

Testimony of the Coalition for National Security Research (CNSR)
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Subcommittee on Defense, Committee on Appropriations, United States Senate

Defense Science & Technology (S&T) Program and Basic Research Funding for FY 2021

Chairman Shelby, Ranking Member Durbin and distinguished Members of the subcommittee, thank you for the opportunity to submit outside witness testimony as you begin to craft the fiscal year (FY) 2021 Defense Appropriations bill. The Coalition for National Security Research (CNSR) (<https://cnsr4research.org/>) is a broad-based alliance of more than 100 members from industry, academia, scientific and professional associations, and non-profits conducting vital scientific research to create new and improve existing technologies and capabilities to support the U.S. Department of Defense's (DoD) operations.

As you would expect, CNSR members are diligently working to help combat the COVID-19 pandemic. From conducting research on vaccines and other therapeutics, exploring the relationship between coronavirus and misinformation, developing decision-making tools for response actions, 3D printing personal protective equipment, and creating emergency ventilators, we are working to support the federal response and our local communities. In many cases, prior DoD-sponsored research has helped create the expertise and capabilities we are utilizing now during the global pandemic. We thank the subcommittee for its role in providing supplemental appropriations to fight the pandemic including the funds provided to the Defense Health Program. While the focus of our testimony is on funding for the Defense Science and Technology (S&T) program, we also include recommendations for emergency appropriations that can help combat COVID-19 and prepare the United States for future pandemics.

Going forward, as hopefully the pandemic subsides, CNSR urges the subcommittee to provide robust support for the Defense S&T program in the FY 2021 Defense Appropriations bill. In FY 2018, CNSR members conducted more than \$5.8 billion in DoD-sponsored scientific research¹. More specifically, with support from Research, Development, Test and Evaluation (RDT&E) funding, particularly the Defense S&T program, CNSR members are making discoveries and advancing technologies in DoD's highest priority areas, including hypersonics, artificial intelligence (AI), quantum information sciences, and directed energy. Given that approximately 69 percent of RDT&E is conducted extramurally, DoD relies on its National Security Innovation Base (NSIB) partners, such as CNSR members, to generate new knowledge and capabilities to enable the United States military to maintain its global technological superiority².

As noted in the Ronald Reagan Institute report *The Contest for Innovation*, generational technological advances, including developing military-relevant technologies, require federal investments in basic and applied research; private-sector research and development (R&D) is an inadequate replacement³. Consequently, it is absolutely essential that Congress provides not only robust funding for RDT&E but specifically for the Defense S&T program as near-peer competitor nations, such as China and Russia, vie for dominance in military technologies.

¹ <https://ncesdata.nsf.gov/herd/2018/html/herd18-dt-tab059.html>

² <https://ncesdata.nsf.gov/fedfunds/2018/html/ffs18-dt-tab009.html>

³ <https://www.reaganfoundation.org/reagan-institute/centers/peace-through-strength/reagan-institute-task-force/>

FY 2021 Budget Request for the Defense S&T Program

The *National Defense Strategy (NDS)* lays out numerous defense objectives and goals for the U.S. to remain as the preeminent military power in the world. Investing in the Defense S&T program is not only consistent with the *NDS*, it is critical to its successful implementation. The Defense S&T program serves as the foundation of the DoD's mission to meet the *NDS's* objectives of deterring adversaries, sustaining Joint Force military advantages, establishing an unmatched twenty-first century NSIB, and continuously improving and developing military technologies and capabilities that provide technological overmatch while anticipating the future needs of our Armed Forces. Simply put, you cannot fight tomorrow's conflicts with yesterday's weapons and technologies.

Unfortunately, the FY 2021 budget request fails to provide the resources to meet the objectives of the *NDS*. While the budget includes the largest RDT&E top line request ever, it simultaneously calls for cutting Defense S&T funding within the larger portfolio by more than \$2 billion including defense basic research by approximately \$285 million compared to FY 2020 enacted levels. In fact, according to the Office of Management and Budget (OMB), the FY 2021 budget request would result in a cut of 7 percent to the Defense R&D portfolio, producing an 11 percent cut for basic research and a 12 percent cut to applied research compared to the previous year⁴. ***With China likely to become the world's top R&D performer in the near future⁵, now is not the time to cut funding for the Defense S&T program designed to create the new technologies and capabilities – as well as help train the next generation workforce - to ensure the U.S. military maintains its global dominance.***

The FY 2021 budget proposes to do more than just cut funding below FY 2020 congressionally enacted levels; it proposes to cut funding below the levels DoD requested in FY 2020. FY 2021 resources for the following are proposed to be cut below the FY 2020 budget request:

- Overall Defense S&T Program
- Overall 6.1 basic research
- Overall Navy basic research
- Navy Defense Research Sciences
- Navy University Research Initiatives
- Overall Air Force basic research
- Air Force Defense Research Sciences
- DTRA Basic Research Initiatives
- Defense-Wide Basic Research Initiatives

CNSR urges Congress to reject these cuts and increase Defense S&T funding consistent with recommendations of the National Defense Strategy Commission⁶ and the more than 500 leading organizations from American industry, higher education, and science and engineering⁷.

⁴ https://www.whitehouse.gov/wp-content/uploads/2020/02/ap_17_research_fy21.pdf

⁵ <https://ncses.nsf.gov/pubs/nsb20203>

⁶ <https://www.usip.org/sites/default/files/2018-11/providing-for-the-common-defense.pdf>

⁷ <https://innovation-imperative.herokuapp.com/index.html>

Defense Basic Research Program Element (PE) Recommendations

For decades, the defense basic research programs have provided the scientific breakthroughs to give the warfighter the weapons and equipment needed to succeed. Capabilities that help ensure our national security – such as stealth technology, night vision, near-real-time delivery of battlefield information, GPS, communication and weather satellites, laser technology, nuclear propulsion, counter-stealth technology, and precision munitions – all derive from defense basic research. If we want to succeed in future global competition, we cannot underinvest in the long-term basic research that will provide the military with new transformational capabilities. Defense basic research is currently exploring future military capabilities in many areas of interest to DoD, such as quantum materials, biologically enhanced sensing and computing, autonomous reasoning, and adaptive materials. The FY 2021 budget undermines the DoD-NSIB partnership to develop future military capabilities and maintain American global preeminence by proposing to slash the defense basic research PEs.

Furthermore, the FY 2021 budget harms DoD's ability to build capacity in its research programs and workforce by proposing to eliminate funding for efforts such as Defense Established Programs to Stimulate Competitive Research (DEPSCoR). DoD often relies on scientists and engineers on an as needed basis and not supporting communities in states that typically are not involved in defense research could slow innovation efforts. In addition, in order to meet the scientific workforce needs of the future, DoD should be seeking to develop talent in every state in the nation. As such, CNSR supports Congress restoring funding for DEPSCoR.

University Research Initiatives (URIs)

University Research Initiatives (URIs) would be absolutely devastated from funding levels proposed in the FY 2021 budget. Overall URI funding would be funded at levels below FY 2010 in real dollars. Compared to FY 2020 enacted levels, Army URI is proposed to be cut by more than *23 percent*, Navy URI by *30 percent* and Air Force URI by almost *10 percent*. We are concerned that cuts of this magnitude would harm fundamental technological developments critical to maintain our military superiority across the air, land, sea, space, and cyber domains.

Within the URI programs, the FY 2021 budget proposes to fund the Multidisciplinary University Research Initiative (MURI) program and Defense University Research Instrumentation Program (DURIP) below FY 2010 levels in real dollars. The MURI program regularly sponsors university basic research that produces revolutionary new military technologies⁸. Drones, nanotechnology, biological detection capabilities and stealth detection sensors all stem from MURI-sponsored scientific research⁹. DURIP helps ensure universities have the appropriate equipment needed to conduct cutting edge research of importance to DoD. The FY 2021 request for these programs would only exacerbate the problem that both are dramatically underfunded. ***In FY 2020, 339 MURI proposals were unfunded¹⁰ and DURIP received proposals requesting \$295 million but***

⁸ <https://www.ida.org/idamedia/Corporate/Files/Publications/IDA.../STD/D-5361.pdf>

⁹ Ibid

¹⁰ <https://www.defense.gov/Newsroom/Releases/Release/Article/2099273/fiscal-year-2020-university-research-funding-awards/source/GovDelivery/>

was only able to award \$49 million, which is less than FY 2019¹¹. It seems unlikely that competitor nations are underfunding scientific research programs in a similar way.

Given the NDS priority of not fighting tomorrow’s conflicts with yesterday’s weapons, *we respectfully request that you increase each URI PE and require that the additional dollars be used to support the MURI & DURIP programs.* We request that these increases not come at the expense of the other initiatives funded under these PEs. We strongly encourage you to direct DoD to maintain and grow funding for both programs in the Future Years Defense Program.

Minerva Research Initiative

The FY 2021 budget proposes to eliminate Defense-Wide funding for Minerva, which is housed within the Basic Research Initiatives PE. In addition, the FY 2021 budget proposes to cancel 23 ongoing Minerva projects being conducted by more than 30 universities.

The Minerva Research Initiative is the Department’s signature social science basic research program that funds university-led teams to address problems of strategic importance to U.S. national security. Minerva has aligned its research with the NDS in support of Department-wide priorities. Recently funded Minerva projects, such as “Russian Disinformation and Propaganda Campaigns” and “Empirical Analysis for Meeting Great Power Challenges” have given DOD unique insights that help shape future national security policies and better position the warfighter in a complex global environment. In FY 2018, Minerva only funded 12 projects but received approximately 175 applications¹². As noted by DoD officials, many of the challenges we face are social or have social elements to them and Minerva research is an important source of new ideas to better understand social, behavioral, cultural, and political aspects that are inherent to our security and stability. By only funding 7 percent of applications, we are missing out on new ideas that will enable us to maintain U.S. superiority with competitor nations and more astutely predict and deter the precursors of conflict. *CNSR urges Congress to restore Defense-Wide funding for Minerva and increase its overall budget to \$17 million.*

Finally, below please find the remainder of CNSR’s basic research PE recommendations:

<u>PE Number</u>	<u>Agency/RDT&E</u>	<u>Program Element</u>	<u>FY 21 Request (Thousands)</u>
601102A	Army	Defense Research Sciences	\$375,749
601103A	Army	University Research Initiatives	\$93,129
601104A	Army	University and Industry Research Centers	\$134,794
601121A	Army	Cyber Collaborative Research Alliance	\$5,281
601103N	Navy	University Research Initiatives	\$177,921
601153N	Navy	Defense Research Sciences	\$491,659
601102F	Air Force	Defense Research Sciences	\$377,473
601103F	Air Force	University Research Initiatives	\$189,591
601108F	Air Force	High Energy Laser Research Initiatives	\$15,683
601000BR	Defense-Wide	DTRA Basic Research Initiatives	\$27,560
601110D8Z	Defense-Wide	Basic Research Initiatives	\$75,126

¹¹ <https://www.defense.gov/Newsroom/Releases/Release/Article/2021937/dod-awards-489-million-to-universities-for-major-research-equipment/>

¹² <https://www.defense.gov/Newsroom/Releases/Release/Article/1787646/dod-announces-fy2018-minerva-research-initiative-awards/>

601120D8Z	Defense-Wide	National Defense Education Program	\$152,718
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Defense Applied Research PE Recommendations

Basic scientific research is just the first step in creating new military technologies. Researchers and scientists must apply the fundamental knowledge learned from basic research in order to solve military problems and develop the systems and components for potential solutions. To that end, we would like to highlight the success of the Defense-Wide Manufacturing Science & Technology PE, which provides resources for DoD’s contribution to the Manufacturing USA Network. The Network’s institutes form public-private partnerships that help move discoveries from the nation’s universities and research laboratories to the defense industrial base while enhancing the workforce. For example, Manufacturing USA created technologies and solutions for reducing weight in aerospace parts by up to 40 percent, built light-based communications systems enabling more effective and safe clandestine operations, developed cybersecurity awareness and compliance tools targeted at securing small- and medium-sized manufacturers and universities, and provided workforce training opportunities for more than 200,000 individuals in FY 2018¹³. The *NDS* says, “Support for a vibrant domestic manufacturing sector, a solid defense industrial base, and resilient supply chains is a national priority.” The Manufacturing USA Network is an example of a program consistent with the *NDS* in support of domestic manufacturing and the defense industrial base.

Defense Advanced Research Projects Agency (DARPA) Recommendation

DARPA’s ability to create truly revolutionary new military capabilities is well documented. With no intramural research laboratories, DARPA relies on partners, such as CNSR members, to conduct transformational scientific research to advance military technologies. In fact, more than 90 percent of DARPA’s RDT&E budget is awarded extramurally¹⁴. While it is likely impossible to list all of DARPA’s game-changing innovations, advances in stealth, unmanned aerial systems, GPS and precision-guided munitions have enabled DARPA to dramatically improve military capabilities¹⁵. In addition, DARPA’s work with the academic community have resulted in the development of the Internet, self-driving cars, neuro-prosthetics, speech technologies, metamaterials and computer chips fueling artificial intelligence technologies¹⁶.

CNSR supports funding for DARPA of \$3.6 billion to further lead scientific research in areas such as artificial intelligence, hypersonics, biological technologies, microelectronics, autonomous systems and long-range anti-ship capabilities.

Defense Medical Research Recommendations

In order to maintain a strong military, the U.S. must have healthy families and soldiers. It is imperative for DoD to contribute to curing diseases that affect the men and women in the military, their families, veterans, and the broader public. The defense medical research programs

¹³ <https://nvlpubs.nist.gov/nistpubs/ams/NIST.AMS.600-5.pdf>

¹⁴ <https://ncesdata.nsf.gov/fedfunds/2018/html/ffs18-dt-tab009.html>

¹⁵ https://www.darpa.mil/attachments/DARAPA60_publication-no-ads.pdf

¹⁶ Ibid

help ensure the U.S. has the medical technologies necessary to enable military readiness and serve those who have been wounded on the battlefield. Developments in battlefield medicine also contribute to advances which benefit civilian medical practice, such as regenerative medicines, vaccine developments, and emergency field treatments.

CNSR wishes to highlight the importance of the Congressionally Directed Medical Research Programs (CDMRPs). Through CDMRPs, DoD is the second largest funder of medical research in the United States¹⁷. According to its mission statement, CDMRPs fill research gaps by funding high impact, high risk and high gain medical research projects that other agencies may not venture to fund¹⁸. The National Academies concluded that CDMRPs coordinate research priorities with other funding agencies and have an effective review and selection process for awarding funds not dissimilar to the process used by the National Institutes of Health (NIH)¹⁹.

CDMRPs have supported research that has improved outcomes and health conditions resulting from military deployment in areas such as treatments for burns, improved prosthetics and long-term care for multiple-system trauma²⁰. *CNSR supports at least \$1.7 billion for CDMRPs* for continued innovation in medical scientific research.

Finally, below please find the remainder of CNSR’s applied research PE recommendations.

PE Number	Agency/RDT&E	Program Element	FY 21 Request (Thousands)
602141A	Army	Lethality Technology	General Support
602143A	Army	Soldier Lethality Technology	General Support
602144A	Army	Ground Technology	General Support
602145A	Army	Next Generation Combat Vehicle Technology	General Support
603461A	Army	High Performance Computing Modernization	General Support
602131M	Navy	Marine Corps Land Force Technology	General Support
602235N	Navy	Common Picture Applied Research	General Support
602236N	Navy	Warfighter Sustainment Applied Research	General Support
602271N	Navy	Electromagnetic Systems Applied Research	General Support
602435N	Navy	Ocean Warfighting Environmental Applied Research	General Support
602750N	Navy	Future Naval Capabilities Applied Research	General Support
603680N	Navy	Manufacturing Technology Program	General Support
604536N	Navy	Advanced Undersea Prototyping	General Support
602102F	Air Force	Materials	General Support
602202F	Air Force	Human Effectiveness Applied Research	General Support
602204F	Air Force	Aerospace Sensors	General Support
602605F	Air Force	Directed Energy Technology	General Support
602788F	Air Force	Dominant Information Sciences and Methods	General Support
602890F	Air Force	High Energy Laser Research	General Support
602668D8Z	Defense-Wide	Cyber Security Research	General Support
603680D8Z	Defense-Wide	Defense-Wide Manufacturing S&T Program	\$209,241
603833D8Z	Defense-Wide	Engineering Science and Technology	General Support
	Defense-Wide	DARPA Total	\$3,665,820

¹⁷ <https://www.nap.edu/catalog/23652/evaluation-of-the-congressionally-directed-medical-research-programs-review-process>

¹⁸ <https://cdmrp.army.mil/aboutus>

¹⁹ <https://www.nap.edu/catalog/23652/evaluation-of-the-congressionally-directed-medical-research-programs-review-process>

²⁰ Ibid

602787A	Army	Medical Technology	General Support
603002A	Army	Medical Advanced Technology	General Support
603807A	Army	Medical Systems Advanced Development	General Support
	DHP	Research, Development, Test and Evaluation Research	General Support
	DHP	Exploratory Development	General Support
	DHP	CDMRPs	\$1,712,536

COVID-19 Emergency Appropriations Priorities

CNSR supports the emergency supplemental appropriations request of \$26 billion from the higher education community (<https://www.aplu.org/members/councils/governmental-affairs/CGA-library/higher-ed-community-phase-iv-research-priorities/file>). Under the request, a portion of the appropriations would address pressing needs in the Defense S&T program. For example, funding for cost extensions of existing research projects will be vital to ensure to the maximum extent possible that milestones are not missed and DoD-sponsored research can be completed in a timely manner so it can hopefully be transitioned to the warfighter. Also, supplemental appropriations would support graduate students who could not complete their degrees due to the inability to perform research. It is more important to our national security than ever that we develop the next generation of scientists and engineers who will conduct the fundamental research to create the military capabilities of tomorrow while solving current problems facing the NSIB.

In addition to the above request, CNSR supports emergency appropriations being provided to combat COVID-19 and for research to help prevent future global pandemics. It is obvious that our national security is harmed when global pandemics essentially shut down DoD-sponsored R&D but our military strength is further weakened when our economy is forced into a recession in order to save lives. DoD has numerous research programs that can support developing solutions to combat COVID-19 and be forward thinking to limit and hopefully prevent future global pandemics. Below please find a list of research programs CNSR respectfully requests the subcommittee consider for emergency appropriations:

Newton Award for Transformative Ideas during the COVID-19 Pandemic: Recently established award to support transformative ideas and produce disruptive ways of thinking about fundamental scientific problems that have evaded resolution that would be of immense potential benefit to DoD and the nation at large.

Vannevar Bush Faculty Fellowship (VBFF): Supports new, out-of-the-box ideas that have the potential for transformative impact. A VBFF researcher is currently working on rapid reliable and adaptable virus testing.

Laboratory University Collaboration Initiative (LUCI): Sponsors research engagements between DoD lab scientists and DoD-funded academics. A LUCI fellow is researching methods for early-stage pathogen detection.

Minerva Research Initiative: DoD's premier social science research program aimed at improving our basic understanding of many security-related issues. Minerva-funded researchers are

examining how foreign nation-state competitors or terrorists may seek to capitalize on the pandemic and tracking disinformation spreading about COVID-19.

Congressionally Directed Medical Research Programs (CDMRPs): Advances medical and scientific research by filling research gaps through funding high impact, high risk and high gain projects that other agencies may not venture to fund. CDMRPs disburse funds similar to NIH and could explore challenges in combating COVID-19 or seeking to defeat future global health pandemics.

Defense-Wide Manufacturing Science & Technology (DMS&T): The eight DoD Manufacturing Innovation Institutes, through public-private partnerships, advance discoveries from the nation's universities and research laboratories to the defense industrial base while enhancing the workforce. DoD leadership has noted the impact of COVID-19 on the supply chain and workforce for critical national security sectors, such aviation, shipbuilding, and space. Manufacturing USA is essential to creating technology solutions and manufacturing innovations in those sectors and preparing a workforce capable of pivoting to supply the nation's most urgent needs for medical supplies and long-term needs for domestic products.

Again, thank you for the opportunity to submit public witness testimony as you develop the FY 21 Defense Appropriations bill. Please do not hesitate to contact me if we can be of any service to you.