

Defense Industrial Base: DOD Efforts to Develop Domestic Biomanufacturing

GAO-26-107797

Q&A

Report to Congressional Committees

February 26, 2026

Why This Matters

The Department of Defense's (DOD) 2023 National Defense Industrial Strategy states that developing and sustaining capabilities critical to national security requires resilient, healthy, dynamic, and secure supply chains. Over the past 3 decades, however, the U.S. defense industrial base has shrunk, and manufacturing capacity has waned. As a result, DOD is exposed to risks that threaten our national security, according to the strategy. Mitigating these risks, which include an over-reliance on foreign and single-source suppliers, is essential for DOD to avoid supply disruptions and ensure that the industrial base can meet current and future needs.

DOD has identified biotechnology and biomanufacturing—the use of biological systems to create and produce new materials—as a critical area of investment within the U.S. DOD is investing in biotechnology research to develop materials critical for producing, operating, and sustaining its weapon systems. DOD also intends to use biomanufactured materials (biomaterials) to enhance capabilities to replace or augment domestic production of critical materials where traditional manufacturing cannot meet current or predicted defense needs. Examples of biomaterials that DOD is developing include novel fuels and explosives.

To expand domestic biomanufacturing to the scale necessary to support the defense industrial base, DOD determined that it needs more infrastructure in the U.S. Without investments in biomanufacturing, DOD considers the U.S. defense industrial base to be increasingly dependent on foreign sources. This dependency makes the U.S. more vulnerable to supply chain disruptions initiated by adversarial nations, such as China. At the same time, China is investing in biotechnology and biomanufacturing for the purpose of achieving strategic dominance in these areas.

House Report 118-529 accompanying a bill for the Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025, Pub. L. No. 118-159, includes a provision for us to review the state of biomanufacturing in the U.S., including DOD's investments in biotechnology and biomanufacturing. In addition, the enacted law includes a provision for us to evaluate a roadmap of DOD's biotechnology efforts once the department completes it. This report describes DOD's recent efforts to accelerate the use of biotechnology and develop a domestic biomanufacturing industrial base.

Key Takeaways

- Biomanufacturing is increasingly critical to DOD and holds the potential to expand and strengthen the U.S. defense industrial base. According to DOD officials, biomanufacturing has the potential to create material for a wide range of defense applications, such as explosives, body armor, and solvents to maintain weapon systems. Biomaterials can expand or create new defense capabilities. They can also replace products and components that are critical to DOD with materials that are domestically sourced, cheaper, and safer.

- DOD identified that the U.S. does not have sufficient infrastructure, such as biomanufacturing facilities, to support the advancement of promising biotechnology projects from the laboratory to commercial-scale production. According to DOD officials, expanding the use of biomanufacturing contributes to the establishment of new supply chains.
- Since fiscal year 2020, DOD has invested \$965.2 million across three initiatives designed to support promising biotechnology projects and establish domestic biomanufacturing supply chains. For example, DOD is collaborating with industry and other partners to build a network of biomanufacturing facilities across the U.S.
- It will likely take years for DOD to establish the domestic biomanufacturing infrastructure planned under these three initiatives, two of which are set to end after 2027. DOD's future plans for advancing biomanufacturing are expected to be set forth in a congressionally-directed biotechnology roadmap by September 2026.

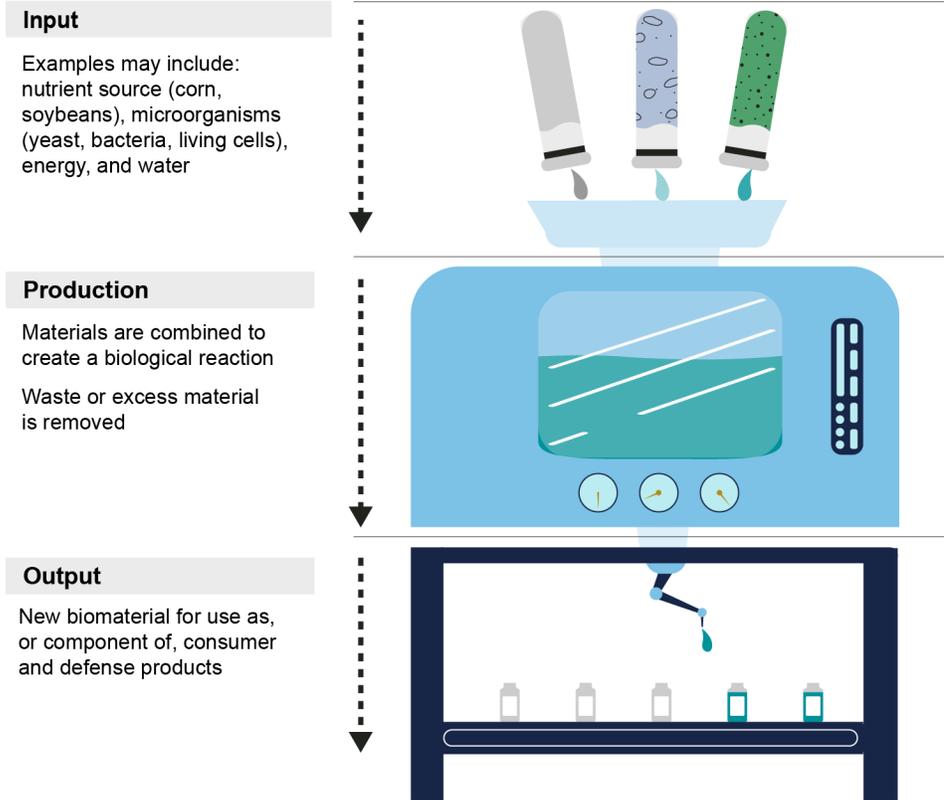
What is biomanufacturing?

Biomanufacturing is a production method that uses biological systems to create a wide range of technologies and products. Through biomanufacturing, scientists can harness the power and complexity of living organisms to create new products for a wide range of commercial and defense applications. Biomanufacturing allows researchers to grow some materials needed to make products that would otherwise be too expensive to make through traditional manufacturing processes and possibly improve them. For example, Army researchers stated that they are working on a project to grow new explosive materials in the U.S. that are more compact and powerful than explosives made through traditional industrial manufacturing processes.

The biomanufacturing process generally involves combining biological materials, which may include microorganisms, a nutrient source such as corn or soybeans, and other inputs such as energy and water to create a biological reaction. This reaction creates the desired product and waste material, which is then extracted or filtered out. Companies then use these biomaterials in the same manner as traditionally manufactured materials to make the products they sell commercially or to defense customers.

Beer is a millennia-old biomanufactured product that is derived using this same process. Brewers combine yeast—living microorganisms—with grains, malt, and a water solution that is heated to begin the biological reaction. This reaction, known as fermentation, results in alcohol and carbon dioxide as well as waste materials, such as the dead yeast. Producers then filter out those waste materials, resulting in the final beer product, which they then package and sell. Figure 1 describes a simplified notional biomanufacturing process.

Figure 1: Simplified Notional Biomanufacturing Process



Source: GAO summary of Department of Defense and National Security Commission on Emerging Biotechnology information; The Img/stock.adobe.com. | GAO-26-107797

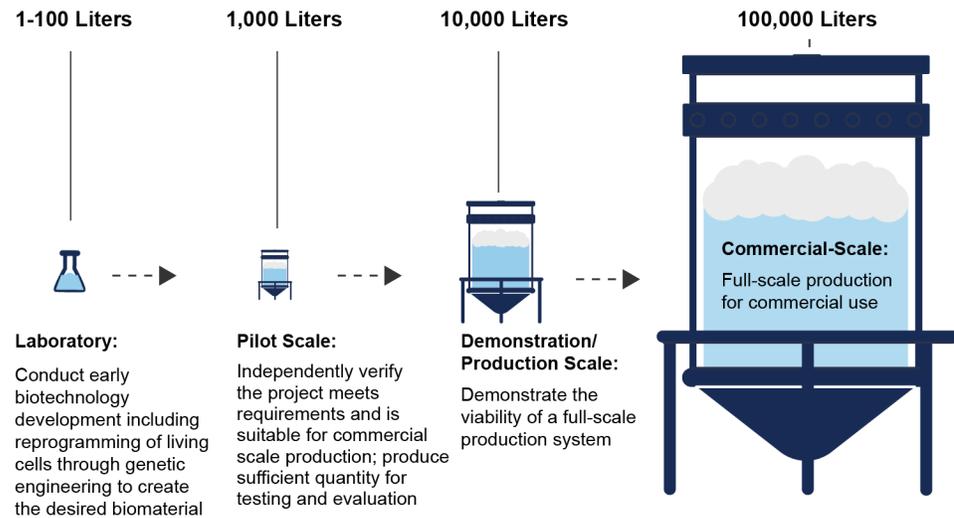
What are the stages of biomanufacturing as it evolves from early research to commercial scale production?

Biomanufacturing development evolves over a multi-stage process that starts with producing small quantities of materials through experiments in laboratories and advances up to commercial-scale production. These stages are:

- **Laboratory:** Scientists experiment in laboratories to identify microorganisms or other biological components that show potential to create the desired material. Through experiments, scientists may alter the genetic material of these microorganisms, or reprogram them, until they are able to make small quantities of the desired biomaterial.
- **Pilot:** If these experiments show promise and receive sufficient support from potential customers, they advance to the pilot project stage. In this phase, scientists attempt to demonstrate that the biomanufacturing processes work and can produce the biomaterial in large enough quantities for further testing.
- **Demonstration/Production:** If the pilot phase is successful, researchers will work with industry partners to develop large-scale manufacturing processes, which are validated during the demonstration stage. If the demonstration shows that the biomaterial can be consistently produced at large quantities, it can then advance to the much larger commercial-scale production stage.
- **Commercial:** Once a product is produced at commercial scale, it can be manufactured in sufficient quantities to support multiple customers at lower costs.

Figure 2 illustrates these biomanufacturing stages and associated production quantities.

Figure 2: Notional Biomanufacturing Development Stages and Production Quantities



Source: GAO Summary of Department of Defense information and Michael J. Smanski et al., "Bioindustrial manufacturing readiness levels (BioMRLs) as a shared framework for measuring and communicating the maturity of bioproduct manufacturing processes," *Journal of Industrial Microbiology and Biotechnology*, 49 (2022); MicroOne/stock.adobe.com | GAO-26-107797

Note: The volumes of material made at each stage will generally vary dependent on the facility.

Why is biomanufacturing important to DOD?

Biomanufacturing's broad applications and potential for innovation make it an important tool for DOD to address risks to the defense industrial base. According to officials within the Office of the Under Secretary of Defense for Research and Engineering (OUSD (R&E)), expanding the use of biomanufacturing would help to create new, secure, enduring, domestic supply chains that can produce critical materials at lower costs or new materials with enhanced capabilities.

The commercial industrial base is already making use of biomaterials but opportunities exist to expand their use for defense applications. Some of the more well-known applications in the commercial manufacturing sector include medical products and food additives. OUSD (R&E) has stated that the commercial sector is rapidly expanding its use of biomanufacturing to create an increasing range of products outside of the health and pharmaceutical sectors. DOD is now leveraging domestic biomanufacturing to produce defense-related biomaterials, such as explosive materials, solvents, and fuels.

Below are some examples of how DOD and its military department laboratories are exploring ways to leverage biomanufacturing to strengthen the defense industrial base.

- DOD is researching how it can use biomaterials to provide supply chain resiliency, such as new biofuels that are expected to be more efficient to use in aircraft and naval vessels.
- Biomaterials can function as replacements to traditionally manufactured chemicals and critical materials that are sourced from foreign suppliers, thereby reducing DOD's reliance on offshore materials and overall supply chain risk. For example, one DOD project is developing a biomaterial that can be used in high-performance coatings for ships, marine vessels, and steel piping. OUSD (R&E) officials said that this material has better properties than the original product, which is made overseas.

- Biomaterials have the potential to be less expensive or safer to create than other materials. For example, DOD is developing a new biomaterial to replace a foreign-sourced hazardous chemical that manufacturers use to create explosives and plastic materials.
- DOD is also working to develop the ability to meet critical needs for supplies, such as building materials, energy, and food at the point-of-need to reduce logistical and supply times. For example, DOD is developing a mobile biomanufacturing system it can deploy with warfighters to create needed items, such as food rations, and reduce shipping logistics.

OUSD (R&E) officials told us that it is critical for the U.S. to have technological superiority in biotechnology and biomanufacturing, which they view as a key frontier in innovation. While biomanufacturing at the commercial scale for defense-related products is relatively new in the U.S., OUSE (R&E) officials expect its use to grow domestically and globally. The National Security Commission on Emerging Biotechnology—made up of Members of Congress, industry leaders, academic experts, and former defense officials— published a report in April 2025 confirming that the use of biomanufacturing is expected to increase globally. According to the report, producers are expanding the use of biotechnology to develop new materials with innovative applications for commercial use.¹

DOD officials we met with consider it vitally important that DOD and its defense industrial base continue to invest in biotechnology and biomanufacturing so the U.S. does not fall behind other countries—in particular, China. According to the DOD Office of Industrial Base Policy, the Chinese government has invested billions in its biomanufacturing infrastructure for the purpose of becoming a world leader in this area. Without more domestic biomanufacturing infrastructure, U.S. innovators have had to turn to China and other foreign markets to scale up their production, reducing U.S. control over the supply chain and transferring technology overseas. More broadly, China’s investments in biomanufacturing could lead to its technical dominance over the U.S. in areas where biotechnologies have widespread defense applications. The National Security Commission on Emerging Biotechnology’s April 2025 report stated that China’s efforts to dominate in the field of biotechnology and biomanufacturing would put the U.S. at a strategic defense disadvantage.

What is the primary challenge DOD identified that inhibits biomanufacturing from meeting its needs?

In 2023, DOD’s Office of Industrial Base Policy’s defense industrial capabilities review and OUSD (R&E) reported that the primary challenge inhibiting biomanufacturing’s potential within the U.S. is insufficient industry infrastructure to expand promising biotechnology concepts into commercial-scale production.² According to OUSD (R&E) officials this infrastructure includes funding, industry partners, workforce, and facilities. Although the U.S has led the world in developing and producing critical biotechnology innovations according to OUSD (R&E) officials, The Office of Industrial Base Policy noted in its 2023 defense industrial capability report that U.S. biomanufacturing capacity and capability are still in early stages of development compared to other countries.³ To address this challenge, OUSD (R&E) identified that DOD needs to make specific investments in four key areas:

- **Building domestic biomanufacturing facilities.** The U.S. needs sufficient domestic physical infrastructure to scale up biotechnology projects from the laboratory to the commercial market. Specifically, there are not enough pilot-scale facilities to propel U.S. innovations forward. Additionally, there are not enough companies in the U.S. investing in biomanufacturing infrastructure to produce biomaterials with defense applications in part due to insufficient and

inconsistent demand. Without sufficient support throughout the stages of biomanufacturing, the domestic development of promising biotechnologies is at risk of not advancing or being acquired by foreign entities.

- **Advancing biotechnology and biomanufacturing research and development.** DOD researchers need funding, industry partners, a trained workforce, and facilities to create and scale-up production of new biomaterials with potential military applications. With sufficient support, researchers could develop and test new biomaterials to demonstrate that they meet specific DOD needs, the efforts can transition to a specific program of record, and the biomaterials can be produced at a commercial scale.
- **Standardizing biotechnology and biomanufacturing processes.** Researchers, industry partners, and DOD customers need uniform processes and standards as the domestic biomanufacturing industry matures. These standards relate to areas such as facility design, equipment, processes, quality, biological data, and workforce training. Further developing and adopting such standards can help support interoperability and data sharing among industry partners and allies, promote safety, and help ensure biomanufactured products conform to military specifications.
- **Protecting biotechnology research and biomanufacturing data.** DOD and industry partners need to continue to develop and adopt processes, strategies, and tools to protect the sensitive and proprietary data produced in biotechnology projects. DOD's Office of Industrial Base Policy's 2023 report noted that industry has security vulnerabilities resulting from issues such as a generally ineffective cybersecurity posture in life sciences and legacy equipment that is incompatible with software upgrades. By adopting new security controls and measures, DOD can better protect biomanufacturing data from theft and cyber-attacks.

OUSD (R&E) issued a Biomanufacturing Strategy in March 2023, which stated that the U.S. faces a foundational gap in its ability to advance laboratory research and development to a commercial scale due to insufficient infrastructure.⁴ To address this challenge, the strategy highlights the importance of DOD matching research efforts with potential customers in DOD to support the transformation of promising biotechnology projects to programs with practical applications. The strategy also promotes the importance of biomanufacturing innovation by supporting research to sufficiently scale up promising projects and demonstrate that they could address DOD capability gaps.

What investments has DOD made to boost the domestic biomanufacturing infrastructure?

Since fiscal year 2020, DOD has established three initiatives and reported that these initiatives collectively received \$965.2 million for investment through fiscal year 2025. These initiatives are intended to collectively boost the biomanufacturing infrastructure within the U.S. and help biotechnology projects transition from the lab to commercial-scale production. See table 1 for a description of these three biomanufacturing initiatives.

Table 1: Department of Defense (DOD) Established Three Biomanufacturing Initiatives

Initiative	Purpose	Reported funding for fiscal years 2020-2025 (in millions)
Tri-Service Biotechnology for a Resilient Supply Chain program	A DOD program that supports biotechnology projects and modernizes DOD facilities and equipment necessary to develop and safeguard biotechnology innovations with defense applications. The program also supports testing that advances biotechnology research from the laboratory to pilot scale.	\$281.9
Bioindustrial Manufacturing and Design Ecosystem	A DOD-sponsored public-private partnership to help develop the U.S. biomanufacturing industry by expanding pilot scale production facilities, supporting biotechnology research, and establishing standards and processes.	\$557.2
Distributed Bioindustrial Manufacturing Program	A DOD program that provides funding to companies to develop plans and construct facilities to support domestic biomanufacturing of critical defense products.	\$126.1
Total Investment		\$965.2

Source: GAO analysis of agency documentation. | GAO-26-107797

Note: A portion of these funds will be available for obligation after fiscal year 2025. For example, DOD's research, development, test and evaluation appropriations are generally available for 2 years. In addition to funding for initial operations and a pilot plant network, BioMADE's reported funding includes funding from the military departments and other DOD offices to support BioMADE projects through July 15, 2025. T-BRSC directed an additional \$51.6 million to support BioMADE efforts that was not included in BioMADE's reported funding in the table.

How is T-BRSC supporting the expansion of domestic biomanufacturing?

DOD launched the Army-led Tri-Service Biotechnology for a Resilient Supply Chains program (T-BRSC) in 2022 to support the transition of promising, military-department-sponsored biotechnology from the laboratory to the pilot-scale production phase.⁵ To help accomplish this goal, T-BRSC modernized DOD's biotechnology and biomanufacturing infrastructure, including a new pilot-scale production facility, and is advancing over 30 promising defense-related biotechnology research projects.⁶ DOD's \$282 million investment in this initiative, as of fiscal year 2025, is allocated to the following areas:

Infrastructure modernization. T-BRSC invested in DOD facilities capable of manufacturing new biomaterials at pilot-scale quantities, modernized DOD facilities with equipment necessary to protect and secure key biological components, and established a new secure network to share research data among DOD research labs and industry partners.

Through T-BRSC, the Army retrofitted an aging chemical defense facility into a biomanufacturing pilot-scale production facility in 2024. The Army designed this facility to ensure that DOD has its own secure pilot-scale facility capable of producing and prioritizing the research of defense-related biomaterials for all the military departments. The biomanufacturing facility is comprised of newly renovated laboratories and supports activities from early laboratory research and development up through pilot-scale production. Key components of the facility include:

- a secure storage and a back-up repository of key microorganisms used to manufacture defense materials;
- laboratories to produce small amounts of biomaterials for research purposes;
- bioreactor equipment to create biomaterials at the pilot-scale, which researchers can then use to demonstrate their bioproduct to potential DOD customers and companies; and
- a digital network to protect and ensure the secure transmittal of biotechnology data sharing among DOD research scientists and industry partners.

Research projects. The T-BRSC program is making investments to advance over 30 biotechnology research projects led by three military department labs.⁷

These investments are intended to assist DOD research teams with maturing biotechnology and developing biomanufacturing processes, producing enough of the biomaterials for testing and customer demonstrations, and identifying and collaborating with DOD customers or industry partners to further develop these biomaterials so the warfighter can use them. These T-BRSC projects are organized across three key mission areas: (1) reduced logistics support, (2) enhanced capabilities, and (3) cost-saving measures.

- **Reduced logistics support.** T-BRSC is advancing projects to develop new biomaterials to support forward deployed forces. These include biomaterials that can be more easily transported or produced with mobile bioreactors at the point of need. For example, one Air Force project is developing a bioengineered cement material derived from bacteria, organic material, and calcium that can reduce the labor hours and materials needed to construct landing strips, roads, and foundations for forward operating bases.
- **Enhanced capabilities.** T-BRSC is advancing projects to develop new biomaterials that can serve new purposes or demonstrate improved performance characteristics. For example, one Navy project is developing bioengineered spider silk to replace materials, such as steel or Kevlar, that are commonly used in protective equipment like body armor. This spider silk is lighter than carbon fiber and is exponentially stronger than steel and Kevlar.
- **Cost-saving measures.** T-BRSC is advancing projects to domestically produce biomanufactured replacements for raw materials and products that are crucial to defense needs but are currently foreign-sourced, expensive, or no longer produced. For example, one Army-led project is developing biotechnology-enabled methods to reclaim critical materials, such as rare earth elements used to make high-powered magnets, from mining waste streams.⁸

According to T-BRSC officials, these projects will likely be completed by the end of fiscal year 2027 but not all of them will transition to a DOD program. As of July 2025, these officials identified approximately 15 projects for transition and stated that others may be dependent on test and demonstration scheduling. Specifically, according to OUSD (R&E) officials, DOD researchers delayed scheduling test and demonstration events for many T-BRSC projects until they were fully funded for fiscal year 2025.⁹ These officials stated that once these test events take place, they will have a better sense of which projects will transition to industry partners and DOD programs of record.

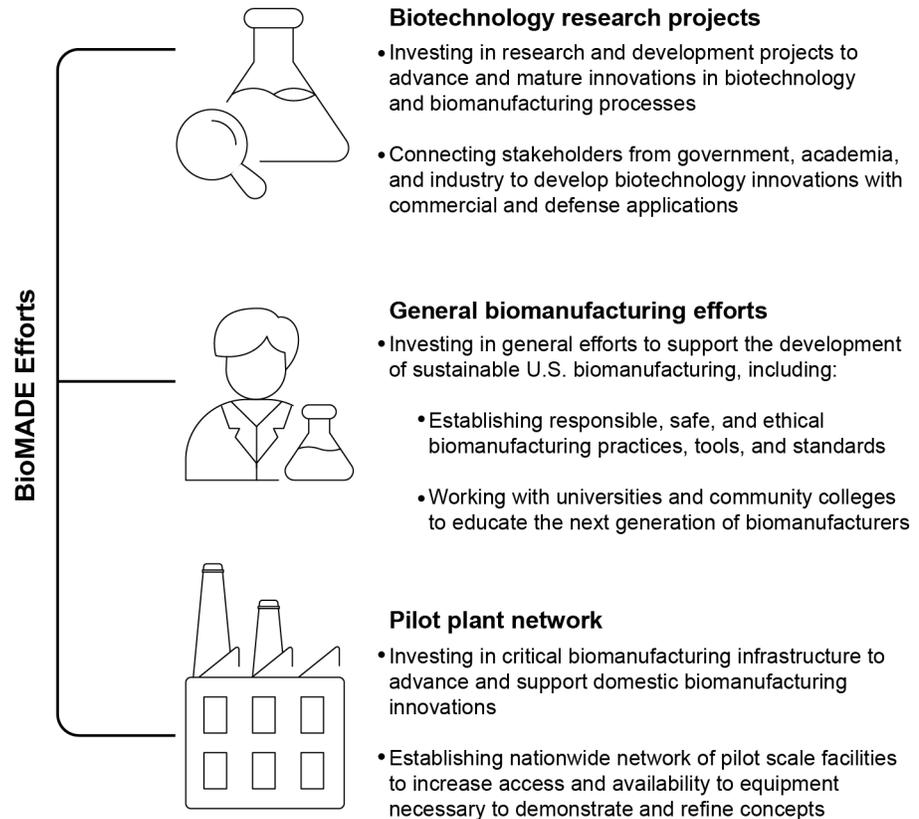
How is BioMADE supporting the expansion of domestic biomanufacturing?

The Bioindustrial Manufacturing and Design Ecosystem (BioMADE) is investing in several areas to promote the expansion of biomanufacturing, including establishing a network of biotechnology experts and investing in new infrastructure. DOD established BioMADE in late 2020 as a Manufacturing Innovation Institute to serve as a public-private partnership that has grown to over 300 members.¹⁰ It connects stakeholders from government, industry, and academia to collaborate on research and development projects intended to support innovations in biotechnology and biomanufacturing for commercial and defense applications. According to DOD (R&E), BioMADE lowers the barrier for industry members and DOD representatives to connect and find opportunities to transition technologies into defense programs.

DOD is investing almost \$600 million to establish BioMADE and support three key investment areas through fiscal year 2025. BioMADE's key investment areas include biotechnology research projects, general biomanufacturing support, and building a network of new biomanufacturing pilot-plants. According to a senior BioMADE official, underpinning these investments is the idea that, as a

Manufacturing Innovation Institute, BioMADE can connect and leverage the strengths and expertise of its membership to facilitate the transition of promising biotechnology research from the lab into commercial-scale production. A senior BioMADE official stated that these partnerships foster the development of new biotechnologies, create jobs and market opportunities, facilitate technology transfer, and accelerate commercialization of biomanufactured products that can create new technological innovations. Over time, DOD intends that BioMADE will become more reliant on its members and other nonfederal sources for future funding. See figure 3 for a description of BioMADE’s key investment areas.

Figure 3: Bioindustrial Manufacturing and Design Ecosystem (BioMADE) Key Investment Areas



Source: GAO analysis of BioMADE documentation; Cetacons/stock.adobe.com. | GAO-26-107797

Biotechnology research projects. Beyond its initial investment of \$87.5 million to establish BioMADE, DOD also provided BioMADE with nearly \$62.4 million more to support and advance 62 promising biotechnology projects with commercial and defense applications.¹¹ According to a senior BioMADE official, they assign each BioMADE project a program manager—a subject matter expert with industry experience—to work with project members and/or government stakeholders to collectively advance biotechnology innovations.¹² For example, BioMADE helped facilitate a project in collaboration with DOD’s Air Force Research Lab, a commercial tire manufacturer, and an agricultural company to develop a domestic source of natural rubber from a species of dandelion. According to a senior BioMADE official, one of the potential strengths of biomanufacturing is the capability to use or convert the U.S.’s abundant natural resources into new materials or products at lower cost or through less hazardous manufacturing processes. While natural rubber is currently sourced from plants in foreign countries, this project is developing a manufacturing process that would allow rubber to be sustainably produced domestically, sourced from dandelions grown in the U.S.

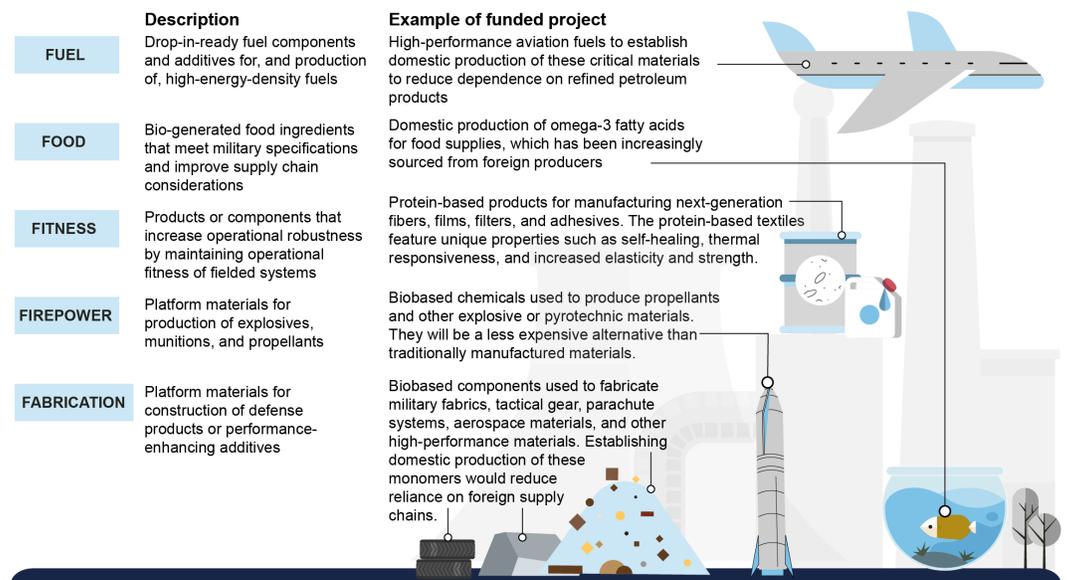
General biotechnology and manufacturing support. DOD provided BioMADE with an additional \$7.3 million for efforts that are intended to generally advance biotechnology and manufacturing in the U.S. These efforts include support for biotechnology education and workforce development and establishing research and manufacturing standards for safety and security. For example, BioMADE has collaborated with universities and community colleges to provide support for courses and scholarships focused on areas such as molecular biology and biomanufacturing principles. In addition, BioMADE is supporting studies that advance a common set of interdisciplinary standards and tools for manufacturing to characterize the maturity of new biotechnologies.

Pilot plant network. BioMADE is also partnering with its members to establish a network of up to three pilot-scale production facilities across the U.S to increase domestic biomanufacturing capacity and reduce reliance on overseas facilities. Congress appropriated an additional \$300 million in fiscal year 2023, and \$100 million in fiscal year 2024, that DOD is using to support the construction of these facilities. BioMADE is currently in the process of building the first two pilot-scale biomanufacturing facilities. In April 2025, BioMADE announced that it would invest around \$132 million for the renovation of an existing 122,000 square foot facility in Minnesota, with approximately \$82 million provided by DOD and approximately \$50 million from the Minnesota Forward Fund program.¹³ The second site will be located in California, with BioMADE anticipating to invest approximately \$80 million for a 25,000 square foot multi-user facility, which it projects to be operational in 2026. In August 2025, after this report was submitted to DOD for comment, BioMADE announced that it selected a third pilot-plant site in Iowa. These facilities are intended to possess a variety of production capabilities that will provide flexibility in the types of biomaterials they can manufacture.

How is DBIMP supporting the expansion of domestic biomanufacturing?

DOD established the Distributed Bioindustrial Manufacturing Program (DBIMP) in 2023 to provide funding to industry partners to plan and construct commercial-scale production facilities in the U.S. for biomaterials with both defense and commercial applications. DBIMP's goal is to build up domestic defense biomanufacturing infrastructure by investing in companies that can demonstrate how they can innovate and commercialize the production of biomaterials in five key mission areas: fuel, food, fitness, firepower, and fabrication.¹⁴ See figure 4 for examples of DBIMP's \$126.1 million in investments in the five mission areas as of fiscal year 2025.

Figure 4: Distributed Bioindustrial Manufacturing Program Mission Areas and Examples



Source: GAO analysis of Distributed Bioindustrial Manufacturing Program documents; Dmytro/stock.adobe.com | GAO-26-107797

DBIMP is using a multi-phased approach to identify projects within these five mission areas and mature them so DOD can award future other transaction agreements (OTA) to support construction of commercial-scale production facilities. Across these areas, DBIMP has funded planning projects with the potential to replace secure supply chains of materials identified by DOD that could be produced in the U.S. through biomanufacturing. From these projects, DBIMP intends to issue follow-on production OTAs worth up to \$100 million each to support the construction or expansion of commercial-scale facilities for biomaterials in these areas.¹⁵ This multi-phase approach includes:

Issue request for white paper. In 2024, DBIMP submitted a public request for white papers for biomanufacturing projects within DBIMP’s five key mission areas. White papers were to outline how biomaterials could address known domestic supply chain issues, such as the bioproduction of a material that is in limited quantity or is not produced domestically. Evaluation criteria of planning OTAs required feasible, economically viable, and competitive technology and business approaches. The submission period was open from the end of January 2024 to early March 2024.

Identify top applicants. From July 2024 to November 2024, DBIMP awarded planning agreements totaling over \$59 million to support 34 companies’ development of business and technical plans for their proposed commercial-scale biomanufacturing facility.¹⁶ These companies are located across the country—including in California, Nebraska, Ohio, Pennsylvania, Tennessee, and Utah. Through the OTA, DBIMP officials are striving to integrate new companies capable of producing DOD-oriented materials into the defense industrial base. According to DBIMP officials, the program works with planning OTA recipients to further develop business plans before they are evaluated for a future production OTA to support construction of the facility. DBIMP officials stated that these plans will help the businesses obtain support and investment from other sources if they are not selected for a production agreement.

Select recipients of production agreements. DBIMP officials stated that they started the process to select recipients of the production OTAs. These agreements, chosen from the pool of 34 companies initially awarded planning OTAs, will provide up to \$100 million to support the construction of commercial-scale biomanufacturing facilities. DBIMP officials plan to select recipients based on how well submitted business plans align with DBIMP’s award criteria,

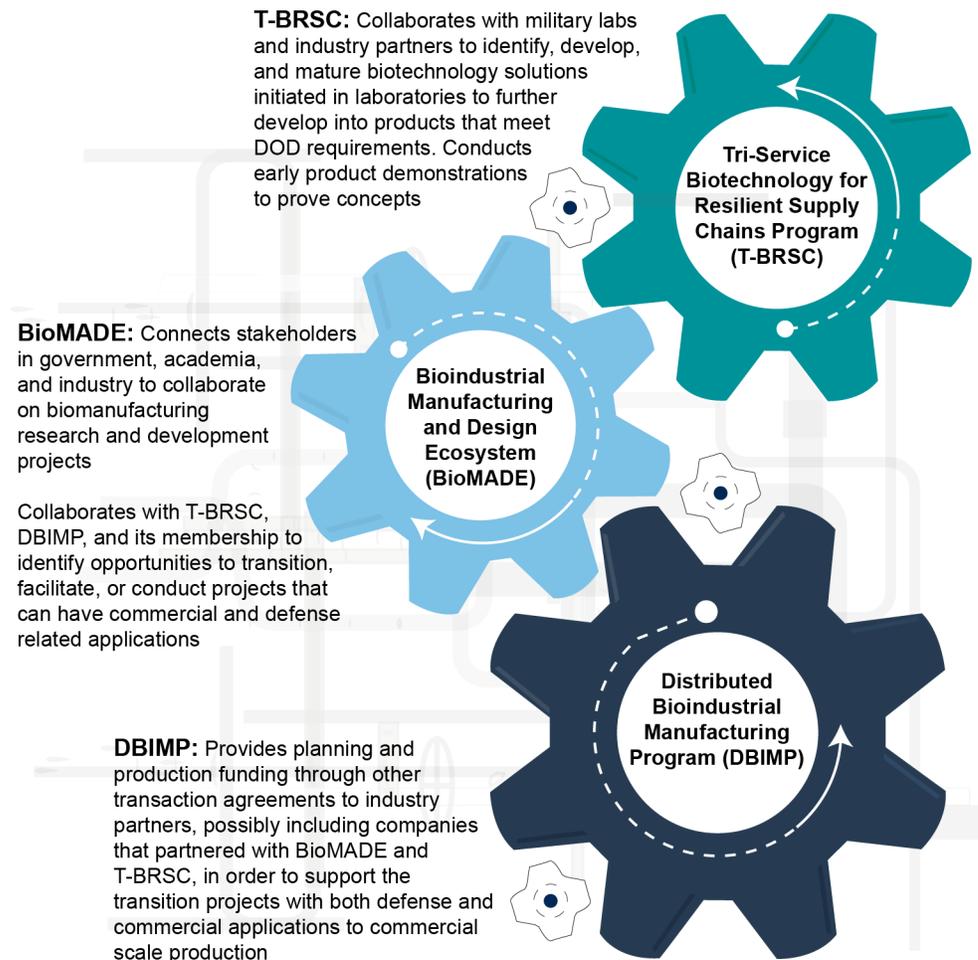
including the recipient’s ability to demonstrate that its product will be useful in both commercial and defense applications, the maturity of the product and its associated manufacturing processes, and the extent to which their product can best fulfill DOD's areas of need. DBIMP officials added that they intend to award their first production OTA in fiscal year 2026 and future awards will be contingent on funding, including DOD’s budget and commercial partner investments.

How are the initiatives intended to work together to accelerate the development of biomanufacturing supply chains?

DOD’s three biomanufacturing initiatives work together to accelerate biomanufacturing by providing support for projects at different stages of development. OUSD (R&E) officials told us that T-BRSC, BioMADE, and DBIMP were established to work in unison to accelerate the development of biomanufacturing supply chains. They noted that many biomanufacturing projects are supported by more than one of the initiatives throughout the projects’ development processes.

Figure 5 illustrates how the three biomanufacturing initiatives can have different roles in the development and expansion of domestic biomanufacturing to support U.S. defense.

Figure 5: Department of Defense (DOD) Biomanufacturing Initiatives’ Notional Roles in Expanding U.S. Defense Biomanufacturing Infrastructure



Source: GAO analysis of Department of Defense documents; GAO (illustration). | GAO-26-107797

What are DOD's plans to advance biomanufacturing after 2025?

DOD's plans to advance biomanufacturing after 2025 are pending until it lays them out in a congressionally mandated biotechnology roadmap.¹⁷ While DOD is committed to expanding biotechnology and domestic biomanufacturing, two of these initiatives are planned to sunset after 2027. Furthermore, it will be years before all the pilot and commercial-scale production facilities DOD is investing in will be built and operational. DOD's forthcoming roadmap will lay out DOD's future plans for biotechnology and biomanufacturing efforts.

- **T-BRSC:** DOD intends to end the T-BRSC program after 2027 but expects to continue leveraging and advancing its biomanufacturing projects. Congress appropriated nearly \$59 million in funding in fiscal year 2025. OUSD (R&E) officials confirmed that DOD currently has no plans to fund the program after its five-year term but stated that DOD plans to continue working with the three military services to advance the ongoing biotechnology projects already in place and utilize the infrastructure established under the T-BRSC effort. Officials added that T-BRSC is working closely with OUSD (R&E) to outline its next steps for further advancing its research projects into biomanufacturing programs that establish new domestic defense supply chains.
- **BioMADE:** The public-private partnership has announced it will build three pilot-plants and may build up to 2 more. BioMADE documents indicate that it plans to invest between \$20 million and \$132 million for each of the three announced pilot-plants. According to a senior BioMADE official, they may build one to two more plants. The pilot plants will be funded through a combination of federal funding, discussed earlier, with state and other non-federal support. Officials, however, expect it will take a year or more for these facilities to be operational. BioMADE is in the process of identifying locations and potential partners for future pilot plants.
- **DBIMP:** While DBIMP intends to award its first infrastructure OTA to support a commercial-scale production facility in 2026, it will be years before it or future facilities are operational. According to OUSD (R&E) officials, the program will end after fiscal year 2028. DBIMP officials noted that planning for additional production agreements is contingent on future funding. OUSD (R&E) officials stated that DOD is reevaluating DBIMP's structure to ensure that its biomanufacturing investments meet defense priorities, have clear paths to support the transition to DOD programs, and are the most cost-effective solutions.

OUSD (R&E) officials plan to complete a biotechnology roadmap by September 2026.¹⁸ Congress required DOD to include elements outlining DOD's general strategic investments priorities, goals, funding requirements, and milestones for its biotechnology efforts. We will continue to monitor DOD's progress on this effort.

While DOD is developing its biotechnology roadmap, the National Security Commission on Emerging Biotechnology's April 2025 report included some recommendations regarding DOD's biomanufacturing initiatives for Congress and DOD to consider.¹⁹ For example, the commission recommended that Congress continue to support and conduct oversight of BioMADE's projects, including the initiative's efforts to create a network of pilot-scale plants. The commission also recommended that Congress continue to provide support for DBIMP to develop commercial-scale biomanufacturing facilities across the country.

Agency Comments

We provided a draft of this report to DOD for review and comment in August 2025. DOD provided technical comments in February 2026, which we incorporated as appropriate.

How GAO Did This Study

To determine how DOD is investing in or leveraging biomanufacturing to strengthen the defense industrial base, we reviewed documents—including briefings, assessments, and roadmaps from DOD’s organizations that lead and support its biomanufacturing efforts. We also interviewed DOD officials from these organizations, including: the OUSD (R&E), Office of the Principal Director for Biotechnology; military service laboratories and research centers, such as the Air Force Research Laboratory; and the Defense Advanced Research Projects Agency. We also reviewed documents and interviewed research officials from the three recently established initiatives to boost the domestic biomanufacturing infrastructure: BioMADE, T-BRSC, and the Distributed Bioindustrial Manufacturing Program. From these documents we reviewed funding for each initiative from fiscal years 2021 through 2025, identified biotechnology projects that have been selected for investment, and reviewed how these efforts are intended to accelerate the development of biomanufacturing supply chains.

To determine to what extent and how DOD is prioritizing biomanufacturing investments to address risk in the defense supply chain, we reviewed documents from BioMADE, T-BRSC, and DBIMP related to program criteria and project selection assessment. We also reviewed documents provided by DOD that described all 163 biomanufacturing projects supported by the three initiatives. From these projects, we identified examples of biomanufacturing investments that illustrated how DOD intends to reduce supply chain risks. In addition, we conducted a site visit to the military biomanufacturing facility in Aberdeen, MD that was constructed with support from T-BRSC. We also interviewed officials from each initiative to determine how DOD is selecting projects for funding.

We conducted this performance audit from August 2024 to February 2026 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.

List of Addressees

The Honorable Roger Wicker
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Mitch McConnell
Chair
The Honorable Christopher Coons
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Mike Rogers
Chairman

The Honorable Adam Smith
Ranking Member
Committee on Armed Service
House of Representatives

The Honorable Ken Calvert
Chairman
The Honorable Betty McCollum
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

We are sending copies of this report to the appropriate congressional committees and the Secretary of Defense. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

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Endnotes

¹National Security Commission on Emerging Biotechnology, *Charting the Future of Biotechnology, An Action Plan for American Security and Prosperity* (April 2025).

²Office of the Assistant Secretary of Defense for Industrial Base Policy, *Fiscal Year 2021 Industrial Capabilities Report to Congress* (Washington, D.C.: March 2023) and DOD, *Department of Defense Biomanufacturing Strategy* (March 2023).

³Office of the Assistant Secretary of Defense for Industrial Base Policy, *Fiscal Year 2021 Industrial Capabilities Report to Congress* (March 2023).

⁴DOD, *Department of Defense Biomanufacturing Strategy* (March 2023).

⁵OUSD (R&E) established the T-BRSC program within the Department of the Army's Combat Capabilities Development Command. The T-BRSC program management office is composed of subject matter experts across the military department labs and additional programmatic and acquisition personnel from the Combat Capabilities Development Command.

⁶Details on the amount of these investments and projects are not publicly releasable.

⁷The military services have a number of laboratories and research centers that conduct biotechnology and biomanufacturing research, including the Army, Navy, and Air Force Research Laboratories, and the Army Combat Capabilities Development Command Soldier Center.

⁸For more information on critical materials and rare earths, see GAO, *Critical Materials: Action Needed to Implement Requirements that Reduce Supply Chain Risk*, [GAO-24-107176](#) (Washington, D.C.: Sept. 10, 2024).

⁹A full-year continuing resolution enacted on March 15, 2025, funded the federal government through the end of fiscal year 2025 (September 30, 2025). Full-Year Continuing Appropriations and Extensions Act, 2025, Pub. L. No. 119-4.

¹⁰DOD sponsors nine Manufacturing Innovation Institutes (MIIs). Each institute is a public-private partnership that focuses on a specific technology area, designed to overcome the challenges faced by American manufacturing innovators across a variety of technologies. BioMADE is one of two biotechnology-related MIIs, with BioMADE focusing on the use of biotechnology in manufacturing for non-medical applications and BioFabUSA focusing on the use of biotechnology in medical applications. For more information on MIIs, see our previous work: GAO, *Advanced Manufacturing: Aligning Strategies and Improving Agency Reviews Could Help Institutes Achieve National Goals*, [GAO-25-107369](#) (Washington, D.C.: June 4, 2025); *Advanced Manufacturing: Innovation Institutes Report Technology Progress and Members Report Satisfaction with Their Involvement*, [GAO-22-103979](#) (Washington, D.C.: December 16, 2021); *Advanced Manufacturing: Innovation Institutes Have Demonstrated Initial Accomplishments, but Challenges Remain in Measuring Performance and Ensuring Sustainability*, [GAO-19-409](#) (Washington, D.C.: May 23, 2019); and *Advanced Manufacturing: Commerce Could Strengthen Collaboration with Other Agencies on Innovation Institutes*, [GAO-17-320](#) (Washington, D.C.: Apr. 6, 2017).

¹¹This figure excludes \$51.6 million in T-BRSC funding for BioMADE biotechnology research projects.

¹²According to a senior BioMADE official, BioMADE projects conducted in collaboration with DOD are generally not announced to the public.

¹³The Minnesota Forward Fund program within Minnesota's Department of Employment and Economic Development provides resources that the state can leverage to increase business expansion and the attraction of projects in both new and existing industries. It also provides funding to match private or public funding to increase investment and opportunity in the state. According to BioMADE, the facility will feature two 25,000-liter industrial fermenters.

¹⁴OUSD (R&E) collaborates with the Office of the Under Secretary of Defense for Acquisition & Sustainment to provide funds through the Defense Industrial Base Consortium (DIBC) Other Transaction Agreement (OTA). OTAs are agreements other than procurement contracts, cooperative agreements, and grants, and are generally not subject to the Federal Acquisition Regulation. 10 U.S.C. §§ 4021, 4022. DOD can award OTAs directly to individual organizations or through a consortium, which is an association of organizations established to provide DOD with a pool of stakeholders to innovate in specific technology areas. DOD established the DIBC OTA with Advanced Technology International, which manages the consortium. Among other benefits, OTAs can help DOD attract companies and other organizations that have not previously done business with DOD. Members of the DIBC include companies of various sizes (including companies that traditionally do not work with DOD), research institutions, and academic institutions. In September 2022, we issued a report that included six recommendations to DOD related to its use of OTAs, including to develop a systematic approach to track OTA award dollars each consortium receives and to collect, document, and share with its contracting personnel information to consider when planning for consortia-based OTA awards. DOD agreed with all six recommendations. See GAO, *Other Transaction Agreements: DOD Can Improve Planning for Consortia Awards* [GAO-22-105357](#) (Washington, D.C.: Sept. 20, 2022).

¹⁵DOD can award follow-on production OTAs or contracts without using competitive procedures to the participants of a competitively awarded prototype OTA that successfully completed the prototype project. 10 U.S.C. § 4022(f). DBIMP's request for white papers involved a competitive process. Successful completion of the prototype project agreements awarded through the white paper process provide the basis for DBIMP's planned follow-on production agreements.

¹⁶These agreements were made through the DIBC OTA as project sub-agreements issued by Advanced Technology International.

¹⁷Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025, Pub. L. No. 118-159, § 242 (2024).

¹⁸Congress directed DOD to complete the biotechnology roadmap by the end of calendar year 2025. According to OUSD (R&E), the office has delayed delivery due to the dynamic nature of biotechnology and biomanufacturing over the last year as well as the government shutdown. Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025, Pub. L. No. 118-159, § 242 (2024).

¹⁹National Security Commission on Emerging Biotechnology, *Charting the Future of Biotechnology* (April 2025).