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Report to Congressional Committees

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DEFENSE SCIENCE AND TECHNOLOGY

Opportunities to Better Integrate Industry Independent Research and Development into DOD Planning

Accessible Version

GAO-20-578

GAO Highlights

DEFENSE SCIENCE AND TECHNOLOGY: Opportunities To Better Integrate Industry Independent Research And Development Into DoD Planning

September 2020

Highlights of GAO-20-578, a report to congressional committees

Why This Matters

Research and development (R&D) projects in high-tech areas like cybersecurity and biotechnology can help the U.S. military reassert its technological edge.

Contractors decide what independent R&D projects to conduct and the Department of Defense (DOD) reimburses them about $4 billion-$5 billion annually.

More information about those projects could help DOD guide its own R&D investments.

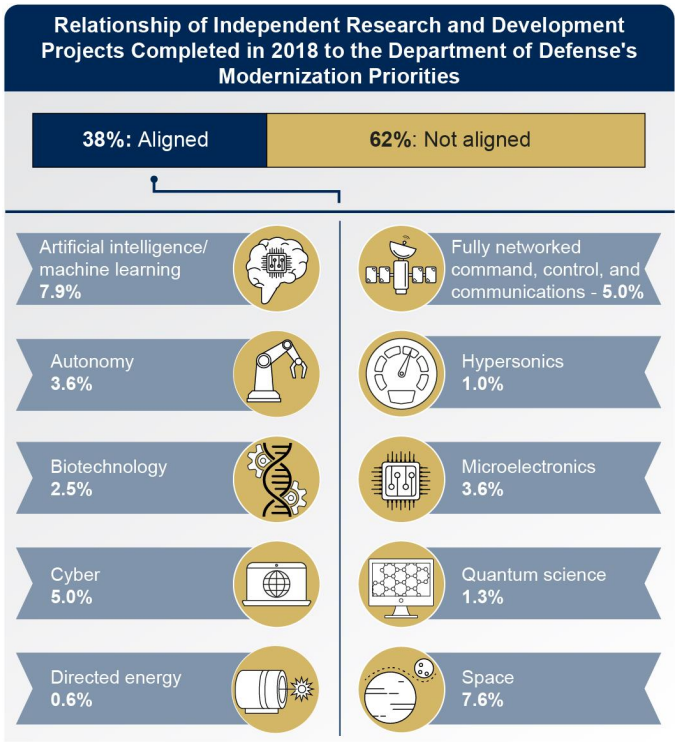
Key Takeaways

DOD does not know how contractors' independent R&D projects fit into the department's technology goals. As a result, DOD risks making decisions about its multi-billion dollar science and tech investments that could duplicate work or miss opportunities to fill in gaps that the contributions of private industry do not cover.

DOD has a database of independent R&D projects, but it is not very useful for informing investment decisions because DOD does not obtain information in these and other areas:

- **Priority.** Contractors do not identify whether a project aligns with any of 10 modernization priorities. The department uses those priorities to make decisions about R&D investments.
- **Cost.** The database does not capture a project's complete cost, which could help DOD understand cost implications of future related work.
- **Innovation.** The database does not include whether a project is a lower-risk, incremental development or a more innovative "disruptive" technology. Disruptive projects carry higher risk of failure but offer possible significant rewards in the long term.

While DOD is not required to review independent R&D projects to understand how they support DOD's priorities, GAO analysis showed 38 percent of industry projects aligned with DOD's priorities.



Source: GAO analysis of Department of Defense data. | GAO-20-578

What GAO Recommends

To help DOD better understand the scope and nature of independent projects, we recommend DOD determine whether to require additional information in the project database and review projects annually as part of its strategic planning process. DOD agreed with both recommendations.

How GAO Did This Study

We categorized a sample of completed projects from 2014–2018 by innovation type and analyzed projects completed in 2018 for alignment with DOD's modernization priorities. We also reviewed DOD policies on independent R&D and interviewed representatives from 10 defense contractors.

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Abbreviations

AFRL	Air Force Research Laboratory
ACO	Administrative Contracting Officer
BBP	Better Buying Power
CAS	Cost Accounting Standards
COI	Communities of Interest
DCAA	Defense Contract Audit Agency
DCMA	Defense Contract Management Agency

DOD	Department of Defense
DTIC	Defense Technical Information Center
DFARS	Defense Federal Acquisition Regulation Supplement
FAR	Federal Acquisition Regulation
FPRA	Forward Pricing Rate Agreement
FPRR	Forward Pricing Rate Recommendation
G&A	General and Administrative
IR&D	Independent Research and Development
OUSD R&E	Office of the Under Secretary of Defense for Research and Engineering
RDT&E	Research, Development, Test, and Evaluation
S&T	Science and Technology
U.S.C.	United States Code
USD R&E	Under Secretary of Defense for Research and Engineering

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Congressional Committees

In 2018, the Department of Defense (DOD) concluded that technology advancements among potential adversaries posed growing challenges to U.S. defense capabilities, putting U.S. battlefield superiority at risk. In this environment, DOD has renewed its efforts to foster innovation and secure technological supremacy. DOD has long relied on the defense industry's Independent Research and Development (IR&D) as a key source of such innovation. The Federal Acquisition Regulation (FAR) allows contractors to recover the cost of IR&D efforts as indirect costs allocated to their government contracts. IR&D costs are contractor incurred costs for IR&D projects that fall within four allowable categories and do not include the costs of efforts sponsored by a grant or required in the performance of a contract. DOD does not specify the research to be conducted or directly fund the IR&D projects. As such, contractors have wide latitude in determining which projects to pursue under IR&D and submit their IR&D expenses to DOD for reimbursement of allowable costs on defense contracts.

The unique business environment in which many defense contractors operate—DOD is often their primary or only customer—incentivizes them to pursue IR&D projects that they anticipate will be of interest to DOD and offer potential future business opportunities. This dynamic contributes to a natural feedback loop that exists between DOD and the defense industry regarding IR&D. Essentially, contractors rely on DOD to communicate its modernization needs as a key input to the IR&D projects they choose to undertake, and DOD relies on contractors to share information about these projects to inform DOD of industry's progress in advancing technology. Nonetheless, DOD acknowledged in a 2010 memorandum that it lacked sufficient insight into industry IR&D projects and the extent to which these reimbursements have helped DOD improve its military capabilities.[1] Such information gaps bring into question the benefits DOD

[1]Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Memorandum for Acquisition Professionals, Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending (Washington, D.C.: Sept. 14, 2010).

has obtained from the tens of billions of dollars it has reimbursed defense contractors over the past decade for expenses incurred for IR&D.

The Senate Report accompanying a bill related to the John S. McCain National Defense Authorization Act for Fiscal Year 2019 included a provision for GAO to review DOD's management of IR&D and innovation outcomes.[2] In this report, we examine (1) DOD's processes for monitoring and auditing IR&D; (2) the extent to which industry's IR&D investments align with DOD's modernization priorities; and (3) the extent to which DOD reviews IR&D as part of its modernization planning efforts. We also identified several recent products developed within the defense industry that stemmed from IR&D investments and present information about them in appendix I.

To examine how DOD monitors and audits IR&D, we analyzed and summarized the existing statute, Cost Accounting Standards (CAS), the Federal Acquisition Regulation (FAR), and the Defense Federal Acquisition Regulation Supplement (DFARS) that govern IR&D. We also analyzed and summarized DOD instructions that detail policies for overseeing IR&D. We reviewed applicable defense agency contract administration, cost monitoring, and audit guidance. We also requested and analyzed recent audit reports and results from overhead rate negotiations that included, in part, assessments of IR&D projects and costs identified by DOD. In addition, we reviewed several studies by various organizations on DOD's management of its research and development activities that include IR&D.

To examine the extent to which industry IR&D investments align with DOD's modernization priorities, we identified DOD's modernization priorities and analyzed IR&D project information reported by all contractors for fiscal year 2018 in DOD's IR&D database.[3] Using fiscal year 2018 data, we analyzed all IR&D projects completed that year—a total of 2,242 projects—to determine how these IR&D projects aligned with DOD's science and technology modernization priorities that are

[2]S. Rep. No. 115-262, at 439 (2019) accompanying a bill related to the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No.115-232.

[3]The 2018 IR&D project data was the most current and complete set available for analysis during the course of our performance audit. Major contractors are required, and non-major contractors are encouraged, to report completed IR&D project data 90 days after the end of their fiscal year.

based on the 2018 National Defense Strategy.[4] We did this by comparing project summary data, including project descriptions and classifications, with DOD's science and technology modernization priorities to determine whether a specific project fit within one of the modernization priorities.

We used a generalizable sample of fiscal years 2014 to 2018 completed IR&D project data to determine whether the potential results of these individual projects in our sample aligned with disruptive or incremental innovation. To make these determinations, we relied on criteria established in our June 2017 report on best practices for managing innovation investments.[5] Specifically, that report found that disruptive innovation projects are those that carry a higher risk of failure, but significant rewards via potentially breakthrough technology in the long-term. The report also found that incremental innovation projects are lower risk efforts intended to be integrated quickly into near-term products.[6] We also determined the extent to which these projects were consistent with the allowable IR&D categories provided under the FAR.[7] We did this to note the difference in the percentage of projects categorized as development projects as compared to the percentage of projects categorized as basic and applied research projects. To complete this analysis, we conducted an independent, two-reviewer, consensus analysis of the IR&D project data. We determined the IR&D project data were sufficiently reliable to conduct our modernization priority alignment and innovation type analyses with the exception of the estimated project cost information, which we therefore excluded from our analyses.

We also reviewed documentation from and interviewed representatives from 10 defense contractors to discuss how they identify and prioritize the IR&D projects they undertake. We selected these 10 contractors based on (1) their annual IR&D expenses, (2) the amount of their overall business with DOD, and (3) their products. Specifically, our selected

[4]The Under Secretary of Defense for Research and Engineering (USD (R&E)) identified 10 priority technology domains for future investment based upon the 2018 National Defense Strategy. In August 2019, USD R&E elevated 5G wireless technology as the eleventh modernization priority. We did not include the 5G wireless technology modernization priority in our analysis.

[5]GAO, *Defense Science and Technology: Adopting Best Practices Can Improve Innovation Investments and Management*, GAO-17-499 (Washington, D.C.: June 29, 2017).

[6]GAO-17-499.

[7]See appendix III for additional information on the sampling method, population size, and sample size.

sample included six contractors that had the highest annual IR&D expenses and corresponding revenues attributable to DOD contracts. These six contractors developed and produced a wide range of DOD products such as aircraft, sensors, satellites, and armored vehicles, among others. Our sample also included four companies that had lower annual IR&D expenses and corresponding revenues attributable to DOD contracts than the other six. These four contractors further increased the diversity of product types—adding aircraft engines, ships, and other specialty products—covered in our sample. In total, the 10 selected contractors represent more than 50 percent of total defense IR&D reimbursements in fiscal year 2018. We conducted semi-structured interviews with each contractor to obtain information on its IR&D program, incentives for participating in IR&D, financial management practices, and corporate research and development strategies.

To examine the extent to which DOD reviews IR&D project information as part of its modernization planning, we reviewed DOD's modernization priority documentation and strategic planning documents from DOD and the military services. We reviewed DOD's unclassified summary of the January 2018 National Defense Strategy along with April 2018 and March 2019 congressional testimonies from the Under Secretary of Defense for Research and Engineering (USD (R&E)).[8] We also reviewed the September 2019 National Defense Science and Technology Strategy, the April 2019 Air Force Science and Technology Strategy, the 2017 Naval Research and Development Framework, and the 2019 Army Modernization Strategy. We also examined the three DOD Better Buying Power memorandums issued between 2010 and 2015 that included, among other things, initiatives to improve the military capability of the United States while preserving industry's independence to select the technologies to pursue.

For each objective, we interviewed DOD officials responsible for DOD's research and development and science and technology investments, IR&D oversight, acquisition policy, and financial management. These officials work in the Office of the Under Secretary of Defense for Acquisition and Sustainment; the Office of the Under Secretary of

[8]*Hearing on Promoting DOD's Culture of Innovation, Before the U.S. House Armed Services Committee,* 116th Cong., 2nd session. (2018) (statement of Dr. Mike Griffin, Under Secretary of Defense for Research and Engineering); and *Hearing on Fiscal Year 2020 Science and Technology Posture, Before the U.S. House Armed Services Committee,* 117th Cong., 1st session. (2019) (statement of Michael D. Griffin, Under Secretary of Defense for Research and Engineering).

Defense for Research and Engineering (OUSD (R&E)); the Office of the Under Secretary of Defense (Comptroller); the Air Force Research Laboratory; the Office of Naval Research; the Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation; and the Office of the Deputy Assistant Secretary of the Army for Research and Technology. We also interviewed officials with the Defense Contract Management Agency (DCMA), the Defense Contract Audit Agency (DCAA), and the Defense Technical Information Center (DTIC) with regard to their responsibilities in contract administration and cost monitoring, auditing, and collecting IR&D project data, respectively. Appendix II provides more details on our scope and methodology.

We conducted this performance audit from December 2018 to September 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Types of Research and Development

The Defense Business Board defined three types of research and development conducted by the defense industrial base.[9] Since the accounting and reimbursement requirements are different for the cost of each of these types of effort, it is important to correctly classify the type of effort involved. These three types are as follows:

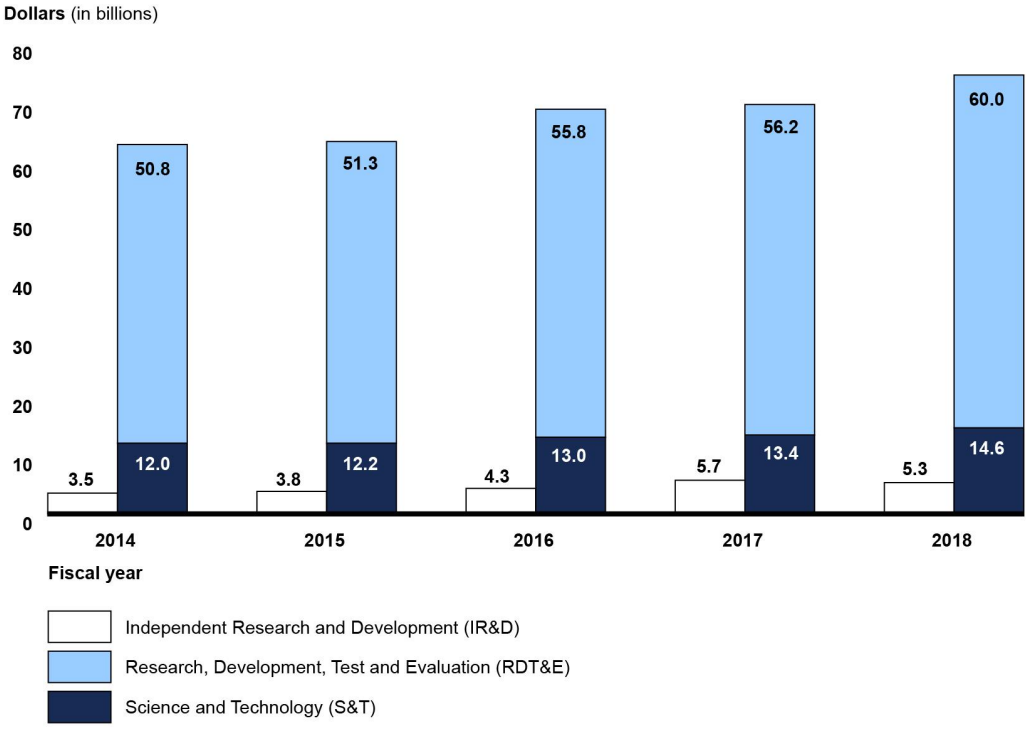
1. **IR&D** is conducted by contractors undertaking research and development activities of their choosing for which costs are reimbursed, in part, with government funds. The amount reimbursed by DOD depends on a number of factors, including the percent of the contractor's business base for which DOD accounts and the indirect cost factors negotiated with the government. We discuss how DOD monitors and audits IR&D costs later in the report.

[9]Defense Business Board, *Innovation: Attracting and Retaining the Best of the Private Sector*, Report Fiscal Year 14-02 (Washington, D.C.: 2014).

2. **Contracted Research & Development** is the primary external method DOD uses to identify and develop new technologies. In contrast to IR&D, DOD awards research and development contracts to contractors using Research, Development, Test and Evaluation (RDT&E) funding and specifies within the contract the objectives for research and development work DOD expects the contractor to pursue. DOD also uses its RDT&E appropriations to develop and test new weapon systems, among other products. A subset of RDT&E funding is specifically identified to fund science and technology (S&T) efforts.
3. **Self-funded, or company-funded, research and development** expenses are paid out of a company's own capital and return on R&D investments would come through higher profit margins. Most self-funded research and development within the defense industry is performed by companies that also have commercial divisions.

Figure 1 compares DOD's IR&D, S&T, and RDT&E funding from fiscal years 2014 through 2018. The figure shows, among other things, that DOD's S&T funding experienced a moderate increase of about 5 percent on average annually over this time span. During the same time frame, DOD's IR&D reimbursements increased about 12 percent on average annually.

Figure 1: Comparison of Annual Independent Research and Development Reimbursements to DOD Science and Technology and Research, Development, Test, and Evaluation Funding, 2014 to 2018



Source: GAO presentation of Department of Defense data. | GAO-20-578

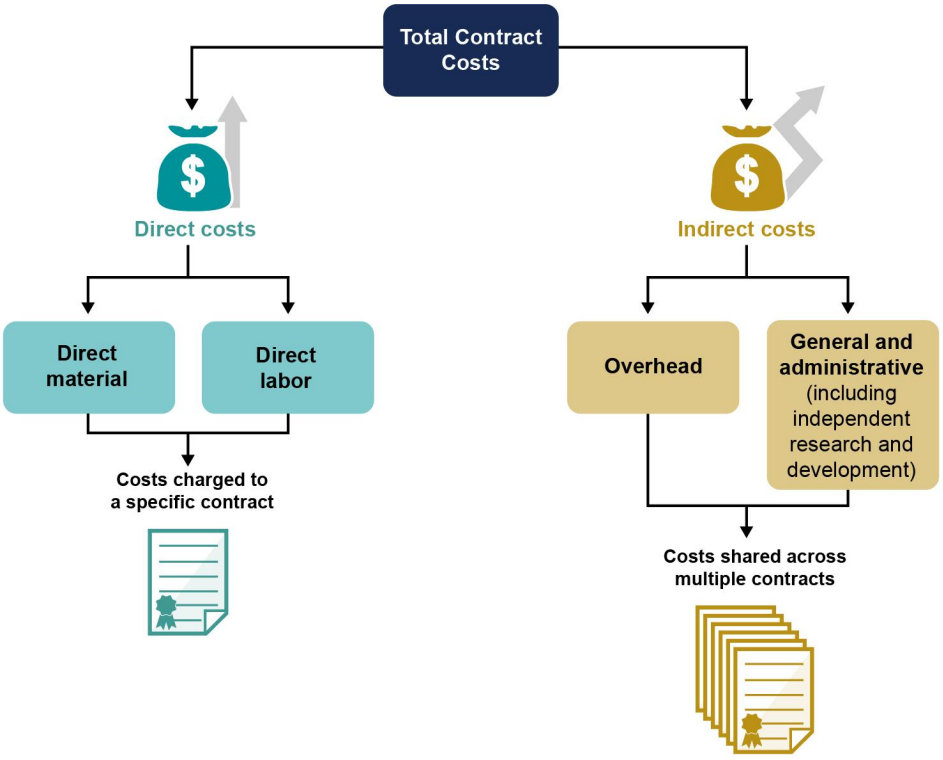
Note: IR&D reimbursements are not limited specifically to research, development, test, and evaluation funding. IR&D is an allowable, indirect cost on contracts that are funded via RDT&E as well as other appropriations.

DOD typically allocates a company's IR&D expenses as indirect costs to contracts over the business unit General and Administrative (G&A) costs allocation basis.[10] After direct costs—those labor and material costs that can be associated with a specific contract—have been determined and charged directly to the contract or other work, indirect costs are those remaining to be allocated to intermediate or two or more final cost objectives. Indirect costs include costs associated with supporting the business as a whole such as human resources, legal, accounting, and finance. IR&D expenses are indirect costs, which are allocated to multiple contracts over the business unit G&A, home office residual cost base,

[10]However, where specific projects clearly benefit other profit centers or the entire company, these costs must be allocated through the G&A of these other profit centers or through the home office to benefiting segments, as appropriate.

special allocations, or FAR-based allocations for home office and business unit (see fig. 2).

Figure 2: Types of Contract Costs



Source: GAO presentation of a Defense Systems Management College graphic. | GAO-20-578

Companies negotiate with administrative contracting officers (ACO) forward pricing rates for indirect cost pools, including their projected IR&D expenses in Forward Pricing Rate Agreements (FPRA).[11] Contractors use these agreements in cost proposals to the government for future solicitations, while the government uses FPRAs to help it evaluate contractors' cost proposals before awarding new contracts. Additionally, contractors report their actual incurred IR&D project costs, as part of their actual G&A expense pool, to the government. Incurred cost claims are due 6 months after the completion of the contractor's fiscal year end. The

[11]Administrative contracting officers, as part of their duties, determine the allowability, negotiate, and agree upon costs, including IR&D, applied to contracts awarded by DOD acquisition commands and other buying offices. Most ACOs work for the Defense Contract Management Agency, but some work for other DOD organizations, such as the Navy's Supervisor of Shipbuilding, Conversion, and Repair.

FAR allows contractors to recover the cost of IR&D efforts as indirect costs allocated to their government contracts.

Statute, Regulations, and DOD Policy Governing IR&D

Statute

The primary statute governing IR&D at DOD is 10 U.S.C. § 2372, as amended. Among other requirements, the statute mandates DOD to prescribe regulations that may include a provision establishing regular communications from (1) DOD to contractors in order to share DOD's needs and plans for future technology and advanced capability; and (2) contractors to DOD regarding their progress on IR&D projects. In 1991, the statute permitted the Secretary of Defense to write regulations to limit the allowability of IR&D costs to those projects that the Secretary determined were of potential interest to the DOD. In 2016, Congress amended the statute by replacing this requirement with a new requirement for the Secretary to prescribe regulations that would not infringe on the independence of a contractor to choose which technologies to pursue in its IR&D program, if the contractor's chief executive officer determines that expenditures will advance the DOD's needs for future technology and advanced capability.[12] Table 1 compares select provisions of the 1991 and 2016 versions of the statute governing IR&D.

Table 1: Overview of Selected Provisions of 10 United States Code §2372 Governing Independent Research and Development (IR&D) at the Department of Defense (DOD) and GAO Assessment of Statutory Changes in 2016

Public Law No. 102-190 § 802 (1991)	Public Law No. 114-328 § 824 (2016)	Assessment of changes in 2016
(a) The Secretary of Defense shall prescribe regulations governing the payment, by DOD, of expenses incurred by contractors for IR&D and bid and proposal costs.	(a) The Secretary of Defense shall prescribe regulations governing payment by the DOD of expenses incurred by contractors for independent research and development costs. Such regulations shall provide that expenses incurred for independent research and development shall be reported independently from other allowable indirect costs.	Required expenses incurred for IR&D to be reported independently from other allowable costs

[12]Pub. L. No. 114-328, §824 (2016).

(b) The regulations prescribed under subsection (a) shall provide that IR&D and bid and proposal costs shall be allowable as indirect expenses on covered contracts to the extent that those costs are allocable, reasonable, and not otherwise unallowable by law or under the Federal Acquisition Regulation. (c) Subject to subsection (f), the regulations prescribed pursuant to subsection (a) may include the following provisions: (1) limitation on the allowability of independent research and development and bid and proposal costs to work which the Secretary of Defense determines is of potential interest to the DOD. (f) Regulations prescribed pursuant to subsection(c) may not include provisions that would infringe on the independence of a contractor to choose which technologies to pursue in its independent research and development program.	(b) The regulations prescribed under subsection (a) shall provide IR&D costs shall be considered a fair and reasonable, and allowable, indirect expense on DOD contracts. (d) Regulations prescribed under subsection (a) may not include provisions that would infringe on the independence of a contractor to choose which technologies to purse in its IR&D program if the chief executive officer of the contractor determines that the expenditures will advance the needs of the DOD for future technology and advanced capability.	Streamlined language on requirements for IR&D costs to be deemed allowable but did not result in substantive changes Required that regulations may not infringe on the independence of a contractor to choose which technologies to pursue in IR&D, as in the previous statute Assigned responsibility to the chief executive officer of the contractor to determine whether a potential IR&D expenditure will advance the needs of the DOD
(g) The regulations under subsection (a) shall encourage contractors to engage in research and development activities of potential interest to the DOD, including activities intended to accomplish any of the following: Enabling superior performance of future United States weapon systems and components. Reducing acquisition costs and life-cycle costs of military systems. Strengthening the defense industrial base and the technology base of the United States. Enhancing the industrial competitiveness of the United States. Promoting the development of technologies identified as critical under section 2506 of this title. Increasing the development and promotion of efficient and effective applications of dual-use technologies. Providing efficient and effective technologies for achieving such environmental benefits as improved environmental data gathering, environmental cleanup and restoration, pollution reduction in manufacturing, environmental conservation, and environmentally safe management of facilities.		Deleted the provision to encourage contractors to engage in research and development activities of potential interest to the DOD Did not include the requirement encouraging contractors to engage in the seven IR&D activities of potential interest to the DOD

Implementation of regular methods of transmission: from the DOD to contractors, in a reasonable manner, of timely and comprehensive information regarding planned or expected DOD future needs; and from contractors to the DOD, in a reasonable manner, of information regarding progress by the contractor on the contractor's IR&D programs.	Implementation of regular methods for transmission: from the DOD to contractors, in a reasonable manner, of timely and comprehensive information regarding planned or expected needs of the DOD for future technology and advanced capability; and from contractors to the DOD, in a reasonable manner, of information regarding progress by the contractor on the IR&D programs of the contractor.	No substantive changes resulted

Source: GAO analysis. | GAO-20-578

Regulations and Policy

The FAR, among other things, limits a contractor's IR&D costs to projects in four areas and prescribes the allowability of IR&D costs as indirect expenses on contracts to the extent they are allocable and reasonable.[13] Further, the DFARS, among other provisions, currently requires that allowable IR&D costs be limited to projects performed by major contractors that are of potential interest to DOD and lists seven categories of allowable IR&D projects. DFARS also stipulates that the cognizant ACO and the cognizant DCAA auditor are responsible for determining the allowability of IR&D costs. Finally, for IR&D costs to be allowable for major contractors, the IR&D projects generating these costs must be reported to an IR&D database managed by the Defense Technical Information Center (DTIC).[14] These requirements are summarized in table 2 below.

[13]The FAR excludes the costs of effort sponsored by a grant, required in the performance of a contract, and technical effort expended in developing and preparing technical data specifically to support a submitted bid or proposal, and technical effort expended in developing and preparing technical data specifically to support a submitted bid or proposal. FAR 48 C.F.R. § 31.205-18(a)(c), FAR 48 C.F.R. § 31.201-2, § 31.201-3, and § 31.201-4. See appendix II for additional information on the four authorized categories for IR&D projects and for definitions of allowable, allocable, and reasonable costs.

[14]DFARS 48 CFR § 231.205-18. While DFARS 231.205-18(c)(iii)(C)(1)-(3) requires major contractors (i.e., those contractors that allocated more than $11 million in IR&D costs to covered contracts during the preceding fiscal year) to report their projects to the DTIC IR&D database, DFARS 231.205-18(c)(iv) provides encouragement for contractors not meeting the major contractor threshold to also report their projects.

Table 2: Summary of the Federal Acquisition Regulation and Defense Federal Acquisition Regulation Supplement Governing Independent Research and Development

Federal Regulation	Summary of selected Independent Research and Development provisions
Federal Acquisition Regulation § 31.205-18	Limits Independent Research and Development to four areas 1) basic research, 2) applied research, 3) development, and 4) systems and other concept formulation studies; and excludes the costs of effort sponsored by a grant or required in the performance of a contract. Prescribes that Independent Research and Development costs must be both allocable and reasonable to be allowable as indirect expenses on contracts.
Defense Federal Acquisition Regulation Supplement § 231.205-18	For major contractors, requires Independent Research and Development costs be limited to those for projects that are of potential interest to the Department of Defense (DOD) to be allowable. Details seven categories of allowable Independent Research and Development activities:[a] 1. Enable superior performance of future weapon systems and components 2. Reduce acquisition costs and life-cycle costs of military systems 3. Strengthen the defense base 4. Enhance industrial competitiveness 5. Promote the development of critical technologies 6. Increase the development and promotion of efficient and effective applications of dual-use technologies 7. Provide efficient and effective technologies for achieving such environmental benefits as: improved environmental data gathering, environmental cleanup and restoration, pollution reduction in manufacturing, environmental conservation, and environmentally safe management of facilities For independent Research and Development costs to be allowable, major contractors must report projects to the Defense Technical Information Center Independent Research and Development project database at least annually and when the project is completed.

Source: GAO summary of Federal Acquisition Regulation § 31.205-18 and Defense Federal Acquisition Regulation Supplement § 231.205-18. | GAO-20-578

[a]Public Law 114-328, § 824 (2016) removed these seven criteria, and DOD is writing defense regulations to implement this provision.

An open DFARS case is currently working its way through the approval process to implement Section 824 of the National Defense Authorization Act for Fiscal Year 2017, which requires regulations to be written governing DOD's payment of expenses that contractors incurred for IR&D costs.[15] As of July 13, 2020, this draft proposed rule is still being reviewed. Until DOD implements a final rule, however, the current requirement that allowable IR&D costs be limited to seven categories of IR&D projects that are of potential interest to DOD remains in effect.

For the past 80 years, DOD's control over contractors' investments by making reimbursement dependent on certain constraints has evolved. For

[15]DFARS Case 2017-D018. For additional information on the rule making process, see GAO, *Defense Acquisitions: DOD Needs to Improve How It Communicates the Status of Regulation Changes*, GAO-19-489 (Washington, D.C.: July 11, 2019).

contracts awarded prior to August 1991, contractors' advance agreements with DOD could include only projects which had "a potential relationship to military function or operation" to be deemed allowable, but, after this time, this provision was revised to expand eligible projects to include those that had "potential interest" to DOD. During the 1990s, DOD reduced its technical exchanges with industry, in part to ensure contractor independence.

Starting in 2010, DOD issued three Better Buying Power (BBP) memorandums that, among other things, concluded DOD needed to analyze industry IR&D spending; determine whether IR&D benefits the government and industry; and examine how industry obtains insight into DOD's growing technical needs. DOD deemed these actions necessary given the third BBP memorandum stated IR&D spending exceeded $4 billion annually. One action, resulting in a DFARS change in 2016 (informally referred to within DOD and industry as the "Kendall Rule"), required major contractors to hold technical interchanges with DOD to discuss their IR&D projects with a relevant DOD official and record the official's name and date of the meeting in the DTIC database prior to starting an IR&D project in order for the costs to be deemed allowable. The intent of the rule was to ensure appropriate DOD officials were informed of relevant IR&D projects and industry was informed about DOD's technical needs. Due to feedback from industry regarding the burdensome requirements to comply with this requirement, DOD removed it from the DFARS in 2018, which resulted in freeing contractors to pursue IR&D projects without including the government in preliminary discussions.

Cost Accounting Standards (CAS) 420

The Cost Accounting Standards (CAS) do not apply to all contracts. When the CAS apply, they govern identifying, accumulating, and defining the amount of cost; assigning the cost to more cost accounting periods; and allocating or distributing costs to contracts or other cost objectives. CAS 420 provides the requirements for measuring, assigning, and allocating IR&D costs. For each IR&D project, CAS 420 requires that all costs except G&A allocable to the project, pursuant to the contractor's consistently applied cost accounting practices, be accumulated for that

project.[16] IR&D costs are allocated to the final cost objectives of the segments that caused or benefitted from the projects.

DOD Organizations' Roles and Responsibilities Related to IR&D

Several DOD organizations are responsible for managing DOD's science and technology investment portfolio as well as setting and executing DOD's IR&D policy.

- **OUSD (R&E)**, among other things, oversees DOD's strategic direction for defense research, development, and engineering priorities. As part of this, OUSD (R&E) aligns DOD's investment portfolio, including science and technology investments, in accordance with the modernization priorities outlined in the National Defense Strategy. OUSD (R&E) relies on portfolio managers to oversee its modernization priority domains.[17] For their assigned domains, each portfolio manager establishes a DOD-wide technology roadmap to deliver technical capabilities to the warfighter; lead independent technical analyses; and assess activities occurring in DOD, industry, and academia that pertain to the domain. Portfolio managers also coordinate with formally established DOD Communities of Interest (COI).[18] OUSD (R&E) is also responsible for DOD's IR&D policy. DOD's IR&D policy, among other things, is to (1) seek visibility and insight into IR&D participants' investment priorities, (2) promote engagement with IR&D participants, and (3) encourage contractors to engage in IR&D activities of potential interest to DOD.[19]

[16]48 C.F.R. §9904.420-30(a)(4) defines a G&A expense as any management, financial, and other expenses which is incurred by or allocated to a business unit and which is for the general management and administration of the business unit as a whole. G&A expense does not include those management expenses whose beneficial or causal relationship to cost objectives can be more directly measured by a base other than a cost input base representing the total activity of a business unit during a cost accounting period.

[17]DOD refers to these portfolio managers as Assistant Directors.

[18]We previously reported DOD relies on COIs to provide it with a way for technical experts from areas such as cyber or space to coordinate S&T-related efforts and identify areas for collaboration. See GAO-17-499.

[19]Department of Defense Instruction 3204.01, DOD Policy for Oversight of Independent Research and Development (IR&D), August 20, 2014; Incorporating Change 2, July 9, 2020.

- **DCMA**, among other things, employs administrative contracting officers (ACO) who, as part of their duties, negotiate FPRAs and agree on indirect costs, including IR&D, applied to contracts awarded by DOD acquisition commands and other buying offices.
- **DCAA** assists the DCMA ACOs by auditing projected and actual costs, including IR&D, associated with DOD contracts to ensure they are allowable, allocable, and reasonable in accordance with CAS, the FAR, and DFARS.
- **DTIC** is an independent agency headed by an administrator and directly reports to OUSD (R&E). Among other responsibilities, DTIC operates and maintains the IR&D project database and the Defense Innovation Marketplace website that serves to enhance communication between DOD and industry on research and development priorities.

DOD Conducts Audits and Takes Other Measures to Monitor Contractors' IR&D Costs

DCMA and DCAA are the two primary DOD organizations that monitor and audit contractors' proposed and actual IR&D expenses to ensure the expenses are properly recorded and allocated to defense contracts. As part of these efforts, both DCMA and DCAA are required to verify that contractors provide summary data on their IR&D projects into DTIC's database. DCMA and DCAA officials we interviewed stated that, while they typically question some IR&D projects and costs as unallowable or unallocable during initial reviews, not all IR&D costs are comprehensively examined or audited.

DCMA Negotiates IR&D Rates and Monitors IR&D Costs

DCMA ACOs, typically with support from DCAA auditors and DCMA technical specialists, negotiate FPRAs—which include projected IR&D costs—generally with large contractors. At the request of the ACO, DCMA technical specialists support the negotiation process by analyzing the contractor's indirect costs, including IR&D. The objective of this technical analysis is to provide sufficient information and insight into a contractor's proposed costs to assist the ACO in negotiating fair and reasonable rates and timely FPRAs. DCMA's technical support for indirect costs instruction details the role of DCMA technical specialists in evaluating IR&D costs for FPRAs as shown in table 3.

Table 3: Defense Contract Management Agency Technical Specialists Responsibilities for Evaluating Independent Research and Development (IR&D) Costs

1.	Determine whether the IR&D costs proposed are of potential interest to the Department of Defense and allowable as per the Federal Acquisition Regulation (FAR) § 31.205-18 and against the seven criteria detailed in the Defense Federal Acquisition Regulation Supplement § 231.205-18.
2.	Review the IR&D projects' scope to ensure these efforts qualify as one of the four approved IR&D categories as described in the FAR § 31.205-18 (a).
3.	Ensure the IR&D projects do not include required tasks already required to be completed under other contracts unless part of a cooperative agreement under certain circumstances.[a]
4.	Use any of several evaluative factors to determine if the forecast IR&D costs are reasonable.

Source: GAO presentation of Defense Contract Management Agency instruction. | GAO-20-578

[a]Cooperative agreements are not acquisition contracts under FAR § 2.101. FAR §31.205-18**(e)(**1) states in part that IR&D costs may be incurred by contractors working jointly with one or more non-Federal entities pursuant to a cooperative arrangement (for example, joint ventures, limited partnerships, teaming arrangements, and collaboration and consortium arrangements).

In addition, the DCMA technical specialists we interviewed stated they validate that required IR&D project data are entered into the DTIC IR&D project database by the contractors. The technical specialists also stated they help DCAA determine whether the IR&D projects are in compliance with CAS 420 by verifying the IR&D project costs are allocated appropriately.

DCMA cost monitors, another specialist position, and ACOs typically compare contractors' actual incurred costs against the projected rates calculated during the FPRA process. If the cost monitors and ACOs determine a significant variance between the actual and projected rates, the ACO may adjust the proposed rates. Further, DCMA technical specialists, which include engineers, may conduct technical assessments of IR&D projects at the request of an ACO. Technical specialists' responsibilities during these technical assessments are listed in table 4.

Table 4: Defense Contract Management Agency Technical Specialist Actions to Evaluate Independent Research and Development (IR&D) Costs

1.	Assess the contractor's policy and procedures for management of their IR&D projects.
2.	Interview the contractor's principal technology leads for the IR&D projects.
3.	Conduct a technical evaluation of the project information uploaded to the Defense Technical Information Center's IR&D project database.
4.	Determine whether the IR&D costs are of potential interest to the Department of Defense by evaluating the technical details of the project against the seven criteria detailed in the Defense Federal Acquisition Regulation Supplement § 231.205-18.

Source: GAO presentation of Defense Contract Management Agency data. | GAO-20-578

For contractors with a large number of IR&D projects, DCMA technical specialists and engineers can consider assessing a sample of IR&D projects. DCMA selects the sample size based on the project dollar value

and the assessed level of cost risk the projects present to the government. The DCMA officials we interviewed stated the samples typically include projects that encompass the bulk of IR&D costs, which is in line with DCMA's goal for sampling the majority of the costs.

DCMA ACOs also negotiate final overhead rate agreements with contractors. Final overhead rate agreements or "year-end actuals" are rates negotiated after contractors submit their final indirect-rate proposals. These submissions are due within 6 months after the end of the contractors' fiscal year. Prior to negotiating these rates, DCMA ACOs may request that technical specialists and engineers conduct pricing and technical reviews of IR&D costs. At the same time, DCAA auditors conduct their audit of the final indirect-rate proposal to determine if the reported costs are allowable. After receiving the audits and analysis, ACOs negotiate these rates with contractors and use them to determine the actual amount of indirect costs, including IR&D, for which contractors will be reimbursed for the applicable year. While the negotiation process for these final overhead rates can take a long time if costs are in dispute, according to DCMA officials, final rates have to be negotiated within 7 years of the final incurred costs submission.

DCAA Auditors Support DCMA ACOs with Financial and Compliance Audits of IR&D Costs

DCAA auditors support DCMA ACOs, in part, by conducting financial and compliance audits, among other types, on a regular basis using a risk based approach. Table 5 details typical audits involving IR&D costs.

Table 5: Defense Contract Audit Agency Audits Involving Independent Research and Development Costs

Audit type	Audit purpose
Forward Pricing Rate Proposal	Used to determine if the forward pricing proposal, consisting of indirect rates forecasted over a period of time submitted by the contractor to the government, are fair and reasonable. These pricing proposals lead to forward pricing rate agreements.
Incurred Costs	Used to determine if costs charged to auditable government contracts are allowable, allocable, and reasonable in accordance with contract terms, applicable generally accepted accounting principles, cost accounting standards, and applicable government acquisition regulations.
Cost Accounting Standards Compliance	Used to determine if the contractor's policies, procedures, and practices used to estimate, accumulate, and report costs on government contracts comply with the requirements of Cost Accounting Standards. Specifically, Cost Accounting Standard 420 establishes criteria for the accumulation of Independent Research and Development costs and for the allocation of such costs to cost objectives.

Source: GAO presentation of Defense Contract Audit Agency guidance. | GAO-20-578

The scope of these audits typically includes IR&D costs; however, according to a DCAA official, auditors select the specific cost elements they plan to test based upon the risk assessment they conduct at the beginning of an audit. A DCAA official stated that auditors look at the dollar value of each cost element, such as IR&D, review any questionable costs, and compare current year's costs to previous year's costs, among other things, during their risk assessment. The official stated that if the auditor sees something that looks out of place or out of scope with previous year's costs, the auditor may focus additional attention on those cost elements. If, for example, a contractor's IR&D costs represent a large percentage of its overall G&A costs and increased substantially from the previous year, that would potentially signal a need for further testing during the audit.

According to a DCAA official, if IR&D costs are selected for testing regardless of the type of audit, a DCAA auditor will first check to see if the IR&D projects are listed in DTIC's IR&D project database. For an IR&D project to be reimbursable, (1) it must be registered in the DTIC database; (2) its data must be updated regularly as changes occur; and (3) the project entry must be marked as complete when the project is finished. According to a DCAA official, if an IR&D project does not meet any of these criteria, then the costs are automatically unallowable. Regardless of the type of audit, the DCAA auditors seek to answer three basic questions about contractors' IR&D projects by typically performing the audit steps shown in table 6.

Table 6: Defense Contract Audit Agency Independent Research and Development Audit Questions and Typical Audit Steps

Audit questions	Audit steps
1. Is the proposed Independent Research and Development effort consistent with the definitions in the Federal Acquisition Regulation 31.205-18 and Cost Accounting Standard (CAS) 420?	(A) Document the contractor's practice for distinguishing between Independent Research and Development costs and similar direct costs and whether the practice is consistent with the definitions for (i) basic research, (ii) applied research, (iii) development, (iv) concept studies, and CAS 420. (B) Ensure contractors do not include Independent Research and Development costs for efforts that are specifically required in the performance of a contract, or those efforts that are not explicitly stated in a contract but are necessary to perform the contract.
2. Is the proposed Independent Research and Development effort an allowable cost under applicable Federal Acquisition Regulation and Defense Federal Acquisition Regulation Supplement provisions?	(A) Evaluate whether the Independent Research and Development costs are otherwise allocable, reasonable, and not otherwise unallowable in accordance with the Federal Acquisition Regulation 31.205-18. (B) Evaluate whether the Independent Research and Development costs are deferred costs from a previous accounting period as these costs are usually unallowable. (C) Evaluate and document the project's potential interest to the department, using the seven categories listed in the Defense Federal Acquisition Regulation Supplement 231.205-18(c)(iii)(b).
3. Do Independent Research and Development allocations to contracts comply with the provisions of CAS 420?	(A) Document the contractor's cost accounting practices for allocation of Independent Research and Development costs and compare them to the contractor's cost submission. (B) Compare the methods used by the contractor to the Cost Accounting Standards 420 requirements for the contractor's Independent Research and Development cost allocations. (C) If the contractor has entered into agreements for special allocations, determine if the contractor properly classified the costs and allocated them in accordance with the advance agreement.

Source: GAO presentation of Defense Contract Audit Agency audit guidance. | GAO-20-578

When DCAA auditors complete their financial audits and identify cost elements that are not allowable, allocable, or reasonable (questioned costs), or identify CAS noncompliance, the auditors include these findings in their audit reports. If questioned costs are identified, the contractor is presented with the findings and may present additional evidence. The contractor may concur, non-concur, or concur in part with the recommended questioned costs. After considering the contractor's response, including any additional evidence provided, both the contractor's response and DCAA's response are included in the audit report. In the event of CAS noncompliance, the final report includes the identified CAS noncompliance, DCAA's recommendation(s), and the contractor's response regarding whether it has implemented the recommendation, will implement the recommendation, or disagrees with the finding.

Ultimately, DCMA ACOs are responsible for ensuring contractors respond to the recommendations made by government personnel and resolving issues of questioned costs or CAS noncompliances. If there are recommended questioned costs, contractors may provide supporting documentation to the auditor or directly to the ACOs before or during negotiations. In the event of CAS noncompliance, if contractors disagree with a recommendation made by government personnel, they may respond with their rationale for disagreement to DCAA or directly to the ACOs in writing. If the contractor agrees, it may submit a corrective action plan detailing the actions to be taken to address any noted deficiencies. In situations where an ACO determines the government is being exposed to unnecessary risk, the ACO can suspend payment or reimbursement of these costs based on the government's cost risk.

DCMA Technical Reviews and DCAA Audits Identify Questionable Costs

Not all IR&D projects and costs are comprehensively audited for compliance with statute, federal and defense regulations, or policy. According to a DCAA official, IR&D costs are initially reviewed during the audit risk assessment, and consistency of costs from year to year is a risk consideration. Throughout an audit, the risk related to IR&D may be revisited and either increase or decrease the amount of testing, as appropriate, for the circumstances. DCMA officials we interviewed stated, while some IR&D projects and costs are questioned as unallowable or unallocable during their initial reviews, additional contractor documentation often resolves these issues. According to DCMA analysis of its technical reviews and DCAA audits, DOD questioned approximately $630 million of $14.4 billion in projected IR&D costs from 10 of 32 FPRAs and Forward Pricing Rate Recommendations (FPRR) finalized between October 2014 and February 2020.[20] The FPRAs and FPRRs covered various business segments of nine different contractors. In the end, DOD removed $202 million in questioned costs—or about 1.4 percent of the total amount of IR&D expenses proposed by the contractors from the final FPRAs and FPRRs. The dollar value of recommended and sustained questioned IR&D costs in other types of audits, such as incurred cost audits, were not reviewed as part of this analysis, nor was the effect of identified CAS noncompliances.

[20]FPRRs contain rates and factors established unilaterally by the ACO for use by government negotiators when FPRA rates and factors are not available.

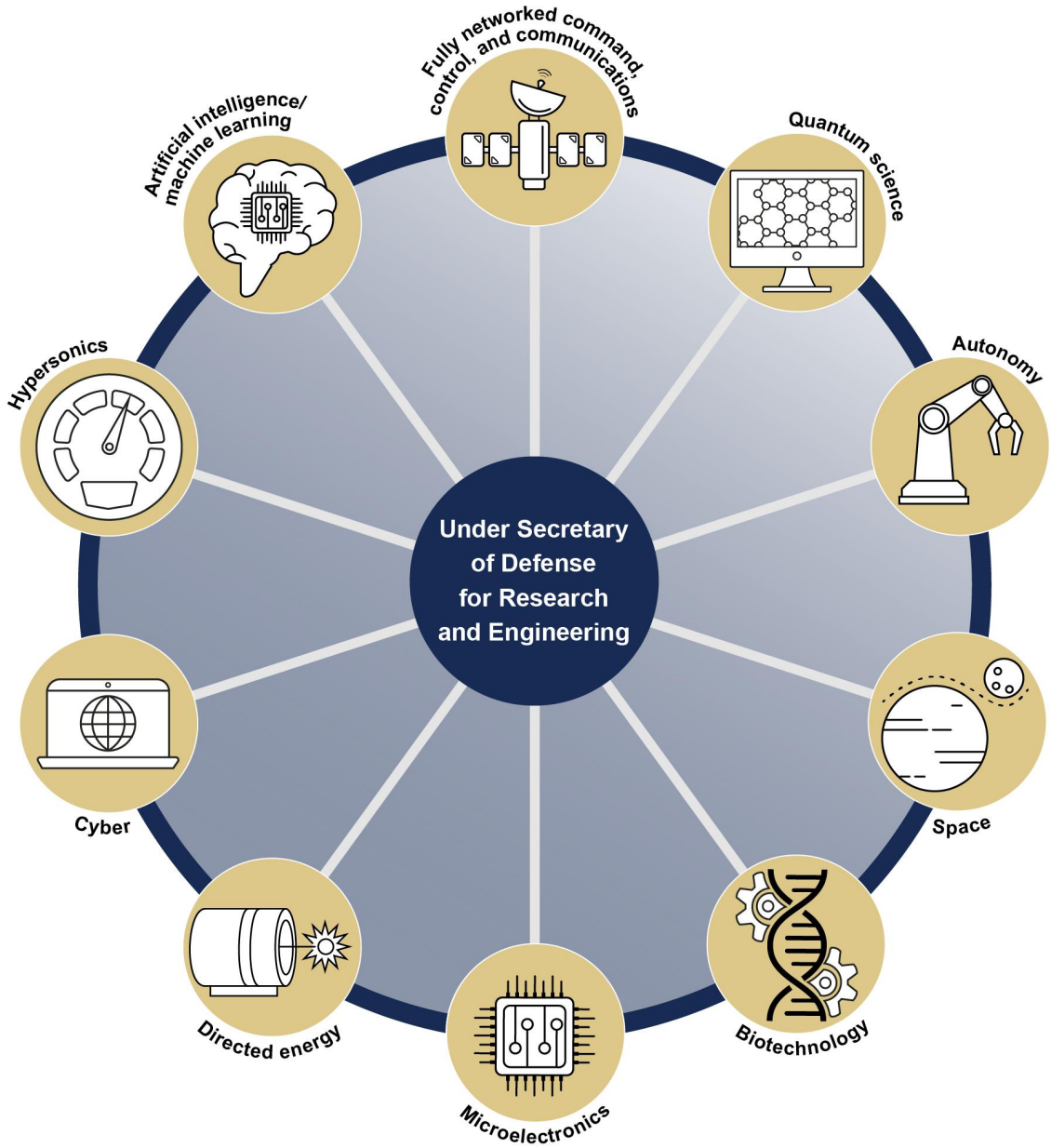
Nearly 40 Percent of IR&D Projects Completed in 2018 Aligned with DOD's 2018 Modernization Priorities, and Generally Focused on Incremental Innovation

While DOD and the defense industry do not seek complete alignment between IR&D projects and DOD's 2018 modernization priorities, we found that nearly 40 percent of projects completed in 2018 aligned with those priorities. Our analysis also showed that the majority (67 percent) of IR&D projects completed between 2014 and 2018 focused on incremental, rather than disruptive, innovation. Contractor representatives from the 10 companies we interviewed noted that their IR&D projects are based on their corporate strategies, which seek to balance near-term profitability with long-term growth potential and market expansion.

DOD's *2018 National Defense Strategy* acknowledged a need to develop new technologies to ensure the United States is able to fight and win the wars of the future.[21] Subsequently, OUSD (R&E) identified 10 priority technology domains for future investment to maintain the technical dominance necessary to deter near-peer adversaries based on the modernization areas outlined in the strategy (see fig. 3).

[21]Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*. 2018.

Figure 3: Ten Priority Technology Domains Identified by the Under Secretary of Defense for Research and Engineering (USD R&E) Pursuant to DOD's 2018 National Defense Strategy

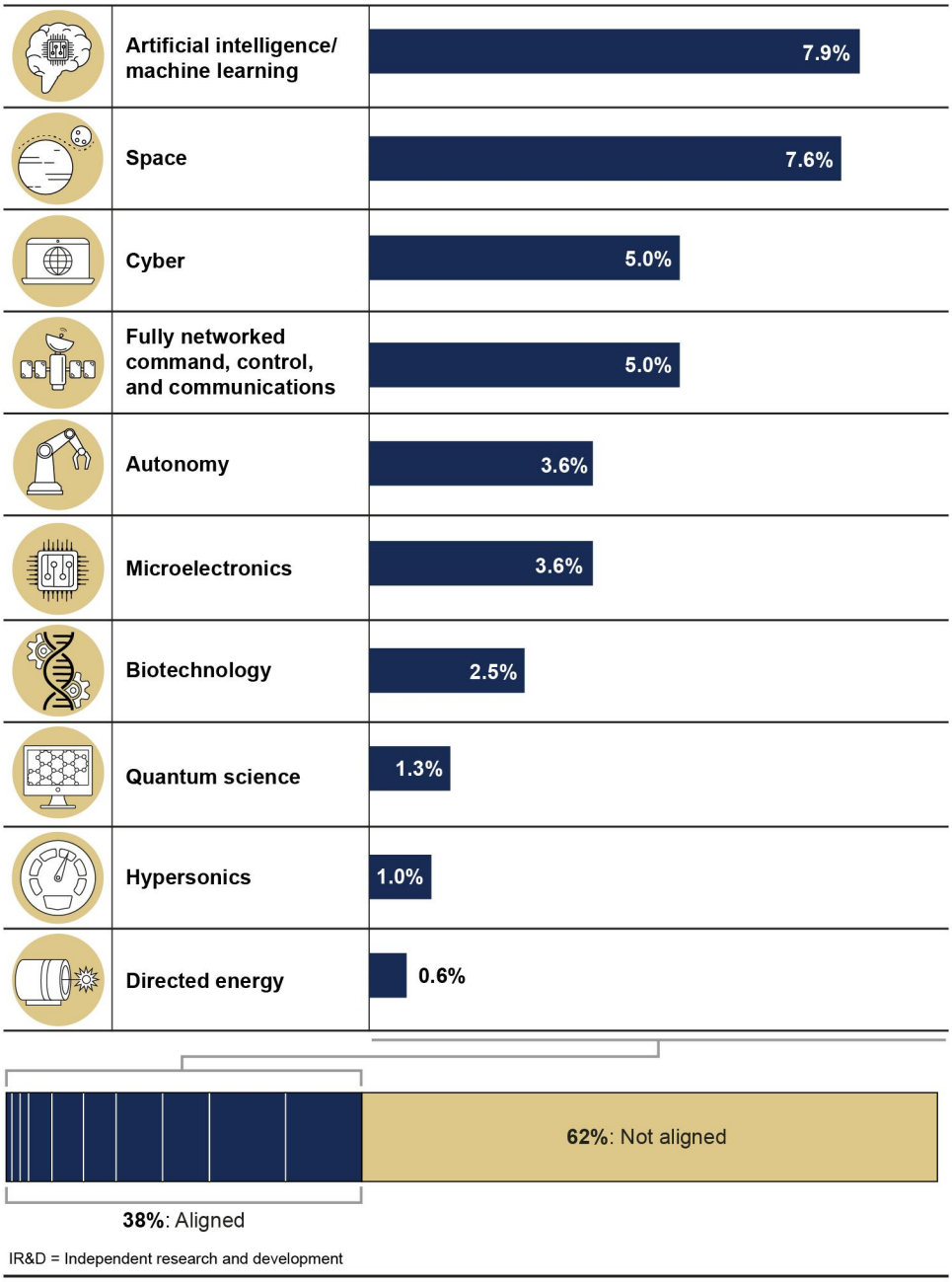


Source: GAO presentation of Department of Defense data. | GAO-20-578

Note: In August 2019, USD(R&E) identified 5G wireless technology as the eleventh modernization priority.

Neither DOD nor the defense industry seeks complete alignment between IR&D projects and DOD's top modernization priorities. A senior OUSD (R&E) official stated that the modernization priorities are meant to increase industry's understanding about DOD's most pressing needs but are not intended to restrict the type of projects in which the defense industry invests. Contractor representatives stated that the strategy and the related modernization priorities provide industry with high-level understanding of the technologies in which DOD plans to invest and help shape their corporate IR&D strategies. Overall, our analysis found that 38 percent of IR&D projects that defense contractors completed in fiscal year 2018 were aligned with DOD's 10 modernization priorities (see fig. 4).

Figure 4: Breakdown of Industry Independent Research and Development Projects by Department of Defense Modernization Priority in Fiscal Year 2018



Source: GAO analysis of Department of Defense data. | GAO-20-578

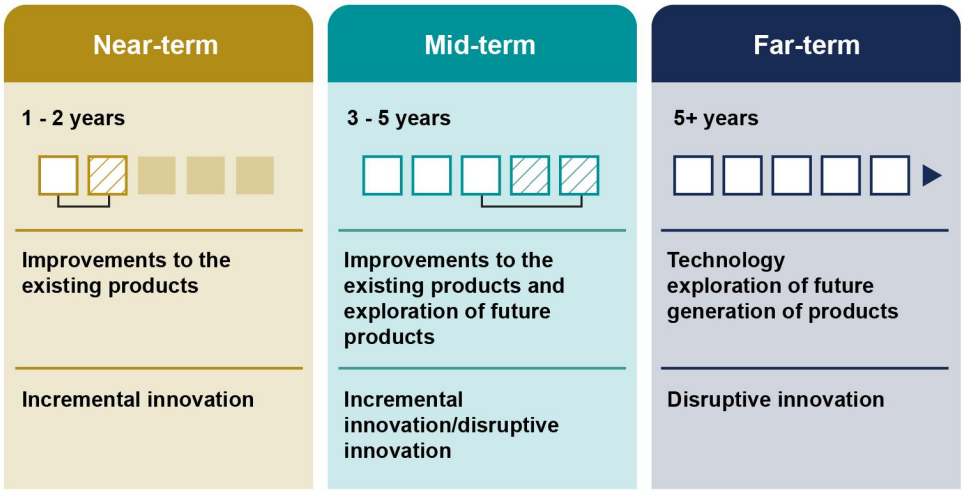
Note: Prior to August 2019, 5G technology was included as a component of the Cyber Modernization Priority. Therefore, our analysis did not separately assess 5G IR&D projects.

In addition, contractor representatives described other information, such as DOD's annual budget submissions and military department-specific priorities, they use in developing long-range strategic plans to identify markets in which to invest and markets to avoid. For example, representatives at one contractor noted that the Army's modernization priorities, such as long range precision fires (ballistic missiles with a planned range of 300 kilometers), next generation combat vehicles, and future vertical lift platforms, are also driving materiel development and are not reflected in USD (R&E)'s modernization priorities. They noted that being awarded future contracts also requires the defense industry to make IR&D investments in these Army-specific areas.

We found that some of the defense contractors in our review rely on sophisticated, company-developed data analytics tools when developing their corporate strategies. The companies use these tools to analyze DOD's planned science and technology and acquisition investments, and to reconcile those plans with their existing corporate R&D portfolios. Defense contractors also noted that they engage with DOD during discussions among corporate and DOD senior leadership, industry-sponsored conferences, and contractor-hosted technology demonstration events. Contractor representatives stated that one-one-one interactions—whether at the senior leadership level or between corporate researchers and DOD program managers—were a good way to solicit feedback about industry's potential IR&D investments. For example, these representatives noted that the Air Force Research Laboratory's Technology Interchange Meetings are one mechanism through which contractors can brief subject matter experts within DOD's science and technology community on ongoing IR&D projects and receive feedback.

Representatives from the 10 defense contractors we interviewed noted that their corporate strategies for IR&D seek to balance near-term profitability with long-term growth potential and market expansion. These representatives said that to remain competitive and profitable their companies must address the existing technology needs of DOD. In contrast, they noted that DOD's modernization priorities are largely focused on technologies that are still relatively immature, such as quantum science or directed energy, and will likely require years to fully develop. Figure 5 shows a notional breakdown of IR&D projects and innovation types, based on documentation provided by the defense contractors in our review.

Figure 5: Notional Industry Breakdown of Independent Research and Development Projects Among Near-, Mid-, and Far-Term Horizons



Source: GAO analysis of contractors' documentation. | GAO-20-578

Note: The hashing in the above squares represents the potential time frames a near- or mid-term IR&D project may take.

According to industry representatives we interviewed for a June 2017 report on leading practices in science and technology management at innovative commercial companies, company R&D funding was either spent on incremental development—intended to maintain near-term profitability—or to fund disruptive technologies, which can provide long-term growth potential to the company.[22] We found, in that report, these companies generally allotted about 80 percent of R&D funds to incremental R&D and the remaining 20 percent to disruptive R&D. Comparatively, our analysis of IR&D projects completed between 2014 and 2018 found that about 14 percent of industry's IR&D investments focused on disruptive R&D.[23]

DOD Strategic Planning for Science and Technology Excludes Review of IR&D Projects

[22]GAO-17-499.

[23]Our categorization analysis of a random, generalizable sample of IR&D projects yielded 14 percent. The lower and upper limit for the sample's 95 percent confidence intervals shows the entire population likely ranged between 11 and 17 percent. In addition, we were unable to classify projects as either incremental or disruptive for 19 percent of the sample. This was due to a lack of sufficient, detailed, project information needed to classify these projects. For more information about our sample analysis, see appendix III.

and Is Hindered by Data Gaps on Key Attributes

Neither DOD nor the military departments review industry IR&D projects as part of their science and technology strategic planning processes. DOD is not reviewing IR&D projects because DOD's IR&D instruction does not require such consideration of the projects. Further, while DOD's IR&D instruction and DFARS require major contractors to report IR&D projects into the DTIC database as a key source of information about these projects, we found that relatively few organizations make use of the database. Our review of the database found that it lacks key information, such as linkages to USD (R&E)'s modernization priorities and whether the project was pursuing incremental or disruptive innovation. These and other information gaps not only limit the database's usefulness to strategic planners but, overall, hinder DOD's efficient decision-making on its own science and technology projects.

Current Policy Does Not Require DOD to Review IR&D Projects When Developing Strategic Plans for Science and Technology

DOD's current IR&D instruction, issued in 2014, contains policy that requires OUSD (R&E) and DOD components to seek visibility and insight into IR&D investments and to engage in robust communication with the defense industry. The policy, however, no longer requires these organizations to review IR&D projects as part of their science and technology strategic planning efforts.[24]

When DOD updated its IR&D instruction in August 2014, it removed the requirements to review industry IR&D efforts that had been included in its May 1999 instruction. Specifically, DOD's 1999 IR&D instruction required DOD to seek to enhance the efficiency and productivity of its own R&D efforts by considering the work of industry IR&D as part of DOD's planning, programming, and budgeting process. Further, the policy required that DOD components enhance their knowledge of industry IR&D by reviewing summary reports of those efforts. Information in these reports included research goals, progress, results, and actual and

[24]Department of Defense (DOD) Instruction 3204.01, DOD Policy for Oversight of Independent Research and Development (IR&D), August 20, 2014; Incorporating Change 2, July 9, 2020.

planned expenditures of IR&D projects. Table 7 compares the relevant sections of DOD's May 1999 and August 2014 IR&D instructions.

Table 7: Selected Department of Defense (DOD) Independent Research and Development (IR&D) Instruction Changes from 1999 to 2014

DOD IR&D Instruction (May 1999)	DOD IR&D Instruction (August 2014)
4.3. The DOD shall seek to enhance the efficiency and productivity of DOD Research and Development, and DOD contract Research and Development, by considering the work and accomplishments of contractor IR&D programs when planning, programing, and budgeting for Department of Defense Research and Development.	No mention of considering the work and accomplishments of contractor IR&D programs when planning, programming, and budgeting for DOD Research and Development.
4.4 The DOD shall enhance its knowledge of contractor IR&D by reviewing summary reports of contractor IR&D efforts. Information from industry includes research goals, progress, results, and actual and planned expenditures for projects conducted as IR&D.	No mention of reviewing summary reports on contractor IR&D efforts including research goals, progress, results, and actual and planned expenditures from projects conducted as IR&D.

Source: GAO analysis of Department of Defense instruction. | GAO-20-578

Note: An October 2018 update clarified that OUSD (R&E) is the office of primary responsibility for the instruction.

A senior OUSD (R&E) official was unable to provide us with specific reasons why the policy changed. However, the official stated that a new requirement that contractors post summaries of their IR&D projects to the DTIC database led to an increase in IR&D submissions from under 1,000 a year to 5,000 to 7,000 a year. Further, the official disagreed that the policy requirement for DOD to consider the work and accomplishments of industry IR&D when planning its research and development was removed. Rather, as the official explained, DOD modified the process to help expand its awareness of IR&D investments by requiring detailed IR&D project summaries into the DTIC database. We found, however, that the August 2014 instruction change, in practice, effectively eliminated review of industry IR&D projects as a required input to strategic planning. For example, our examination of four recent science and technology strategies created by OUSD (R&E) and the military departments did not show that DOD or the military departments had considered IR&D projects as part of their strategic planning process.[25]

Another senior OUSD (R&E) official we interviewed confirmed that, in practice, DOD does not review industry's IR&D investments to directly inform its strategic planning processes for science and technology. Similarly, officials with the Office of Naval Research, the Office of the

[25]We examined the September 2019 National Defense Science and Technology Strategy, the April 2019 Air Force Science and Technology Strategy, the 2019 Army Modernization Strategy, and the 2017 Naval Research and Development Framework.

Deputy Assistant Secretary of the Navy for Research, Development, Testing & Evaluation, and the Office of the Deputy Assistant Secretary of the Army for Research and Technology acknowledged that they do not review industry IR&D investments as part of their strategic planning processes.

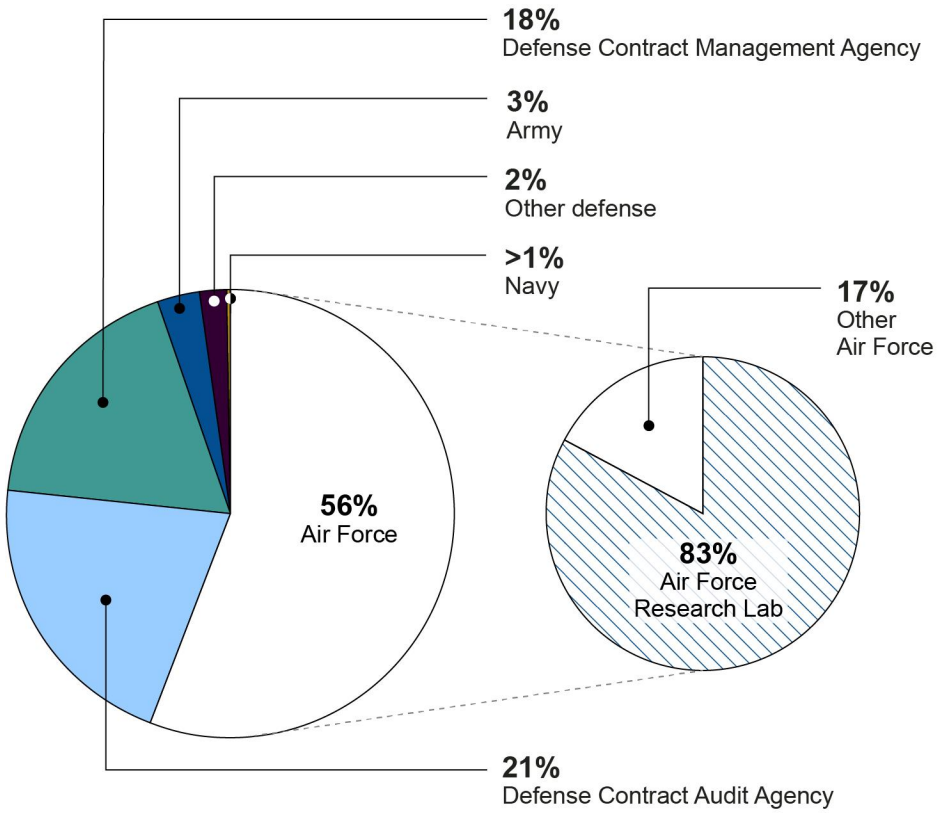
DOD plans to invest billions in its modernization priorities, including almost $7.5 billion in four specific domains—artificial intelligence, autonomy, directed energy, and hypersonics—in fiscal year 2020 alone. The 2019 National Defense Science and Technology Strategy acknowledges the need to invest more in the modernization priorities. However, without taking into account planned defense industry IR&D investments, DOD's ability to invest most efficiently in its own science and technology pursuits is constrained.

DOD's IR&D Project Database Lacks Key Attributes to Aid DOD Strategic Planners

DOD's 2014 IR&D policy identifies DTIC's IR&D project database as a required key source of information about IR&D projects, but we found that use of the database was limited and not for strategic planning purposes. While our review of the database found that it includes some key information such as a title, summary, and description for individual projects, we found that it lacks other key information, such as the projects' linkages to USD (R&E)'s modernization priorities and whether the project is pursuing incremental or disruptive innovation.

The 2014 IR&D instruction also identifies the DTIC database as a tool that provides OUSD (R&E) and the military departments with visibility and insight into IR&D investments. We analyzed database usage and found that most DOD components do not access the database to analyze industry's IR&D projects. For example, as shown in figure 6, the Air Force accounted for more than 55 percent of all searches in 2019, primarily, from users with the Air Force Research Laboratory (AFRL). AFRL officials stated they use the database to narrow down the projects that are included at their Technology Interchange Meetings.

Figure 6: Breakdown of Independent Research and Development Database Access in Calendar Year 2019



Source: GAO analysis of Department of Defense data. | GAO-20-578

Note: The above figure does not include data for searches conducted by the Defense Technical Information Center (DTIC). DTIC officials stated that their use of the database is limited to searching projects on behalf of defense contractors in order to make edits to submissions. In calendar year 2019, DTIC searches totaled over 320,000.

Our analysis found the database's usefulness for strategic planning purposes is constrained by limitations with some of the project data currently collected. DTIC requires, in accordance with DOD IR&D policy, major defense contractors to report several data elements for each IR&D project, including a project description and an estimated cost for the fiscal year. Our review of more than 440 IR&D projects completed between fiscal years 2014 and 2018 found, however, that project descriptions had varying levels of details, and that many completed projects had an estimated cost reported as $1. The absence of more detailed project information and more reliable data on estimated and actual project costs limits DOD's ability to more fully understand the technologies being developed.

Contractor representatives stated that the level of information they provide in the descriptions varies for several reasons. For example, because the IR&D project database is unclassified, contractor representatives noted they have to ensure they are not disclosing classified or proprietary information about an IR&D project when submitting a project description. Further, although defense contractors are required to enter data on a project's estimated cost for the fiscal year into the IR&D project database, they are not required to enter actual final costs of a project. The numerous occurrences where the database identified an estimated cost of $1 for a project contributed to our decision to exclude cost data from our various analyses due to data reliability concerns.

DTIC officials acknowledged these limitations with the database and expressed understanding of contractors' reluctance to provide more details about projects because of concerns with proprietary data. However, they stated that, in their role as maintainers and administrators of the IR&D project database, they are able to restrict who within DOD has access. For example, access to search the database is restricted to DOD federal employees or military service members with science and technology, research and development, or acquisition responsibilities.

Our analysis found the database's usefulness is also limited by the lack of key attributes that would provide DOD with a more complete awareness of how industry R&D efforts are complementing those made by DOD. The DTIC database does not track the allowable category of research, such as whether the research is for basic research or concept studies, or whether the nature of a project is disruptive or incremental innovation. Requiring defense contractors to identify whether an IR&D project is intended to provide incremental or disruptive innovation would give DOD leadership more information regarding the extent to which industry investments are focused more on improving existing technologies or on developing the next generation of technology. Several defense contractors we interviewed, however, stated that prerequisite to any such requirement would be a need for clear and consistent definitions from DOD of what constitutes incremental versus disruptive innovation.

Additionally, the database does not track an IR&D project's linkage, if any, to a DOD modernization priority, but instead only provides the capability to identify a project's linkages, if any, to DOD's Communities Of Interest (COIs) and COI sub-areas. COIs are cross-cutting technology focus areas with investment from multiple military departments. Although nine of these mirror individual DOD modernization priorities—space

programs, for example, are both a modernization priority and a COI—two modernization priorities do not directly link to an individual COI or COI-sub-area.[26] By only linking IR&D projects to COI and COI sub-areas, DOD risks not capturing the investments toward at least two of its modernization priorities and potentially more as those priorities evolve in the future. Capturing an IR&D's project linkage to a modernization priority provides DOD leadership with more knowledge of the extent to which industry is pursuing technologies in those areas and may help inform DOD's own S&T investments.

OUSD (R&E) is responsible for determining which IR&D project data contractors are required to submit in DTIC.[27] Our analysis found that the IR&D database's lack of four key attributes—final project cost, allowable category of research, nature of innovation, and linkage to modernization priority, reduces the overall usefulness of the database to DOD planners. However, requiring contractors to report additional IR&D information must be weighed against related concerns that contractor representatives cited to us, including (1) the additional resources that they would need to devote to meet any new reporting requirements; (2) skepticism as to whether DOD would use any additional information to further its science and technology planning, or simply to advance its auditing function; and (3) risk that any new DOD requirements would impinge on the independence of the contractor to select its IR&D projects. Nonetheless, without assessing and determining whether it is feasible to obtain additional data about IR&D projects, DOD risks making decisions regarding its own science and technology investments without full awareness of the contributions industry is making through IR&D.

[26]Five of the modernization priorities—Fully Networked Command, Control, and Communications, Autonomy, Biotechnology, Cyber, and Space—have corresponding COIs. Directed Energy, Hypersonics, Microelectronics, and Quantum are sub-COIs within the Weapons COI, Air Platform COI and Advanced Electronics COI, respectively. Artificial Intelligence/Machine Learning and 5G have no direct COI or sub-COI.

[27]The Office of the Assistant Secretary of Defense for Research and Engineering developed the IR&D project data requirements that must be included in DTIC. Pursuant to the National Defense Authorization Act for Fiscal Year 2017, effective February 1, 2018, DOD restructured the office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, under which the Assistant Secretary of Defense for Research and Engineering resided. Pub. L. No. 114-328 § 901 (2016) (codified at 10 U.S.C. §§ 133a and 133b). The position has been divided into the Under Secretary of Defense for Acquisition and Sustainment and the Under Secretary of Defense for Research and Engineering.

Conclusions

DOD's investments in research and development, particularly science and technology, are key to maintaining our military's technological superiority over potential adversaries. However, the growing capability needs of the military departments, coupled with modest increases in DOD's science and technology budget, threaten to erode this superiority. DOD has taken initial steps to confront this imbalance, including strategic planning to identify its top modernization priorities. Nonetheless, the DOD instruction that guides this planning does not require DOD to account for the billions of dollars that industry invests in IR&D projects annually at industry's own discretion—nor the innovation outcomes that industry obtains from these IR&D projects. Although the IR&D statute and policy prohibit DOD from requiring what IR&D projects contractors undertake, they require DOD to communicate its science and technology needs to industry. Correspondingly, our analysis of IR&D project data covering a single year showed that industry has responded to the modernization priorities DOD set forth in 2018 by investing almost 40 percent of its IR&D funding on related technologies. However, the extent to which this will continue in future years is not something we can forecast. DOD can achieve this visibility by initiating its own annual reviews of IR&D project data. Such assessments would provide DOD with important information needed to develop more comprehensive strategic plans for defense science and technology investment.

At the same time, the primary tool DOD relies on for IR&D project data—the DTIC IR&D database—has several limitations in terms of the data it captures. For instance, it does not identify, whether the IR&D project is linked to a DOD modernization priority or if it constitutes disruptive or incremental innovation. However, capturing additional data could place burdens on contractors. Determining whether to collect additional information on the billions of dollars contractors spend annually on IR&D projects falls squarely within OUSD (R&E)'s responsibility to oversee DOD's strategic planning process for science and technology investments.

Recommendations for Executive Action

We are making the following two recommendations to DOD:

The Secretary of Defense should ensure that the Under Secretary of Defense for Research and Engineering revise its IR&D instruction to require USD (R&E) personnel to annually review defense industry IR&D investments to inform DOD's science and technology strategic planning efforts. (Recommendation 1)

The Secretary of Defense should ensure that the Administrator, Defense Technical Information Center, assess and determine whether the DTIC IR&D database should require contractors to include additional information on IR&D projects, such as:

(a) The IR&D project's linkage, if any, to DOD's modernization priorities;

(b) The allowable category (basic research, applied research, technology development, or concept study) to which the IR&D project belongs;

(c) The nature of the project as either potentially disruptive or potentially incremental research and development; and

(d) The actual IR&D project costs when the project is completed. (Recommendation 2)

Agency Comments

We provided a draft of this report to DOD for review and comment. In its comments, reproduced in appendix IV, DOD concurred with both of our recommendations. Further, in its response to our second recommendation, DOD stated that the DTIC Administrator would recommend any changes to IR&D database requirements to the Director of Defense Research and Engineering for Research and Technology—which provides DOD IR&D programmatic oversight—for decision. DOD also provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees; the Secretary of Defense; and the Secretaries of the Army, Navy, and Air Force. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or dinapolit@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.

Timothy J. DiNapoli
Director, Contracting and National Security Acquisitions

List of Committees

The Honorable James M. Inhofe
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Richard C. Shelby
Chairman
The Honorable Dick Durbin
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Adam Smith
Chairman
The Honorable Mac Thornberry
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Peter Visclosky
Chairman
The Honorable Ken Calvert
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Examples of Current Products from Independent Research and Development Investments

Figure 7: Northrop Grumman's Advanced Anti-Radiation Guided Missile

Northrop Grumman's Advanced Anti-Radiation Guided Missile Extended Range (AARGM-ER) is intended to improve the effectiveness of suppression and destruction of enemy air defense missions. The missile is one of the newest class of missiles for the F-35 and is meant to significantly increase the effectiveness of the legacy AARGM. Northrop Grumman invested approximately $15 million from 2012 through 2018 in independent research and development funds to mature technologies and demonstrate mission readiness to the Navy and Air Force.

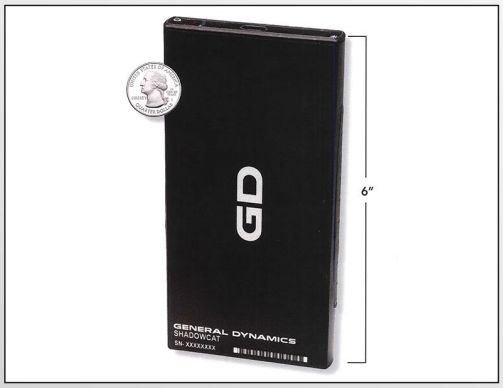
Source: Northrop Grumman. | GAO-20-578

Figure 8: Lockheed Martin Sikorsky's MATRIX Technology Program for Large Rotorcraft

Lockheed Martin Sikorsky's MATRIX Technology program, developed with IR&D, is developing systems intelligence to give operators the confidence to fly large rotorcraft safely, reliably and affordably as autonomous or optionally piloted aircraft. The program is also intended to improve operator effectiveness when making decisions for manned aircraft. MATRIX technology combines software and hardware components, enabling autonomous, reliable mission execution in obstacle-rich environments.

Source: Lockheed Martin. | GAO-20-578

Figure 9: General Dynamics Mission Systems Independent Research and Development (IR&D) Investments in Affordable Radios



General Dynamics' Shadowcat is intended to be an affordable and survivable radio used at the squad level (10-11 soldiers) with advanced radio frequency techniques to achieve Low Probability of Detection. Shadowcat is designed to be small, lightweight, and simple to use, providing both voice and data modes and can be paired with unmanned aerial vehicles to increase its range. General Dynamics invested approximately $10 million in independent research and development funding to design, build, and test five different prototypes.

Source: General Dynamics. | GAO-20-578

Figure 10: L3Harris Investments in High Compaction Radio Antennas for Small Satellites

L3Harris research in High Compaction Ratio (HCR) antennas started in fiscal year 2015 with its Micro Satellite Deployable Reflector Antennas Project. HCR antennas were intended to provide increased satellite antenna capability than existing satellite antennas but with a significantly reduced size. The initial investment of $15,000 explored surface and design options and how to maximize the use of additive manufacturing to increase efficiencies in production. Over a 4-year period, L3Harris invested IR&D funds, aligned with growing mission needs, to advance HCR technology. These investments led to the development of the Small Satellite Enterprise—constellations of small satellites in orbit for government customers—providing advanced Intelligence, Surveillance, and Reconnaissance capabilities.

Source: L3Harris. | GAO-20-578

Figure 11: Raytheon Developed Gallium Nitride Monolithic Microwave Integrated Circuits, the Semiconductor Technology behind Its Latest Radars

Source: Raytheon. | GAO-20-578

Raytheon has invested over $200 million in IR&D in Gallium Nitride (GaN) Monolithic Microwave Integrated Circuits (MMIC) since 1999. Raytheon partnered with the Defense Advanced Research Projects Agency from 2002 to 2013 to develop and mature Wide Bandgap Semiconductor Technology – Radio Frequency, which relied on GaN MMIC concepts. In 2013, the Navy awarded contracts to Raytheon for the Air and Missile Defense Radar and Next Generation Jammer programs, which represented the first major DOD acquisition programs to include GaN MMICs. Raytheon has since included this technology in the Navy's Extended Air Surveillance Radar and the Army's next generation Patriot radar, the Lower Tier Air and Missile Defense Sensor pictured above.

Appendix II: Objectives, Scope, and Methodology

This report examines (1) the Department of Defense's (DOD) processes for monitoring and auditing industry's Independent Research and Development (IR&D); (2) the extent to which industry's IR&D investments align with DOD's modernization priorities; and (3) the extent to which DOD considers industry IR&D as part of its modernization planning efforts.

To examine how DOD monitors and audits IR&D, we analyzed and summarized the following federal statute, Federal Acquisition Regulation, Defense Federal Acquisition Regulation Supplement, Cost Accounting Standards (CAS), and DOD instruction and guidance documents that govern and explain IR&D, including the following, as shown in table 8.

Table 8: Statute, Federal Regulations, and Department of Defense (DOD) Policies Governing Independent Research and Development

1.	10 United States Code § 2372
2.	Federal Acquisition Regulation § 31.205-18; § 31.201-1 through 4
3.	Defense Federal Acquisition Regulation Supplement § 231.205-18; § 242.771
4.	48 C.F.R. part 9904.420, Cost Accounting Standards
5.	Department of Defense Instruction 3204.01, DOD Policy for Oversight of Independent Research and Development
6.	Indirect-Cost Management Guide: Navigating the Sea of Overhead Third Edition

Source: GAO. | GAO-20-578

We reviewed the Federal Acquisition Regulation § 31.201-1-4 definitions for allowable, allocable, and reasonable costs. A cost is allowable only when it complies with all the following requirements: (1) reasonableness, (2) allocability, (3) standards promulgated by the CAS Board, if applicable, (4) other generally accepted accounting principles and practices appropriate to the circumstances, (5) terms of the contract, and (6) any limitations set forth in subpart FAR 31.2. A cost is reasonable if, in its nature and amount, it does not exceed that which would be incurred by a prudent person in the conduct of competitive business. A cost is allocable if it is assignable or chargeable to one of more cost objectives on the basis of relative benefits received or other equitable relationship. Subject to the foregoing, a cost is allocable to a government contract if it: (a) is incurred specifically for the contract; (b) benefits both the contract

and other work, and can be distributed to them in reasonable proportion to benefits received; or (c) is necessary to the overall operation of the business although a direct relationship to any particular cost objective cannot be shown.

We reviewed the annual Defense Contract Audit Agency (DCAA) reported IR&D cost data from 2014 to 2018. We analyzed data provided by the Defense Contract Management Agency (DCMA) detailing the amount of questioned costs during price negotiations and audits by DCMA and DCAA for the contractors included in our engagement. We reviewed DCMA contract administration and cost monitoring guidance and instructions along with DCAA audit guidance and instructions. In addition, we also reviewed several studies by various organizations on DOD's management of its research and development activities that include IR&D.

We also interviewed officials from the following offices and agencies, as shown in table 9, regarding DOD's policies and processes for monitoring and overseeing industry's IR&D.

Table 9: Department of Defense Offices, Military Service Offices, and Defense Agencies Included in Our Department of Defense Independent Research and Development Engagement

1.	Office of the Under Secretary of Defense for Research and Engineering
2.	Office of the Under Secretary of Defense for Acquisition and Sustainment, Defense Pricing and Contracting
3.	Office of the Under Secretary of Defense (Comptroller)
4.	Defense Contract Management Agency
5.	Defense Contract Audit Agency
6.	Defense Technical Information Center
7.	Deputy Assistant Secretary of the Army, Research and Technology
8.	Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation and the Office of Naval Research
9.	Air Force Research Laboratory

Source: GAO. | GAO-20-578

We interviewed DCMA officials, including divisional and corporate administrative contracting officers, engineers, and price analysts with regard to their responsibilities in contract administration, cost monitoring, and technical evaluation. We interviewed a DCAA official with regard to their financial audit and cost accounting standards compliance review responsibilities. We interviewed officials with the Defense Technical Information Center (DTIC) concerning their responsibilities for operating and maintaining the Defense Innovation Marketplace IR&D project database to collect and protect industry's IR&D project and expense data.

We also interviewed officials from the Air Force Research Laboratory, the Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation, Office of Naval Research, and the Office of the Deputy Assistant Secretary of the Army for Research and Technology regarding the policies and processes the services use to oversee industry's IR&D investments.

To examine the extent to which industry IR&D investments align with DOD modernization priorities, we reviewed DOD's unclassified summary of the January 2018 National Defense Strategy along with April 2018 and March 2019 congressional testimonies by the Under Secretary of Defense for Research and Engineering on DOD's modernization priorities. We obtained IR&D project information for all IR&D projects completed between fiscal year 2014 through 2018 from the DTIC Defense Innovation Marketplace database, the official repository for all industry IR&D project information.[1] Using the fiscal year 2018 data, we analyzed all IR&D projects completed that year—a total of 2,242 projects—and compared project summary data, including project descriptions and classifications, with DOD's 2018 science and technology modernization priorities to determine whether a specific project fit within one of DOD's 10 modernization priorities. The 2018 IR&D project data was the most current and complete set available for analysis during the course of our performance audit.

We used a generalizable sample of the 2014 to 2018 IR&D project data to determine the extent to which the projects were consistent with the allowable IR&D categories provided under Federal Acquisition Regulation (FAR) § 31.205-18.[2] These categories include (1) basic research, (2) applied research, (3) development, and (4) concept studies. We did this to note the difference in the percentage of projects categorized as development projects as compared to the percentage of projects categorized as basic and applied research projects. Table 10 provides a description of each type of research category.

[1]The DTIC IR&D project database does not include detailed descriptions or summaries of any classified projects. As a result, our analysis does not include any classified IR&D project information.

[2]See appendix III for additional information on the sampling method, population size, and sample size.

Table 10: Allowable Independent Research and Development (IR&D) Project Categories

Research category	Description
Basic research	Basic research is directed toward increasing knowledge in science. The primary aim of basic research is a fuller knowledge or understanding of the subject under study, rather than any practical application of that knowledge.
Applied research	Applied research is the effort that (1) normally follows basic research, but may not be severable from the related basic research; (2) attempts to determine and exploit the potential of scientific discoveries or improvements in technology, materials, processes, methods, devices, or techniques; and (3) attempts to advance the state of the art. Applied research does not include efforts whose principal aim is design, development, or test of specific items, or services to be considered for sale. These efforts are within the definition of the term "development."
Development	Development means the systematic use, under whatever name, of scientific and technical knowledge in the design, development, test, or evaluation of a potential new product or service (or of an improvement in an existing product or service) for the purpose of meeting specific performance requirements or objectives. Development includes the functions of design engineering, prototyping, and engineering testing. Development excludes— (1) subcontracted technical effort that is for the sole purpose of developing an additional source for an existing product; or (2) development efforts for manufacturing or production materials, systems, processes, methods, equipment, tools, and techniques not intended for sale.
Concept and system studies	Analyses and study efforts either related to specific IR&D efforts or directed toward identifying desirable new systems, equipment or components, or modifications and improvements to existing systems, equipment, or components.

Source: Federal Acquisition Regulation. | GAO-20-578

We also analyzed the project data to determine whether the potential results of these individual projects in our sample aligned with disruptive or incremental research and development, using criteria from GAO's prior report on best practices for managing innovation investments. Specifically, the report found that disruptive innovation projects are those that carry a higher risk of failure, but significant rewards via potentially breakthrough technology in the long-term. The report also found that incremental innovation projects are lower risk efforts intended to be integrated quickly into near-term products[3] To complete this analysis, we conducted an independent, two-reviewer, consensus analysis of the IR&D project data with assistance from scientists and engineers on GAO's Science, Technology Assessment, and Analytics team. The results from our sample category analysis including confidence intervals and both the upper and lower limits for each result are provided in appendix III.

We determined the data reliability of the DTIC IR&D database was suitable to conduct our modernization priority alignment and innovation type analyses. We conducted data frequency and missing data analyses of the IR&D project database data. We interviewed knowledgeable

[3]GAO-17-499.

officials and assessed answers the officials provided regarding the IR&D project data and how the database is managed. In addition, we evaluated obtaining the IR&D project data directly from contractors instead of the DTIC database and found this option would be much more difficult and take significantly longer to obtain the data. We found, with a few exceptions of some incomplete and missing data as well as the majority of the estimated cost data, that the DTIC IR&D project database contained sufficiently reliable IR&D project data to support our analysis. Due to data reliability concerns, we did not include any estimated IR&D project cost information in our analyses.

We also conducted site visits with 10 defense contractors and one trade association, the Aerospace Industries Association. We selected these 10 companies through our evaluation of (1) the amount of their IR&D expenses, (2) the amount of their overall business with DOD, and (3) the type of research and products manufactured by the companies. Specifically, our selected sample included six contractors that had the highest annual IR&D expenses and corresponding revenues attributable to DOD contracts. These six contractors developed and produced a wide range of DOD products such as aircraft, sensors, satellites, and armored vehicles, among others. Our sample also included four companies that had lower annual IR&D expenses and corresponding revenues attributable to DOD contracts than the other six. These four contractors further increased the diversity of product types—adding aircraft engines, ships, and other specialty products—covered in our sample. In total, the 10 selected defense industry companies represent more than 50 percent of total defense IR&D spending, as reported by each company to DCAA in fiscal year 2018. We used a similar selection methodology for the trade association. The following companies shown in table 11 were included in our review.

Table 11: Defense Industry Companies Included in our Department of Defense Independent Research and Development Engagement

1.	Lockheed Martin
2.	Raytheon Company
3.	BAE Systems, Inc.
4.	Northrop Grumman
5.	Boeing Defense Space and Security
6.	General Dynamics Mission Systems
7.	L3Harris
8.	Pratt and Whitney
9.	Huntington Ingalls Industries
10.	Ball Aerospace

Source: GAO. | GAO-20-578

During the contractor site visits, we conducted semi-structured interviews that covered the contractors' IR&D program management, incentives for participating in IR&D, financial management practices, and corporate research and development strategies. We also discussed leveraging IR&D investments for business development and intellectual property issues. We summarized and analyzed the contractors' responses. We also obtained examples of current defense systems, products, and components that originated as IR&D investments from several of the defense contractors included in our engagement. We also provided the contractors with select summaries of the information they shared with us, to ensure we characterized their responses appropriately, along with our recommendations from a draft of this report. The contractors provided us their comments and we incorporated them as appropriate.

To examine the extent to which DOD reviews IR&D project information as part of its modernization planning, we analyzed DOD's modernization priority documentation and strategic planning documents from DOD and the services. We reviewed DOD's unclassified summary of the January 2018 National Defense Strategy along with April 2018 and March 2019 congressional testimonies by the Under Secretary of Defense for Research and Engineering. We reviewed the September 2019 National Defense Science and Technology Strategy, the April 2019 Air Force Science and Technology Strategy, the 2017 Naval Research and Development Framework, and the 2019 Army Modernization Strategy. We also examined the three Department of Defense Better Buying Power memorandums issued between 2010 and 2015 that included, among other things, initiatives to improve DOD's oversight of IR&D while preserving industry's independence to select the technologies to pursue.

We interviewed officials from the Offices of the Under Secretaries of Defense for Acquisition and Sustainment and for Research and Engineering, respectively, regarding the extent to which DOD took industry IR&D into account for its strategic planning process. We also interviewed officials from the Air Force Research Laboratory, Office of the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation, Office of Naval Research, and the office of the Deputy Assistant Secretary of the Army for Research and Technology regarding the extent to which the services took industry IR&D into account in their planning processes. We also obtained the DTIC IR&D database usage data and assessed which DOD and military service organizations and activities were regularly accessing the IR&D project information within the database.

We conducted this performance audit from December 2018 to September 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix III: Independent Research and Development Project Categorization Sample Design and Analysis Results

To conduct our Independent Research and Development (IR&D) project categorization analysis we used a generalizable, random sample of IR&D projects ranging from 88 to 90 per year. We calculated our sample size from a population ranging from 2,242 to 3,403 individual projects for each fiscal year. We calculated each year's sample to produce results at a 95 percent confidence level. Our sample is one of many possible combinations drawn randomly from the population. A 95 percent confidence interval indicates that 95 out of 100 different combinations of samples should include the statistics of the true population. This appendix shows the data tables (tables 12 and 13 below) from our sample analysis, our confidence interval results, and both the upper and lower limits for each category.

Table 12: Percentage of Industry Independent Research and Development (IR&D) Projects by Category and Year from GAO's Generalizable Sample Analysis of the Defense Technical Information Center IR&D Project Database Allowable Category Analysis

IR&D project category	Fiscal Year 2014	2015	2016	2017	2018	Total (2014-2018)
Basic research	4.44%	4.49%	2.25%	N/A[a]	1.14%	**2.72%**
95% Confidence Level Upper Limit	11.20%	11.30%	8.46%	N/A	7.47%	**4.83%**
95% Confidence Level Lower Limit	1.69%	1.71%	0.57%	N/A	0.16%	**1.52%**
Applied research	27.78%	29.21%	24.72%	23.86%	39.77%	**28.76%**
95% Confidence Level Upper Limit	37.83%	39.38%	34.63%	33.72%	50.18%	**33.13%**
95% Confidence Level Lower Limit	19.55%	20.77%	16.91%	16.18%	30.22%	**24.76%**
Technology development	24.44%	40.45%	51.69%	53.41%	39.77%	**40.84%**
95% Confidence Level Upper Limit	34.30%	50.84%	61.78%	63.43%	50.18%	**45.36%**
95% Confidence Level Lower Limit	16.70%	30.85%	41.45%	43.11%	30.22%	**36.48%**
Concept study	18.89%	21.35%	11.24%	12.50%	9.09%	**15.15%**

95% Confidence Level Upper Limit	28.25%	30.99%	19.56%	21.06%	17.02%	**18.83%**
95% Confidence Level Lower Limit	12.11%	14.09%	6.18%	7.11%	4.65%	**12.08%**
Not enough information/	24.44%	4.49%	10.11%	10.23%	10.23%	**12.52%**
Doesn't fit above categories						
95% Confidence Level Upper Limit	34.30%	11.30%	18.23%	18.38%	18.38%	**15.93%**
95% Confidence Level Lower Limit	16.70%	1.71%	5.37%	5.45%	5.45%	**9.75%**
Sample Size	90	89	89	88	88	**444**
Population Size	3,403	2,915	2,872	2,247	2,242	**13,679**

Source: GAO analysis of Department of Defense data. | GAO-20-578

[a]We identified zero basic research projects in our sample of 88 projects from 2017. N/A is the appropriate way to report a zero result, since we cannot derive a confidence interval from a null result in the sample.

Table 13: Percentage of Industry Independent Research and Development (IR&D) Projects by Category and Year from GAO's Generalizable Sample Analysis of the Defense Technical Information Center IR&D Project Database Incremental versus Disruptive Potential Analysis

IR&D project potential innovation category	Fiscal Year 2014	2015	2016	2017	2018	Total (2014-2018)
Incremental potential	58.89%	58.43%	70.79%	81.82%	71.59%	**67.14%**
95% Confidence Level Upper Limit	68.51%	68.11%	79.23%	88.49%	79.93%	**71.33%**
95% Confidence Level Lower Limit	48.54%	48.05%	60.62%	72.48%	61.45%	**62.65%**
Disruptive potential	10.00%	22.47%	12.36%	7.95%	14.77%	**13.60%**
95% Confidence Level Upper Limit	18.06%	32.21%	20.88%	15.64%	23.68%	**10.73%**
95% Confidence Level Lower Limit	5.30%	15.03%	7.01%	3.87%	8.83%	**17.09%**
Not enough information /	31.11%	19.10%	16.85%	10.23%	13.64%	**19.26%**
Doesn't fit above categories						
95% Confidence Level Upper Limit	41.32%	28.52%	26.02%	18.38%	22.37%	**23.23%**
95% Confidence Level Lower Limit	22.46%	12.26%	10.46%	5.45%	7.96%	**15.84%**
Sample Size	90	89	89	88	88	**444**
Population Size	3,403	2,915	2,872	2,247	2,242	**13,679**

Source: GAO analysis of Department of Defense data. | GAO-20-578

Appendix IV: Comments from the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

RESEARCH AND ENGINEERING

Mr. Timothy J. DiNapoli
Director, Contracting and National Security Acquisitions
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. DiNapoli

This is the Department of Defense's (DoD) written response to the GAO Draft Report, GAO-20-578, "DEFENSE SCIENCE AND TECHNOLOGY: Opportunities to Better Integrate Industry Independent Research and Development into DOD Planning" (GAO Code 103037).

The DOD concurs with your two recommendations. My point of contact is Mr. Christopher Thomas, Administrator, Defense Technical Information Center. Mr. Thomas can be contacted at (571) 448-9900 or via email at christopher.e.thomas26.civ@mail.mil.

Sincerely,

LEI.JIH-FEN.1230395949 Digitally signed by LEI.JIH-FEN.1230395949 Date: 2020.08.18 10:23:02 -04'00'

JihFen Lei
Acting Director of Defense Research and Engineering for Research and Technology

Attachment(s):
As stated

GAO DRAFT REPORT
GAO-20-578 (GAO CODE 103037)

"DEFENSE SCIENCE AND TECHNOLOGY: OPPORTUNITIES TO BETTER INTEGRATE INDUSTRY INDEPENDENT RESEARCH AND DEVELOPMENT INTO DOD PLANNING."

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO DRAFT RECOMMENDATIONS

RECOMMENDATION 1: The Secretary of Defense should ensure that the Under Secretary of Defense for Research and Engineering revise its IR&D instruction to require USD(R&E) personnel to annually review defense industry IR&D investments to inform DoD's science and technology strategic planning efforts.

DOD RESPONSE: Concur. USD(R&E) will investigate and revise its IR&D Instruction to require annual review of defense industry IR&D investments.

RECOMMENDATION 2: The Secretary of Defense should ensure that the Administrator, Defense Technical Information Center, assess and determine whether the DTIC IR&D database should require contractors to include additional information on IR&D projects, such as:

(a) The IR&D project's linkage, if any, to DoD modernization priorities;
(b) The allowable category (basic research, applied research, technology development, or concept study) to which the IR&D project belongs;
(c) The nature of the project as either potentially disruptive or potentially incremental research and development; and
(d) The actual IR&D project costs when the project is completed.

DOD RESPONSE: Concur. The DTIC Administrator will assess whether the DoD IR&D database should require contractors to include additional information on IR&D projects, and make his recommendation to the Director of Defense Research and Engineering for Research and Technology (DDR&E (R&T)) for decision. DDR&E (R&T) provides DoD IR&D programmatic oversight.

Text of Appendix IV: Comments from the Department of Defense

Page 1

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

Mr. Timothy J. DiNapoli
Director, Contracting and National Security Acquisitions
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. DiNapoli

This is the Department of Defense's (DoD) written response to the GAO Draft Report, GAO- 20-578, "DEFENSE SCIENCE AND TECHNOLOGY: Opportunities to Better Integrate Industry Independent Research and Development into DOD Planning" (GAO Code 103037).

The DOD concurs with your two recommendations. My point of contact is Mr. Christopher Thomas, Administrator, Defense Technical Information Center. Mr. Thomas can be contacted at (571) 448-9900 or via email at christopher.e.thomas26.civ@mail.mil.

Sincerely,

JihFen Lei

Acting Director of Defense Research and Engineering for Research and Technology

Attachment(s): As stated

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Page 2

GAO DRAFT REPORT GAO-20-578 (GAO CODE 103037) "DEFENSE SCIENCE AND TECHNOLOGY: OPPORTUNITIES TO BETTER

INTEGRATE INDUSTRY INDEPENDENT RESEARCH AND DEVELOPMENT INTO DOD PLANNING."
DEPARTMENT OF DEFENSE COMMENTS TO THE GAO DRAFT RECOMMENDATIONS

RECOMMENDATION 1:

The Secretary of Defense should ensure that the Under Secretary of Defense for Research and Engineering revise its IR&D instruction to require USD(R&E) personnel to annually review defense industry IR&D investments to inform DoD's science and technology strategic planning efforts.

DOD RESPONSE:

Concur. USD(R&E) will investigate and revise its IR&D Instruction to require annual review of defense industry IR&D investments.

RECOMMENDATION 2:

The Secretary of Defense should ensure that the Administrator, Defense Technical Information Center, assess and determine whether the DTIC IR&D database should require contractors to include additional information on IR&D projects, such as:

a. The IR&D project's linkage, if any, to DoD modernization priorities;

b. The allowable category (basic research, applied research, technology development, or concept study) to which the IR&D project belongs;

c. The nature of the project as either potentially disruptive or potentially incremental research and development; and

d. The actual IR&D project costs when the project is completed.

DOD RESPONSE:

Concur. The DTIC Administrator will assess whether the DoD IR&D database should require contractors to include additional information on IR&D projects, and make his recommendation to the Director of Defense Research and Engineering for Research and Technology (DDR&E (R&T)) for decision. DDR&E (R&T) provides DoD IR&D programmatic oversight.

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

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Appendix VI: Accessible Data

Data Tables

Figure 1: Comparison of Annual Independent Research and Development Reimbursements to DOD Science and Technology and Research, Development, Test, and Evaluation Funding, 2014 to 2018

Year	Independent Research and Development	Science and Technology	Research, Development, Test and Evaluation
2014	3.5	12	50.8
2015	3.8	12	51.3
2016	4.3	13	55.8
2017	5.7	13.4	56.2
2018	5.3	14.6	60

Figure 6: Breakdown of Independent Research and Development Database Access in Calendar Year 2019

Independent Research and development Database	**Percentage**
Air Force	56%
Air Force Research Lab	83%
Other Air Force	17%
Defense Contract Audit Agency	21%
Defense Contract Management Agency	18%
Army	3%
Other defense	2%
Navy	>1%