id=276); and http://corrdata.ustb.edu.cn/news/industry/2018-02-06/168160.html)
航空等离子体动力学国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Aerospace Plasma Dynamics] / 等离子体动力学国家级重点实验室 [State Key Laboratory of Plasma Dynamics]	Science and Technology on Plasma Dynamics Laboratory; Key Laboratory for National Defense Science and Technology on Plasma Dynamics	PLA Air Force Engineering University [空军工程大学]	See pages 99–103 of China Aerospace Studies Institute (CASI) Study (Matthew Bruzzese, "China's Defense S&T Key Lab System (Updated 2025)," China Aerospace Studies Institute (CASI), Sept. 2025)
航空发动机气动热力国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Aero-Engine Thermodynamics] / 航空发动机气动热力国家重点实验室 [State Key Laboratory of Aero-Engine Thermodynamics]	National Key Laboratory of Science and Technology on Aero-Engine Aero-thermodynamics	Beihang University [北京航空航天大学]	See Beihang University page (https://riae.buaa.edu.cn/yjygk/yjyjs.htm)

可靠性与环境工程技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Reliability and Environmental Engineering Technology] / 可靠性与环境工程技术重点实验室 [Key Laboratory of Reliability and Environmental Engineering Technology]	National Key Laboratory of Science and Technology on Reliability and Environmental Engineering; Reliability and Environmental Engineering Science & Technology Laboratory; Science and Technology on Reliability and Environmental Engineering Laboratory; Key Laboratory on Reliability and Environmental Engineering Technology	Jointly run by Beihang University School of Reliability and Systems Engineering [北京航空航天大学可靠性与系统工程学院]; CASC China Academy of Space Technology Beijing Institute of Spacecraft Environment Engineering [中国航天科技集团中国空间技术研究院北京卫星环境工程研究所] (also known as CASC 511th Research Institute [511所]); and CASC China Academy of Launch Vehicle Technology [中国运载火箭技术研究院]	Description of the lab mentioned on archived page of the China Academy of Launch Vehicle Technology and a news item (https://web.archive.org/web/20230324104426/http://m.calt.com/n1689/n1713/c13698/content.html; and https://web.archive.org/web/20190521025355/http://www.hjjs.org/newsview.asp?id=480)
冲击环境材料技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Impact Environment Materials Technology] / 冲击环境材料技术国家级重点实验室 [National Key Laboratory of Materials Technology in Impact Environments]	National Key Laboratory of Science and Technology on Material Under Shock and Impact	Beijing Institute of Technology [北京理工大学] – possibly also affiliated with China North Industries Group Corp (NORINCO) 52nd Research Institute	See pages 307–311 of CASI Study
爆炸科学与技术国家重点实验室 [State Key Laboratory of Explosion Science and Technology]	State Key Laboratory of Explosion Science and Technology; State Key Laboratory of Explosion Science and Safety Protection	Beijing Institute of Technology	A list of labs states that the State Administration for Science & Technology Industry for National Defense (SASTIND) is the supervising organ of this entity (https://www.edu.cn/rd/gai_kuang/xin_wen_gong_gao/200807/t20080709_307886.shtml; and https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/qtwj/qtwj2010before/201811/t20181128_143836.html)
粉末冶金国家重点实验室 [State Key Laboratory of Powder Metallurgy]	State Key Laboratory of Powder Metallurgy	Central South University [中南大学]	See Section III of this study
表面物理与化学国防科技重点实验室 [National Defense	Science and Technology on Surface Physics and	China Academy of Engineering Physics	Referred to as a “Defense Science and Technology

Science and Technology Laboratory on Surface Physics and Chemistry]	Chemistry Laboratory; Key Laboratory of Surface Physics and Chemistry	[中国工程物理研究院]	Laboratory" here: (https://www.nature.com/nature-index/institution-outputs/china/science-and-technology-on-surface-physics-and-chemistry-laboratory-caep/548a9261140ba05c438b4567); and (https://news.sciencenet.cn/dz/upload/2019/1/20191462846416.pdf)
人因工程国防科技重点实验室 [National Defense Science and Technology Laboratory of Human Factors Engineering]	National Key Laboratory of Human Factors Engineering	Chinese Astronaut Research and Training Center [国航天员科研训练中心]	This entity is overseen by the Central Military Commission Equipment Development Department (https://std.samr.gov.cn/gb/search/gbDetailed?id=F4A4A38B3845382DE05397BE0A0AC012)
复杂系统建模与仿真教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Complex Systems Modeling and Simulation (Type B)]	Key Laboratory of Complex Systems Modeling and Simulation (Ministry of Education)	Hangzhou Dianzi University [杭州电子科技大学]	Profiles of two university professors state this is a Ministry of Education (MoE) Type B lab (http://zcfcia.org.cn/site/content/7362.html); and (https://www.ccf.org.cn/YOCSEF/Branches/Changsha/News/club/2018-11-22/656936.shtml)
核安全与仿真技术国防重点学科实验室 [National Defense Key Discipline Laboratory of Nuclear Safety and Simulation Technology] / 国防科工局核安全与仿真技术国防重点学科实验室 [SASTIND Nuclear Safety and Simulation Technology National Defense Key Discipline Laboratory] Fundamental Science on Nuclear Safety and Simulation Technology Laboratory	Key Subject Laboratory of Nuclear Safety and Simulation Technology; Fundamental Science on Nuclear Safety and Simulation Technology Laboratory; Nuclear Safety and Simulation Technology Laboratory	Harbin Engineering University [哈尔滨工程大学]	Harbin Engineering University College of Nuclear Science and Technology website refers to the entity as a SASTIND lab (https://web.archive.org/web/20220320014044/http://cnst.hrbeu.edu.cn/1928/list.htm)
先进焊接与连接国家重点实验室 [State Key Laboratory of Advanced Welding and Joining] / 现代焊接生产技术国家重点实验室 [State Key Laboratory of Modern	State Key Laboratory of Advanced Welding Production Technology; State Key Laboratory of Precision Welding & Joining of Materials and Structures;	Harbin Institute of Technology (HIT) [哈尔滨工业大学]	A list of labs states that SASTIND is the supervising organ of this entity (https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/qtwj/qtwj2010before/201811/t20181128

Welding Production Technology] / 材料结构精密焊接与连接全国重点实验室 [State Key Laboratory of Precision Welding and Joining of Materials and Structures]	State Key Laboratory of Advanced Welding and Joining		_143836.html)
金属精密热加工国防科技重点实验室 [National Defense Science and Technology Laboratory of Precision Hot Processing of Metals] / 金属精密热加工国家级重点实验室 [National Key Laboratory for Precision Hot Processing of Metals]	National Key Laboratory for Precision Hot Processing of Metals; National Key Laboratory for Precision Hot Forming	Harbin Institute of Technology School of Materials Science and Engineering [哈尔滨工业大学材料科学与工程学院]	Description of HIT School of Material Science and Engineering uses "national defense" in the lab's official name (https://mse.hit.edu.cn/_s296/2023/0508/c16879a305794/page.psp)
特种环境复合材料技术国防科技重点实验室 [National Defense Science and Technology Laboratory of Composite Materials Technology in Special Environments] / 特种环境复合材料技术国家级科技重点实验室 [National Key Laboratory of Science and Technology on Composite Materials Technology in Special Environments]	Science and Technology on Advanced Composites in Special Environments Laboratory; State Key Laboratory of Science and Technology on Advanced Composites in Special Environments; National Key Laboratory of Science and Technology for National Defense on Advanced Composites in Special Environments	Harbin Institute of Technology School of Astronautics [哈尔滨工业大学航天学院]	A directory of national defense key labs was reposted here: (http://www.ecorr.org/news/industry/2018-02-06/168160.html); variations of the lab name found on HIT's website (https://web.archive.org/web/20190517054529/http://news.hit.edu.cn/2008/1201/c1990a49048/page.htm)
可调谐气体激光国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Tunable Gas Laser] / 可调谐激光国家级重点实验室 [National Key Laboratory of Tunable Gas Laser]	National Key Laboratory of Science and Technology on Tunable Laser; National Key Laboratory of Tunable Laser Technology; State Key Laboratory on Tunable Laser Technology	Harbin Institute of Technology School of Astronautics Optoelectric Technology Research Institute [哈尔滨工业大学航天学院光电子技术研究所]	An archived news item on HIT's website uses the official lab name with "national defense" (https://web.archive.org/web/20190517054529/http://news.hit.edu.cn/2008/1201/c1990a49048/page.htm); a description of the lab on an optics journal web page states that the lab was established by SASTIND's predecessor (Commission for Science, Technology and Industry for National Defense) (https://web.archive.org/web/20190517054906/http://www.opticsjournal.net/Lab/STTL.htm?action=index)

专用集成电路国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Specialized Integrated Circuits] / 专用集成电路国家级重点实验室 [National (or State) Key Laboratory of Application Specific Integrated Circuit] / 砷化镓超高速集成电路和功率器件国防科技重点实验室 [Defense Science and Technology Key Laboratory of Gallium Arsenide Super High-speed Integrated Circuits and Power Devices]	National Key Laboratory of Application Specific Integrated Circuit	Hebei Semiconductor Research Institute [河北半导体研究所], also known as the China Electronics Technology Group Corp (CETC) 13th Research Institute [中国电子科技集团公司第十三研究所]	See pages 463–467 of CASI study (directory)
多谱图像信息处理技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Multi-Spectral Information Processing Technology] / 多谱图像信息处理技术重点实验室 [Key Laboratory of Multi-Spectral Image Information Processing Technology] /多谱信息处理技术国家级重点实验室 [National Key Laboratory of Multi-Spectral Image Information Processing Technology]	National Key Laboratory of Science & Technology on Multispectral Information Processing	Huazhong University of Science and Technology School of Artificial Intelligence and Automation [华中科技大学人工智能与自动化学院] / HUST Institute for Pattern Recognition & Artificial Intelligence [华中科技大学图像识别与人工智能研究所（图像所)]	See pages 338–341 of CASI study (directory)
特种装备先进设计技术与仿真教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Advanced Design Technology and Simulation for Specialized Equipment (Type B)]	Key Laboratory of Advanced Design and Simulation Technology for Special Equipment, Ministry of Education	Hunan University	Archived website of Hunan University Office of Scientific R&D lists "Government Approved Organizations," indicating this is an MoE Type B lab (https://archive.fo/Bcsrz#selection-579.0-579.25)
计算物理国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Computational Physics]	Laboratory of Computational Physics; Key Laboratory of Computational Physics	China Academy of Engineering Physics [中国工程物理研究院], Institute of Applied Physics and Computational Mathematics [北京应用物理与计算数学研究]	See Section III of this study; history of the Institute of Applied Physics and Computational Mathematics indicates this entity is a national defense lab (http://www.iapcm.ac.cn/history.html)

特种工程塑料教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Specialty Engineering Plastics (Type B)]	Laboratory of High Performance Plastics, Ministry of Education	Jilin University [吉林大学]	Jilin University College of Chemistry page indicates this is an MoE Type B lab (http://chem.jlu.edu.cn/info/1261/7262.htm)
特殊功能材料与结构设计教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Special Functional Materials and Structural Design (Type B)]	Key Laboratory of Special Function Materials and Structure Design of MoE	Lanzhou University [兰州大学]	News item on an academic study reported by the Chinese Academy of Sciences lists this as an MoE Type B lab (https://www.cas.cn/hy/hyyg/201407/t20140714_4156998.shtml); see also (https://web.archive.org/web/20190620000749/http://110.lzu.edu.cn/lzupage/2019/06/13/N20190613181619.html)
雷达成像与微波光子技术教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Radar Imaging and Microwave Photonics Technology (Type B)]	Key Laboratory of Radar Imaging and Microwave Photonics, Ministry of Education	Nanjing University of Aeronautics and Astronautics [南京航空航天大学]	Nanjing University of Aeronautics and Astronautics website lists this as an MoE Type B lab (https://nuaa.edu.cn/631/)
信息系统工程国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Information Systems Engineering]	National Key Laboratory of Information Systems Engineering; Science and Technology on Information Systems Engineering Laboratory	National University of Defense Technology (NUDT) [国防科学技术大学]	Many Chinese-language journal articles use "national defense" in the Chinese lab name. An example: (https://www.aas.net.cn/cn/article/doi/10.3724/SP.J.1004.2012.00570)
新型陶瓷纤维及其复合材料国防科技重点实验室 [National Defense Science and Technology Key Laboratory of New Ceramic Fibers and Their Composite Materials]/ 陶瓷纤维及其复合材料重点实验室 [Ceramic Fiber and Its Composite Materials Key Laboratory] / CFC 国防科技重点实验室 [CFC National Defense Science and Technology Key Laboratory] /	Science and Technology on Advanced Ceramic Fibers and Composites Laboratory	National University of Defense Technology	See pages 350–353 of CASI study (directory)
高功率微波技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory on High-Power Microwave Technology]	Science and Technology on High Power Microwave Laboratory	Northwest Institute of Nuclear Technology (NINT) [西北核技术研究所] Note there is another lab with the same name that is	See pages 234 of CASI study (directory)

		part of the China Academy of Engineering Physics (CAEP) Institute of Applied Electronics. It is unknown if they are the same; we treat them separately and assign NINT as the parent affiliation based on the articles in the collected corpus.	
凝固技术国家重点实验室 [National Key Laboratory of Solidification Technology] / 凝固技术全国重点实验室 [National (or All-Nation) Key Laboratory of Solidification Processing]	State Key Laboratory of Solidification Processing	Northwestern Polytechnical University [西北工业大学]	A list of lab names states that SASTIND is the supervising organ (https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/qtwj/qtwj2010before/201811/t20181128_143836.html); see Section III of this study for more details
超高温结构复合材料国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Ultra-High Temperature Structural Composites] / 超高温结构复合材料国家级重点实验室 [National Key Laboratory of Ultra-High Temperature Structural Composites] / 超高温结构复合材料重点实验室 [Key Laboratory of Ultra-High Temperature Structural Composites]	National Key Lab of Thermostructure Composite Materials; Science and Technology on Thermostructural Composite Materials Laboratory	Northwestern Polytechnical University School of Materials Science and Engineering [西北工业大学材料科学与工程学院]	An archived version of the university's website notes that in 2004 this entity received approval to be designated as a national defense key lab (https://web.archive.org/web/20190521005159/http://kypt.nwpu.edu.cn/index.php?c=content&a=show&id=301)
空间生物实验模拟技术国防重点学科实验室 [National Defense Key Discipline Laboratory for Space Biology Experiment Simulation Technology]	Key Laboratory for Space Biosciences and Biotechnology	Northwestern Polytechnical University School of Life Sciences [西北工业大学生命学院]	News item on university website indicates this entity is a national defense key discipline lab (https://web.archive.org/web/20171110084358/https://news.nwpu.edu.cn/info/1002/46250.htm)
微电子器件与电路教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Microelectronic Devices and Circuits (Type B)]	Ministry of Education Key Laboratory of Microelectronic Devices and Circuits	Peking University [北京大学]	Peking University Advanced Technology Institute provided a list of centers and labs, indicating this is an MoE Type B lab (https://web.archive.org/web/2

			0190307235330/http://www.ati.pku.edu.cn/yjzxhsys/index.htm)
放射化学与辐射化学国防重点学科实验室 [National Defense Key Discipline Laboratory of Radiochemistry and Radiation Chemistry]	Fundamental Science Laboratory on Radiochemistry and Radiation Chemistry; Radiochemistry and Radiation Chemistry Key Laboratory of Fundamental Science	Peking University	Peking University Advanced Technology Institute provided a list of centers and labs and used "GF" in the Chinese name "放射化学与辐射化学GF重点学科实验室." GF is shorthand for *guofang*, meaning national defense (https://web.archive.org/web/20190307235330/http://www.ati.pku.edu.cn/yjzxhsys/index.htm)
功能晶体材料及器件教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Functional Crystal Materials (Type B)]	Key Laboratory of Functional Crystal Materials and Device, Ministry of Education	Shandong University [山东大学]	Archived news page identifies this as an MoE Type B lab (https://web.archive.org/web/20150514204230/http://www.ccement.com/news/content/4345544574250.html)
特种功能聚集体材料教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Special Function Aggregated Materials (Type B)]	Key Laboratory of Special Aggregated Materials; Key Laboratory of Special Aggregated Materials (Ministry of Education)	Shandong University	Archived news page identifies this as an MoE Type B lab (https://web.archive.org/web/20150514204230/http://www.ccement.com/news/content/4345544574250.html)
纳米加工技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Nanofabrication Technology] / 微米/纳米加工技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Micro/Nano Fabrication Technology]	National Key Laboratory of Science and Technology on Micro/Nano Fabrication	Shanghai Jiao Tong University [上海交通大学] and Peking University	The Shanghai Municipal Education Committee's 1997 Yearbook announced this laboratory's establishment at Shanghai Jiao Tong University, using "national defense science and technology" in its official Chinese name (https://oversea.cnki.net/kcms2/article/abstract?v=Mz9udXFtQxnOPMDhYA01iFQp0FhsZlGZQJU3ZTNK5S4yb98BFy94cpqjE1S_-YfMmy2tcbCQTuG7HIv_K8YLwvimkIXsYOjqYOAd13m00Hm-1-oRwc2R5SkrCx4sgeW9rFWPsAAlQHFYk5JAelyG9yUMIKiUdEbWCi3zsQ2qfy4LWew_eJYY

			yQ); the lab is jointly run with Peking University (https://web.archive.org/web/20240329135021/https://www.seiee.sjtu.edu.cn/kyjd_gjj/85.html)
水动力学教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Hydrodynamics (Type B)]	MoE Key Laboratory of Hydrodynamics; Key Laboratory of Hydrodynamics (Ministry of Education)	Shanghai Jiao Tong University School of Naval Architecture Ocean and Civil Engineering [上海交通大学船舶海洋与建筑工程学院]	Website posting a list of MoE Type B labs names three labs housed at Shanghai Jiaotong University (https://www.toutiao.com/article/7074579917006160396/?wid=1756317655829)
高能量密度物理及技术教育部重点实验室 (B类) [Ministry of Education Key Laboratory of High Energy Density Physics and Technology (Type B)]	Key Laboratory of High Energy Density Physics and Technology of the Ministry of Education	Sichuan University [四川大学]	Archived version of Sichuan University website describes this as an MoE Type B lab (https://web.archive.org/web/20190528005324/http://physics.scu.edu.cn/lhedp/sysjj.html)
水声信号处理教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Underwater Acoustic Signal Processing (Type B)]	Key Laboratory of Underwater Acoustic Signal Processing of Ministry of Education	Southeast University [东南大学]	Southeast University website provided a brief history of this entity and stated it is an MoE Type B lab (https://radio.seu.edu.cn/_upload/article/files/fe/e9/b99697b0468fb0b9eeb3251b4919/6cea6676-09e0-43e5-8fb1-0a9aea540f5b.pdf)
核废物与环境安全国防重点学科实验室 [National Defense Key Discipline Laboratory on Nuclear Waste and Environmental Safety]	Nuclear Waste and Environmental Safety Key Laboratory of Defense; Fundamental Science on Nuclear Wastes and Environmental Safety Laboratory	Southwest University of Science and Technology [西南科技大学]	Archived website of this university profiled this entity, indicating it is a national defense key discipline laboratory (https://archive.ph/fOkYJ#selection-1533.5-1537.0)
先进微结构材料教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Advanced Microstructural Materials (Type B)]	Key Laboratory of Advanced Microstructure Materials of Ministry of Education; MoE Key Laboratory of Advanced Micro-Structured Materials	Tongji University [同济大学]	Archived website of the Tongji University Institute for Advanced Study names this as an MoE Type B lab (https://archive.fo/2x0OG#selection-439.0-439.9)
大功率微波电真空器件技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of High-Power Microwave	Vacuum Electronics National Laboratory; National Key Lab on Vacuum Electronics; National Key Laboratory of High-Power	Jointly run by the University of Electronic Science and Technology of China School of Physical Electronics	A news item on the university's website states this is a national defense science and technology laboratory

Vacuum Device Technology] / 大功率微波电真空器件技术重点实验室 [Key Laboratory of High-Power Microwave Vacuum Device Technology]	Vacuum Electronics	[电子科技大学物理电子学院] and CETC 12th Research Institute [中国电子科技集团公司第十二研究所]	(https://new1.uestc.edu.cn/?n=UestcNews.Front.DocumentV2.ArticlePage&Id=54288); another university's employment page also states this entity is a national defense science and technology laboratory, jointly run by CETC 12th Research Institute (https://job.xidian.edu.cn/company/view/id/817515)
通信抗干扰技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Anti-Interference Communication Technology] / 战术通信抗干扰技术国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Anti-Interference for Tactical Communications]/ 通信抗干扰技术国家级重点实验室 [National Key Laboratory of Anti-Interference Communication Technology]	Key Laboratory of Science and Technology on Communications; National Key Laboratory of Science and Technology on Communications	University of Electronic Science and Technology of China	A PRC higher education resource website lists national-level defense science and technology laboratories, naming this entity (http://www.ysygaokao.cn/ceeInfocxDetails.aspx?Id=276); a news item on another university website also describes this entity as a national defense laboratory (http://corrdata.ustb.edu.cn/news/industry/2018-02-06/168160.html)
空天信息安全与可信计算教育部重点实验室 (B类) [Ministry of Education Key Laboratory of Aerospace Information Security and Trusted Computing (Type B)]	MoE Key Laboratory of Aerospace Information Security and Trusted Computing; Key Laboratory of Aerospace Information Security and Trusted Computing, Ministry of Education	Wuhan University [武汉大学]	Two Wuhan University web pages described this entity as an MoE Type B lab (https://web.archive.org/web/20190530055744/http://csold.whu.edu.cn/a/Research/Key_Laboratory/201512246338.html) and https://news.whu.edu.cn/info/1002/45395.htm)
多功能材料与结构教育部重点实验室 (B类) [Ministry of Education Key Laboratory for Multifunctional Materials and Structures (Type B)]	Multifunctional Materials and Structures, Key Laboratory of the Ministry of Education; Key Laboratory of Multifunctional Materials and Structures, Ministry of Education	Xi'an Jiaotong University [西安交通大学]	Website posting a list of MoE Type B labs names three housed at Xi'an Jiaotong University (https://www.toutiao.com/article/7074579917006160396/?wid=1756317655829)
超高速电路设计与电磁兼容教育部重点实验 (B类) [Ministry of Education Key Laboratory	Key Laboratory of High-Speed Circuit Design and EMC; Key Laboratory of	Xidian University [西安电子科技大学]	Website posting a list of MoE Type B labs includes this entity

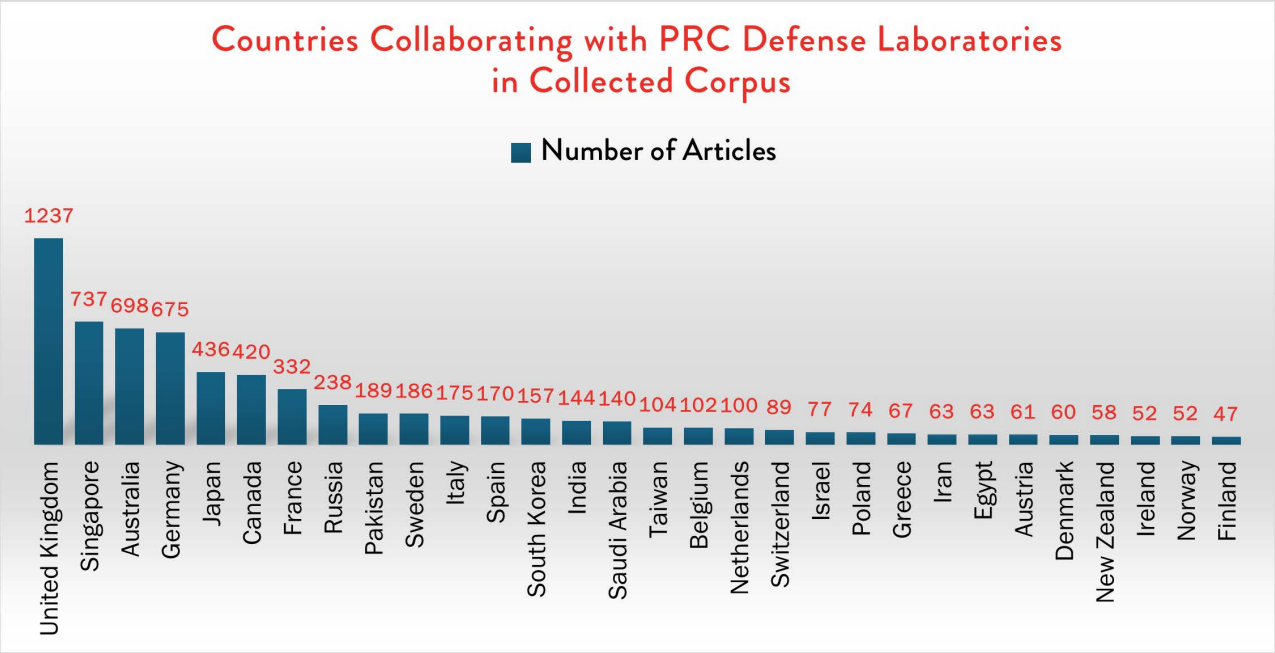
of Ultra-High-Speed Circuit Design and Electromagnetic Compatibility (Type B)]	High-Speed Circuit Design and EMC Ministry of Education		(https://www.toutiao.com/article/7074579917006160396/?wid=1756317655829)
宽带隙半导体技术国防重点学科实验室 [National Defense Key Discipline Laboratory of Wide Bandgap Semiconductor Technology]	Key Laboratory of Wide Band-Gap Semiconductor Materials and Devices; State Key Discipline Laboratory of Wide Band Gap Semiconductor Technology	Xidian University	Archived Xidian University news page indicates this entity is a national defense key discipline laboratory (https://web.archive.org/web/20190531023153/https://news.xidian.edu.cn/info/1002/33638.htm)
雷达信号处理国防科技重点实验室 [National Defense Science and Technology Key Laboratory of Radar Signal Processing] / 雷达信号处理国家重点实验室 [State Key Laboratory of Radar Signal Processing]	National Key Laboratory of Radar Signal Processing; State Lab of Radar Signal Processing	Xidian University School of Electronic Engineering [西安电子科技大学电子工程学院]	A higher education resource website lists national-level defense science and technology labs and includes this entity (http://www.ysygaokao.cn/ceelnfocxDetails.aspx?Id=276); also listed here (http://corrdata.ustb.edu.cn/news/industry/2018-02-06/168160.html); also see page 182 of CASI study

Appendix B: International Collaborations with PRC Defense Laboratories

This study did not address the fact that the challenges and risks associated with research collaborations with People's Republic of China (PRC) defense laboratories are not uniquely a US problem. These PRC defense laboratories also enjoy extensive collaborations with other nations.

CRSI compiled bibliographic metadata from *Dimensions* on all articles that name at least one coauthor from each of the 45 defense laboratories listed in Appendix A, including identified English name variants. The data covered the same period used in this study: articles published from January 2019 through July 2025. The result included 52,703 articles involving at least one of the PRC defense laboratories. The data were filtered and sorted based on whether another country is listed (based on coauthor affiliations). The chart below shows the results. Note that more than one nation is sometimes involved in the same research article.

The chart only lists the top 30 nations collaborating with the 45 PRC defense laboratories, based on the number of coauthored articles. Key US allies should examine closely the nature of these collaborations, the entities involved, and whether government funding has directly or indirectly supported such research.[u] These data are limited to the 45 PRC laboratories identified as collaborating with US entities. There may be other PRC defense laboratories partnering with other nations not included in this dataset.



[u] Upon request, CRSI can replicate elements of this US study for other nations. Please reach out to info@researchsecurity.org for more details.

CRSI

Appendix C: Research Methodology and Process

This study's authors initially compiled a list of over 200 People's Republic of China (PRC) laboratories as candidates for inclusion in this study that are "key laboratories" known or suspected of being a defense laboratory. This initial list was derived from the authors' independent research and information contained in the Australian Strategic Policy Institute (ASPI) "China Defense Universities Tracker" (prior to its update in 2025)[126] and a directory produced by the China Aerospace Studies Institute.[127] This list formed the basis for identifying scientific and engineering publications that list coauthors affiliated with these laboratories. However, China's lack of standardized nomenclature – particularly for English names of laboratories – creates challenges in compiling a comprehensive list. To address this, the authors utilized data in *Dimensions* to identify all English name variants most likely associated with each of the 200+ PRC laboratories.

The authors limited their surveys of literature to articles published January 2019 through July 2025. *Some of the laboratories from the original list do not appear to publish in English-language sources, and some may not publish at all in publicly available sources*. Those laboratories were removed from this list. Many of the laboratories publish articles in domestic PRC journals in Mandarin; however, resource limitations prevented the ability to build queries on each of the Chinese names of the over 200 laboratories from PRC publication aggregators, such as the China National Knowledge Infrastructure (CNKI) database. As this study focuses on collaborations with US institutions, surveying international English-language publication sources is sufficiently comprehensive, though it may not be exhaustive. There are rare instances where US-based researchers have coauthored publications with PRC entities that appear in domestic PRC journals (in Mandarin), but in observed cases, the article is often a translated version or substantively similar to an English-language publication.

For each key laboratory that had contributed to an English-language article, the authors built a bulk query containing all of these laboratories and their identified name variants (over 300 entities) to run in *Dimensions*. The bibliographic metadata contained over 50,000 publication records that list a coauthor affiliated with one of these laboratories.

This dataset was then reduced to articles listing a coauthor affiliated with a US-based institution, yielding approximately 2,000 records. Some articles contained more than 15 coauthors – those were removed from the dataset. Supplemental due diligence was then conducted on each of the PRC defense-affiliated laboratories appearing in this subset of data to independently validate that each laboratory is officially designated as a national-level defense laboratory (i.e., one of the four

types of defense laboratories discussed in Section I).[v] **The full corpus was reduced to 1,793 articles.**

The bibliographic metadata was analyzed to focus primarily on a subset of publications that acknowledge US government funding, specifically articles crediting support from the Department of Energy, the Department of Defense, the National Science Foundation, and the National Institutes of Health. This study limited its discussion and analysis to these four agencies. A few other agencies (e.g., NASA, the Department of Agriculture) were also identified in the dataset, but they only appeared in a few articles out of the 2,000 records surveyed.

The result is a subset of data involving 45 PRC defense laboratories that involved US collaborators and acknowledge US federal funding. A list of these 45 laboratories, their Chinese and English name variants, and the sources validating their defense designations is provided in Appendix A. Grant or contract codes for US federal funding sources were then cross-referenced with data in usaspending.gov to identify additional information, such as dollar amounts obligated, periods of performance, project descriptions, and receiving institution(s).

Caveats and limitations

This study provides details on US government funding sources and aggregates these amounts for further analysis. However, the dollar figures discussed in this study are a snapshot in time and **not a fully accurate accounting of all government funding,** for several reasons.

We exclude award amounts associated with contracts to run facilities, such as DoE national laboratories, as those do not break down specific amounts allocated to the research projects reflected in the publications. Additionally, the figures we obtained may understate actual amounts obligated and disbursed due to discrepancies in financial reporting timelines by grantee institutions and the federal funding agencies, and the administration of the usaspending.gov website, where public information on grants is collated.

Some articles do not acknowledge funding sources but may still include US government sources; others credit US funding but do not specify the grant number or code. There are also several grants where we were unable to verify the amounts obligated from publicly available sources.

Another critical factor relates to scoping limitations. This study only covers *a small subset of PRC national-level laboratories that are designated as defense laboratories and have collaborated with US institutions receiving federal funding*. There are other PRC defense laboratories that do not appear to engage with US institutions. Additionally, the PRC runs hundreds, possibly thousands, of other laboratories in China (e.g., state key laboratories, ministry-run laboratories, state-owned

[v] In a few cases, we were unable to find any Chinese source indicating that a laboratory was officially designated as a defense laboratory, and these were thus removed from our dataset. An example of one such laboratory is discussed later in this appendix.

enterprise-run laboratories, Chinese Academy of Sciences key laboratories, and provincial-level key laboratories) that *also* conduct defense research to varying degrees. Identifying each of these laboratories and assessing their level of involvement in supporting China's military or defense industry far exceeds the scope of this study. **Thus, readers should not conclude that the figures presented here are the total amount of government outlays to US institutions collaborating with PRC defense research institutions.** Far from it.

Finally, we excluded from our statistics a few laboratories for which we could not validate whether the PRC officially designates them as defense laboratories. For example, several articles in the full corpus included coauthors affiliated with a Ministry of Education key laboratory that does not appear to be an officially designated defense laboratory (i.e., there is no indication it is a Ministry of Education "Type B" laboratory). The entity is known in English as the Key Laboratory of Information Fusion Technology of the Ministry of Education (信息融合技术教育部重点实验室), housed at Northwestern Polytechnical University's (NWPU) School of Automation. According to an archived NWPU source provided by ASPI's Defense Universities Tracker, "the laboratory is committed to serving national defense science and technology and focusing on improving academic standards."[128] This description suggests that conducting defense research is its primary mission, and given that it is housed at a "Seven Sons of National Defense" university, it is clear that the laboratory is extensively involved in defense. What is not clear is why the laboratory is not officially designated as a defense laboratory. It only appeared in our corpus because one of the other coauthor's affiliations was with another official defense laboratory.

ABOUT THE AUTHORS

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ENDNOTES

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