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EMERGING TECH RESEARCH

Vertical Snapshot: Defense Tech

VC trends, industry overview, and market landscape

2023

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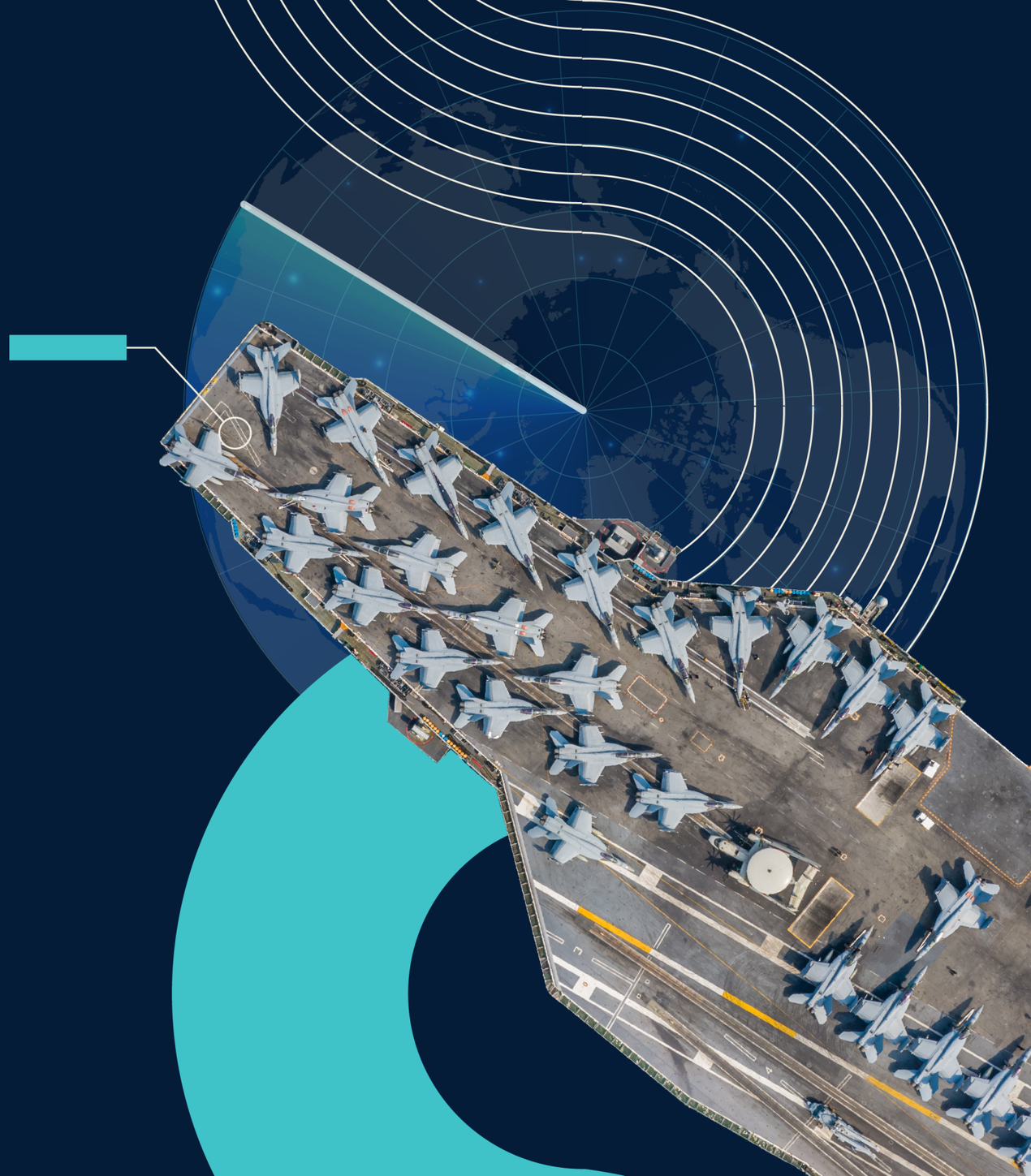

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Executive summary

Defense tech investment and acquisitions were robust from 2016 to 2022—$135.3 billion was invested, and 71.0% of VC exits were acquisitions. From 2016 to 2022, the defense tech sector experienced remarkable growth, with a total of $135.3 billion invested across 4,744 deals. During the same time frame, acquisitions accounted for 71% of defense tech VC exits, reflecting the sector's consolidation and the strategic value of these companies to larger industry players.

The top segments in defense tech are not necessarily about defense. Over the past 12 months, the top defense tech segments were renewable energy & generation ($3.9 billion), sensing, connectivity & security ($3.4 billion), and biotechnology ($3.2 billion). The inclusion of biotechnology and renewable energy segments at the top indicate that military priorities go beyond just aerospace and weaponry to include a full suite of technologies that form a broad definition of "national security."

Venture capital and government demand will drive rapid growth. Opportunities abound in the booming defense tech market, which is expected to surge to $184.7 billion by 2027, driven by the government's growing demand for innovative dual-use technologies to meet its national security goals. With a projected CAGR of 15.9%, this market presents a lucrative and dynamic landscape for investors and entrepreneurs alike.

Organizations are emerging to build a 21st century military-industrial complex. The defense tech industry is undergoing significant transformation as governments prioritize national security objectives and promote the adoption of commercial technologies for military use. The establishment of innovation hubs like the Defense Innovation Unit (DIU) and capital providers like the Office of Strategic Capital are meant to bridge the gap between the military, entrepreneurs, and investors. This shift encourages the development of critical technologies and attracts funding, fostering innovation and growth in the sector.

Geopolitical tensions are driving demand for advanced defense technologies. Escalating geopolitical tensions have led to increased demand for advanced defense technologies with global military expenditure rising 3.7% to $2.24 trillion in 2022. This surge in demand is benefiting traditional defense contractors and creating opportunities for technology companies and startups to innovate and compete in the growing defense tech market.

An influx of talent and emerging challenges are shaping the defense tech landscape. The increasing need for skilled talent in the defense tech sector is attracting professionals from various disciplines and driving industry growth and innovation. Emerging challenges, such as climate change, resource scarcity, and the rise of unconventional warfare tactics, are propelling the industry to seek innovative solutions that enhance resilience and sustainability.

Introduction

Geopolitical tensions are ballooning—literally—and with them, so too is the nature of warfare. As changing technologies such as artificial intelligence, autonomous weapons, and cyber warfare come to the fore, traditional military power based on mass and firepower is becoming less relevant. Instead, the future of warfare will be defined by technology, speed, agility, and innovation, and the country that can best leverage these will have a significant advantage.

However, the US and its allies are facing challenges in adapting quickly enough to these changing circumstances. According to Christian Brose's book, "The Kill Chain," the US military is falling behind potential adversaries such as China and Russia in key areas such as artificial intelligence and cyber warfare. Brose argues that the military's bureaucratic structure and slow decision-making processes are hindering its ability to innovate, and it needs to adopt a new approach to defense that is more focused on innovation, agility, and collaboration with the private sector.

This is where the defense tech industry comes in. VCs are increasingly investing in companies that are developing innovative technologies to help the US military keep pace with emerging threats. In this vertical snapshot, we will explore the current state of VC investment in the defense tech industry, identify trends and patterns in investment activity, and examine the implications of these trends. By analyzing the latest data and insights, we aim to provide a comprehensive overview of this rapidly evolving market and help investors, entrepreneurs, and policymakers make informed decisions about the future of defense.

Defense innovation ecosystem

Previously, the focus of technology provision for the Department of Defense (DoD) was strictly on specific military hardware elements such as components for the F16 or Bradley Tank. However, the DoD and US national security network are quickly adopting advancements in dual-use technologies that stem from outside the conventional defense industry. With an annual budget of over $300 billion for research, development, testing, evaluation, and procurement, the DoD is allocating a significant portion of these funds toward innovative tech solutions in fields such as artificial intelligence, autonomous systems, additive manufacturing, life sciences, and cybersecurity.

Moreover, the department is not merely upgrading its weapons platforms. It is also heavily investing in enhancing business procedures, mirroring the efforts typically seen in large-scale private industries. For instance, funds are being channeled into using cutting-edge analytics for predictive maintenance of vehicles and providing better understanding of supply chain vulnerabilities through vendor insights. The DoD is also employing new tech to boost intelligence and kinetic capabilities, such as utilizing satellite imagery and software packages for improved spatial awareness, or deploying small drones for intelligence gathering in hazardous environments where troops would be at risk otherwise. With the DoD and national security marketplace set for sustained growth, this transformation presents a remarkable opportunity for investors and entrepreneurs. Despite some procedural hurdles, which are discussed in further detail later in the report, the potential for growth in this sector is anticipated to expand further.

The defense tech market presents unique challenges for startups, especially when navigating the government acquisition process. Analyzing the factors that deter startups from successfully entering the market requires a closer look at the Planning, Programming, Budgeting, and Execution (PPBE) model, the consolidation of the defense industry, the “valley of death,” and the government’s resistance to change. In response to these challenges, the US government has implemented initiatives to better support startups in the defense tech market.

DoD innovation organizations

There are a multitude of organizations and initiatives focused on promoting innovation in the defense industry, such as the Defense Advanced Research Projects Agency (DARPA) and the Defense Innovation Unit (DIU). These organizations offer additional opportunities for small businesses and other innovators to participate in defense-related research and development projects. The DIU aims to accelerate the adoption of commercial technologies within the DoD by connecting innovative startups with government partners. The DIU offers Other Transaction Authority (OTA) agreements, which are flexible contracting mechanisms that allow the government to rapidly acquire and prototype emerging technologies. OTAs bypass many of the traditional procurement regulations, reducing bureaucratic obstacles and accelerating the development acquisition process. Additionally, AFWERX, a US Air Force innovation program, utilizes strategic financing (STRATFI) as a funding mechanism to help startups overcome the valley of death and bring their technologies to market. These initiatives signify a move toward addressing the barriers that hinder startups in the defense tech market, with the goal of fostering a more innovative and competitive industry landscape.

To provide a broader view of the defense innovation ecosystem, the charts included below outline various government funding mechanisms and organizations involved in promoting innovation and supporting startups in the defense tech sector. By understanding the roles and objectives of these institutions, startups can better navigate the complex landscape of government acquisition and identify potential partnerships and funding opportunities that can help them succeed in the market.

Defense innovation organizations

DEFENSE INNOVATION UNIT

The DIU works with organizations across the DoD to quickly prototype and field advanced commercial solutions that address national security challenges. They aim to move from problem identification to prototype contract award in 60 days to 90 days and prototype projects typically run from 12 months to 24 months, with successful prototypes leading to noncompetitive follow-on production, OTAs, or FAR-based contracts.

VC funding stage equivalent:
Late-stage VC

NSIC NATIONAL SECURITY INNOVATION CAPITAL

The National Security Innovation Capital (NSIC) is a DoD initiative that supports hardware technology startups in the early stages of development or preproduction (at least from proof of concept to technology readiness level three or higher) that have both commercial and defense applications. NSIC helps address the lack of private investment from trusted sources by awarding OTAs to accelerate productization efforts. It is distinct from its sister organization, the National Security Innovation Network, and the core DIU, and reports to the DIU leadership.

VC funding stage equivalent:
Seed, late-stage VC

iqt IN-Q-TEL™

In-Q-Tel (IQT) invests in VC-backed startups and partners with intelligence and defense communities to identify "ready-soon" technology that can be modified, tested, and delivered for use within six months to 36 months. The investments typically range from $500,000 to $3 million, and if successful, government customers can buy the product directly from the company. IQT works closely with portfolio companies to ensure rapid product development and valuable product enhancements, focusing on both their commercial potential and impact on national security.

VC funding stage equivalent:
Seed, early-stage VC, late-stage VC

AFWERX

AFWERX is a US Air Force program that serves as a catalyst for the Air Force's engagement across industry, academia, and nontraditional contributors. AFWERX facilitates partnerships with startups and venture capitalists to foster innovation and rapidly develop technologies that address the evolving needs of the Air Force.

VC funding stage equivalent:
Late-stage VC

Source: MITRE

Defense tech innovation organizations, continued

DARPA collaborates with academia, industry, and government partners to cultivate new military technologies. DARPA's innovation ecosystem includes an the SBIR and STTR programs that provide opportunities for small, high-tech businesses and academic institutions, with the goal of supporting DARPA's overall strategy to bridge the gap between fundamental discoveries and new military capabilities. DARPA often awards prototype OTA awards under its broad agency announcements, enabling noncompetitive follow-on production activities to successful prototype OTAs.

VC funding stage equivalent:
Seed, early-stage VC

The Innovation for Defence Excellence and Security (IDEaS) program is a Canadian government initiative that supports defense and security innovation by providing funding opportunities for small and medium-size enterprises, academia, and other organizations to develop innovative solutions to current and future defense and security challenges. The program encourages collaboration between industry, academia, and government to foster technological advancements that enhance Canada's defense and security capabilities.

VC funding stage equivalent:
Seed, early-stage VC, late-stage VC

The UK's Defence Innovation Fund is a government initiative that supports cutting-edge research and development in defense and security by providing funding for innovative projects that address the country's strategic needs. The fund encourages collaboration between industry, academia, and government to accelerate the development of new technologies and capabilities that enhance the UK's national security.

VC funding stage equivalent:
Seed, early-stage VC, late-stage VC

The Defence Innovation Hub is an Australian government initiative that aims to support innovation and technology development in the defense sector by providing funding opportunities for small and medium-size enterprises, academia, and other organizations. The Hub facilitates collaboration between defense industry players and innovators to bring innovative capabilities to the Australian Defence Force.

VC funding stage equivalent:
Late-stage VC

Source: MITRE

A variety of funding options

US programs for funding small businesses overview

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are designed to stimulate technological innovation in the US by providing funding to small businesses for research and development.[1] The programs are divided into three phases, each with a different contract type and purpose.

	Phase I	Phase II	Phase III
Contract type	Feasibility study/proof of concept	Full research/research & development	Commercialization
Purpose	To establish the technical merit, feasibility, and commercial potential of the proposed research and development efforts.	To further develop the technology based on the results of Phase I, addressing the key technical and commercialization challenges.	To transition the technology into a viable commercial product or service. No direct SBIR/STTR funds are awarded in this phase, instead agencies may enter into Phase III contracts, grants, or agreements with Phase I or Phase II awardees.
Funding range	SBIR: up to $150,000 STTR: up to $225,000	SBIR: up to $1 million STTR: up to $1.5 million	Variable, depending on granting agency
Duration	SBIR: six months STTR: one year	SBIR and STTR: two years	Variable, depending on commercialization strategy and market demands

Sources: PitchBook, DAU

1: "Small Business Innovation Research and Small Business Technology Transfer Programs (15 USC §638)," Defense Acquisition University, n.d., accessed May 10, 2023.

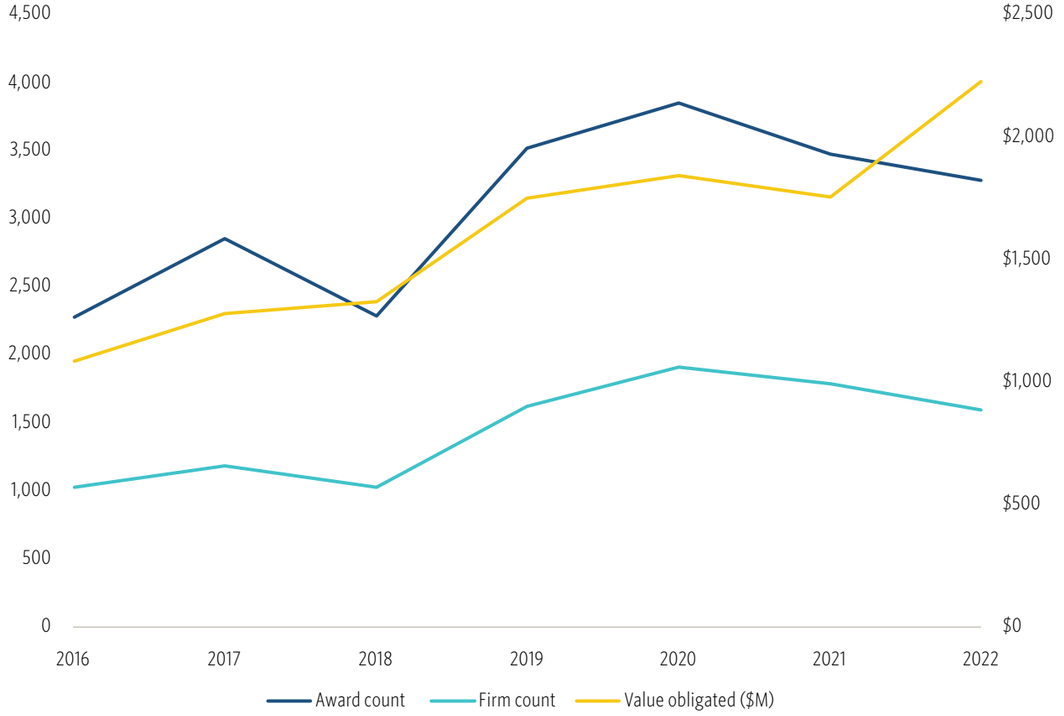
The SBIR and STTR programs have faced several criticisms, including limited access to funding, narrow small business eligibility criteria, concerns about the lack of success in commercializing technologies, administrative burden associated with the application process, and concentration of funding to a small number of firms.[2] Despite these criticisms, proponents of the programs argue that they have still played an important role in supporting small businesses in the development of innovative technologies.[3]

In addition to SBIR and STTR, the US Air Force oversees the Strategic Funding Increase (STRATFI) and Tactical Funding Increase (TACFI) programs for Phase II awardees.[4] These programs provide funding to support small businesses developing technology that has the potential for commercialization and significant impact in the defense and civilian agency sectors, respectively. The funding amounts and durations for STRATFI and TACFI vary based on individual projects.

Other transaction authorities

OTAs are flexible agreements used for research, prototype development, and production purposes with nontraditional defense contractors.[5] Unlike traditional contracts, OTAs are not subject to the Federal Acquisition Regulations (FAR) and offer greater flexibility in terms of procurement processes, intellectual property rights, and other terms and conditions. The funding amounts and durations for OTAs vary based on individual projects.

SBIR & STTR DoD awards*



Sources: PitchBook, SBIR.gov • Geography: US • *As of April 28, 2023

2: "Emerging Tech Is Transforming War in Real-Time, Yet the Biggest DOD Incubator Is Stuck in the Past," Substack, Ben Van Roo, May 4, 2022.
3: "The Fate of the SBIR Program Hangs in the Balance of the Next Month," Federal News Network, Jason Miller, August 30, 2022.
4: "Frequently Asked Questions (FAQs)," AFWERX, n.d., accessed May 10, 2023.
5: "Department of Defense Other Transaction Authority Trends," Center for Strategic and International Studies, Rhys McCormick, December 2020.

The Office of Strategic Capital

The Office of Strategic Capital (OSC) is a new division within the DoD, established to incentivize private capital investment in areas typically overlooked and align private investment with national security priorities.[6] The OSC focuses on bridging gaps in early-stage and supplier-facing technologies, particularly hardware, which is more expensive and challenging compared with software.

In collaboration with the US Small Business Administration, the OSC is launching the Small Business Investment Company (SBIC) Critical Technology Initiative. This initiative aims to support the licensing of purpose-built critical technology funds, targeting early-stage component technologies like batteries. Licensed SBICs are required to raise capital from private investors, and they receive an additional two dollars of government-guaranteed debt for every one dollar of private capital raised. After meeting this criterion, they become eligible for matching funds at a ratio of 3-to-1 from the OSC, reducing the portfolio's cost of capital and increasing returns for investors.

Additionally, the OSC plans to introduce the Transition Acceleration Program, designed to facilitate contracts between DoD research, development, testing, and evaluation (RDT&E) funds and private capital for larger investments in critical technology. This program emphasizes cost-sharing with private capital providers for early-stage products that possess actual capabilities. The OSC's approach extends beyond merely maturing technology; it encompasses understanding the value chain of these technologies. Traditional acquisition processes fall short when it comes to investing in technologies not yet available for purchase.

By partnering with external organizations and launching various programs, the OSC aims to stimulate investment in essential technologies, potentially reshaping the defense tech industry landscape. Therefore, monitoring the OSC's progress is crucial for market research purposes, as its efforts may have significant implications for the industry.

Challenges

The defense industry is concentrated, which exacerbates the challenges faced by startups. Over the past decades, the number of major defense contractors has significantly decreased, resulting in an oligopoly that dominates the market. This situation stifles innovation, as reduced competition allows established players to maintain their market position without the need for significant technological advancements. Highly specific procurement requirements issued by the government deters prime contractors from developing novel technologies for the platforms they build. Moreover, these contractors often have entrenched relationships with government officials and a deep understanding of the acquisition process, putting startups at a disadvantage when competing for contracts.

The multiple valleys of death is another critical barrier for startups in the defense tech market. This term refers to the funding gap between the early stages of a project's development, when research grants are typically available, and the later stages, when the project requires substantial financial support to transition to market-ready solutions. Startups often struggle to secure the necessary funding during this phase, hindering their ability to bring innovative technologies to fruition.

6: "Office of Strategic Capital: Attracting and Scaling Private Capital in Support of National Security," Center for Strategic & International Studies, March 17, 2023.

Furthermore, the government's resistance to change presents an additional obstacle for startups. The defense sector is inherently risk-averse, and government officials are often reluctant to adopt unproven technologies or approaches. This mindset can limit opportunities for startups to demonstrate the value of their innovations and gain traction in the market. Of course, the Department of Defense has goals beyond creating a favorable environment for startups—yet delivering superior technology to the warfighter in the most efficient way possible should clearly be in the government's interest. One such barrier to efficient technology deliverance is the government's PPBE model.

The PPBE process model is a resource allocation system within the Department of Defense that consists of four distinct phases: planning, which assesses the strategic landscape and identifies priorities; programming, which aligns resources with priorities and develops plans; budgeting, which translates the programs into budgetary terms; and execution, which monitors the use of allocated funds. Although this process aims to ensure efficient resource allocation, it has several shortcomings that adversely affect startups. The PPBE model's slow and bureaucratic nature makes it difficult for startups to secure funding in a timely manner. Moreover, its long timelines can hinder startups from adapting to rapidly evolving technological advancements, ultimately reducing their competitiveness in the market.

With these challenges in mind, it is also clear that the broader issue at hand is not just about nurturing startups or creating a more streamlined acquisition model, but also about maintaining a dominant economic and technological position. Economic security is national security, as the nature of a country's economic health is intertwined with its ability to safeguard its interests through technological prowess. Fostering an environment that encourages innovation and rapid technological adaptation can ensure continued leadership in setting global technological standards. Now, considering the symbiotic relationship between economic stability, technological leadership, and national security, it is important to examine some of the practical implications for startups seeking to navigate the defense tech market.

Go-to-market strategies for startups

The defense tech market presents unique challenges and opportunities for startups looking to enter the space. A key consideration is the long federal sales motion, usually taking 18 months to 24 months, that often involves a multi-year commitment and significant investment. Companies may need to decide whether to go all-in on defense first, or if they should build a notable commercial product before pivoting to defense. This decision is crucial, as it affects not only the company's market entry strategy but also the resources and expertise needed to succeed in this complex industry. For example, drone company Skydio developed and iterated upon a hobbyist drone for five years to accumulate runway and experience before specifically targeting the defense tech market.[7]

A successful go-to-market strategy in the defense tech sector requires a deep understanding of the federal sales process and commitment from the entire organization. This involves recruiting experienced personnel; investing in a fully integrated team of sales, marketing, and product development resources; and maintaining a balance between urgency and patience.[8] Additionally, companies must focus their efforts on specific agencies and markets to avoid spreading resources too thin. Establishing connections within the defense industry is also crucial—startups are often advised to support prime contractors as a supplier or subcontractor.

7: "Defense Innovation & Venture Capital: Skydio a Case Study," RealClearDefense, Andy Yakulis, March 3, 2023.
8: "So, You Want to Sell Into Federal?" Insight Partners, April 30, 2019.

Defense tech timeline

Government policies, initiatives, and business programs

Private sector and the military-industrial complex

Geopolitical events

October 1957

The Soviet Union launches Sputnik 1, spurring the United States to invest heavily in space and missile defense technology.

February 1958

Formed in response to the Soviet Union's launch of Sputnik 1, DARPA is founded as an agency of the US DoD that is responsible for the development of emerging technologies for use by the military.

August 1961

US Secretary of Defense Robert McNamara introduces the PPBE process to the DoD. The PPBE system is designed to improve decision-making, resource allocation, and management efficiency within the defense establishment. This innovative approach to defense acquisition and resource management seeks to align military strategy, program planning, and budgeting, while emphasizing the integration of analysis and evaluation in defense decision-making.

July 1958

The SBIC program is established by the US Congress as part of the Small Business Investment Act to promote the growth of small businesses by providing access to financial support and private equity capital. SBICs are privately owned and managed investment funds, licensed and regulated by the US Small Business Administration (SBA), which invests in small businesses with the potential for growth and job creation.

March 1983

US President Ronald Reagan announces the Strategic Defense Initiative (SDI), a missile defense system intended to protect the United States from a potential nuclear attack.

November 1969

The US Advanced Research Projects Agency Network (ARPANET) is created. The project, funded by the US DoD, lays the foundation for the modern internet.

August 1990 - February 1991

The US enters the Gulf War, showcasing the effectiveness of advanced defense technologies such as stealth aircraft, precision-guided munitions, and satellite-based communications.

September 2001

Terrorists attack the World Trade Center in New York City, which results in a renewed focus on counterterrorism and defense technology investments among the Five Eyes countries: the US, the UK, Canada, New Zealand, and Australia.

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June 2003

Palantir Technologies, a software company specializing in data analysis and integration for defense, intelligence, and security applications, is founded with initial backing from In-Q-Tel, the venture capital arm of the US Central Intelligence Agency (CIA).

March 2004

The first DARPA Grand Challenge is announced—a driverless vehicle competition organized by DARPA aimed at fostering the development of autonomous ground vehicles for military applications and advancing the state of robotics and artificial intelligence research.

December 2009

The UK's Defence Cyber Security Programme is created. It is aimed at enhancing the country's cyber defense capabilities.

May 2010

The United States Cyber Command (USCYBERCOM) is established. The unified combatant command is responsible for centralizing cyberspace operations, strengthening the military's cybersecurity, and ensuring the protection of US critical infrastructure from cyber threats.

January 2014

China successfully tests a hypersonic glide vehicle, the WU-14, raising concerns about the country's development of advanced defense capabilities.[9]

February 2014 to March 2014

Russia annexes Crimea, a major geopolitical event involving the seizure and subsequent incorporation of the Crimean Peninsula by the Russian Federation, leading to increased tensions between Russia and Western countries and influencing global defense strategies and investments.

August 2014

The US Navy announces the successful test of its first laser weapon system (LaWS), demonstrating the potential of directed energy technology in defense applications.

February 2015

The Royal Australian Air Force establishes Plan Jericho, an initiative to modernize and integrate its defense capabilities with advanced technologies.[10]

August 2015

The US DIU is launched with the aim of accelerating the adoption of commercial technology for national defense purposes.

June 2016

Palantir Technologies files a lawsuit against the US Army, alleging that the Army's procurement process for its Distributed Common Ground System (DCGS-A) was biased and unfairly favored traditional defense contractors over commercial technology companies.[11] The lawsuit underscores the challenges faced by innovative technology companies in entering the defense market and the need to modernize the military procurement processes.

9: "China Confirms Hypersonic Missile Carrier Test," Reuters, Sui-Lee Wee and Phil Stewart, January 15, 2014.
10: "Plan Jericho: RAAF 10-Year Transformation Plan Launched by Air Marshal Geoff Brown," news.com.au, February 23, 2015.
11: "Palantir Takes Fight With Army to Federal Court," Defense News, Jen Judson, July 1, 2016.

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July 2016

The Permanent Court of Arbitration in The Hague rules against China's territorial claims in the South China Sea in a case brought by the Philippines. Despite the ruling, China continues to assert its claims and expands its presence in the disputed waters, building artificial islands and militarizing them with naval, air, and missile defense facilities. This ongoing situation highlights China's growing military capabilities and its willingness to assert its interests in the region, contributing to increasing tensions and potential conflicts with neighboring countries and their allies, including the US.

August 2016

DARPA launches the Cyber Grand Challenge, a competition to develop autonomous cybersecurity systems, emphasizing the importance of advanced computing and software in the defense sector.

April 2017

The US DoD launches Project Maven, an initiative focused on leveraging artificial intelligence and machine learning technologies to analyze drone and satellite imagery, improving situational awareness and decision-making on the battlefield.

2017

June 2017

The founding of Anduril Industries, a US technology company focused on developing advanced defense technologies, such as autonomous systems, artificial intelligence, and sensor networks, to provide innovative solutions for national security and military applications.

September 2017

Google becomes involved in Project Maven, providing its artificial intelligence and machine learning expertise to assist the US DoD in analyzing drone and satellite imagery.

July 2017

The Chinese government releases its "New Generation Artificial Intelligence Development Plan," a comprehensive strategy outlining the country's ambition to become a global leader in artificial intelligence by 2030. The plan emphasizes the importance of AI in various sectors, including defense, and underscores China's commitment to investing in cutting-edge technologies to enhance its military capabilities and global influence.

September 2017

Russian President Vladimir Putin asserts that AI will play a crucial role in global power dynamics, stating, "Whoever becomes the leader in [AI] will become the ruler of the world."[12] This statement highlights the increasing importance of AI in shaping national defense strategies and geopolitical competition.

12: "Putin Says the Nation That Leads in AI 'Will Be the Ruler of the World,'" The Verge, James Vincent, September 4, 2017.

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June 2018

Google announces its decision not to renew the contract for Project Maven with the US DoD, following internal and external controversy, employee protests, and resignations over the use of Google's artificial intelligence technology in military applications.

March 2019

Palantir Technologies is awarded a contract by the US Army for its Distributed Common Ground System (DCGS-A), following the resolution of the lawsuit filed by the company in 2016.[14] The contract marks a significant milestone in Palantir's efforts to provide its data integration and analysis software to the US military and demonstrates the potential for commercial technology companies to play a key role in the defense sector.

December 2019

Russia announces the deployment of its Avangard hypersonic glide vehicle, underscoring the growing importance of hypersonic technology in global defense.[16]

December 2019

The US Space Force is officially established, highlighting the increasing significance of space technology in defense strategy.

2018

2019

2020

October 2017

China introduces the "military-civil fusion" strategy, an initiative championed by President Xi Jinping, which aims to integrate civilian and military technologies to rapidly advance the nation's defense capabilities.[13] The strategy underscores the value of capitalizing on commercial innovations and breakthroughs in areas such as artificial intelligence, autonomous systems, and cyber capabilities in order to bolster China's defense capacity and maintain strategic competitiveness on the global stage.

December 2018

US President Donald Trump signs the National Quantum Initiative Act, a law aimed at accelerating the development of quantum information science (QIS) and technology in the US. The act allocates over $1.2 billion over five years for quantum research, development, and education, emphasizing the importance of quantum computing in maintaining the nation's competitive edge in technology and defense.

October 2019

Google announces a significant milestone in quantum computing, claiming "quantum supremacy" with its 53-quantum-bit quantum computer called Sycamore.[15] The computer successfully performs a complex computational task in just 200 seconds. The same task would take a classical supercomputer approximately 10,000 years to complete. This breakthrough highlights the potential of quantum computing to revolutionize various industries, including defense, by solving complex problems and enhancing encryption and cybersecurity capabilities.

13: "China's Shift From Civil-Military Integration to Military-Civil Fusion," Asia Policy, Richard A. Blitzinger, January 2021.
14: "Palantir — Who Successfully Sued the Army — Has Won a Major Army Contract," Defense News, Jen Judson, March 29, 2019.
15: "Quantum Supremacy Using a Programmable Superconducting Processor," Nature, Frank Arute, et al., October 23, 2019.
16: "Russia Deploys Avangard Hypersonic Missile System," BBC, December 27, 2019.

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December 2020

Researchers at the University of Science and Technology of China announce a major breakthrough in quantum computing, claiming "quantum supremacy" with their photonic quantum computer called Jiuzhang.[17] The computer performs a specific calculation in just over three minutes, a task that would take a classical supercomputer an estimated 2.5 billion years to complete. This achievement underscores China's progress in the field of quantum computing and its potential implications for defense, encryption, and cybersecurity.

September 2021

The US, the UK, and Australia announce the formation of the AUKUS alliance, focusing on cooperation in areas like artificial intelligence, quantum technologies, and undersea capabilities.

February 2022

Russia invades Ukraine, but contrary to intelligence estimates, Ukrainian forces manage to prevent significant Russian advancements, leading to an effective stalemate in the eastern provinces. Ukraine leverages cutting-edge technology from defense startups such as Anduril and Starlink, showcasing the impact of innovative defense solutions in modern warfare and their potential to alter the course of conflicts.

December 2022

The Secretary of Defense announces the establishment of the Office of Strategic Capital, which aims to foster and execute collaborative capital initiatives that can attract and expand private investment into critical technologies.[18]

2021 2022 2023 2024

October 2021

Palantir Technologies and Raytheon Intelligence & Space announce a strategic partnership to develop TITAN, an advanced ground system that fuses data from multiple sources, including satellite imagery and signals intelligence, to provide near-real-time insights for US military commanders. This collaboration highlights the growing synergy between traditional defense contractors and innovative technology companies, as well as the increasing importance of data analytics and its integration in modern warfare.

August 2022

President Joe Biden signs the CHIPS and Science Act into law, allocating $280 billion to strengthen domestic semiconductor research and manufacturing in the US during a global shortage. The act invests $10 billion in regional innovation and technology hubs, promoting collaboration between governments, industry, and academia. Additionally, it establishes a technology-focused directorate at the National Science Foundation (NSF), concentrating on fields such as semiconductors, advanced computing, advanced communications technology, advanced energy technologies, quantum information technologies, and biotechnology.

April 2023

The Secretary of Defense appoints Apple Vice President Doug Beck as the new director of the DIU. Beck's appointment also coincides with a departmental reshuffling, resulting in the Director of the DIU reporting directly to the Secretary of Defense.[19]

17: "The New Light-Based Quantum Computer Jiuzhang Has Achieved Quantum Supremacy," Science News, Emily Conover, December 3, 2020.
18: "Secretary of Defense Establishes Office of Strategic Capital," United States Department of Defense, December 1, 2022.
19: "Secretary of Defense Lloyd J. Austin III Announces New Director of the Defense Innovation Unit," United States Department of Defense, April 4, 2023.

Industry drivers

The defense tech industry is undergoing a significant transformation as government acquisition processes and policy incentives align to prioritize national security objectives and promote the adoption of commercial technologies for military use. This strategic shift, marked by the establishment of the DIU and AFWERX, along with policy incentives like the CHIPS Act, encourages the development of critical technologies and attracts funding. By leveraging commercial off-the-shelf (COTS) products, defense agencies can reduce development costs and expedite innovation, resulting in a more diverse and dynamic industry landscape. This approach also fosters a broader intellectual shift, emphasizing the need for the market to serve national security objectives and inspiring technology companies and startups to develop dual-use applications catering to both commercial and military markets.[20] Consequently, the defense tech market is witnessing an influx of new players and innovative solutions, driving growth and diversification within the sector.

Escalating geopolitical tensions have led to an increased demand for advanced defense technologies. In 2022, global military expenditure increased by 3.7% to $2.24 trillion, driven by the top three spenders—the US, China, and Russia—accounting for 56% of the world total.[21] As nations vie for strategic dominance and security, governments are allocating more resources to the defense tech industry. Several global flashpoints, such as territorial disputes in the South China Sea, ongoing conflicts in the Middle East, and the 13% rise in Europe's military spending,[22] largely influenced by the Russia-Ukraine war, are driving defense expenditure. This results in more advanced weapons systems and technologies being developed. This surge in demand is not only benefiting traditional defense contractors, but is also creating opportunities for technology companies and startups to innovate and compete for a share of the growing defense tech market.

The increasing need for skilled talent in the defense tech sector attracts professionals from various disciplines, such as computer science, engineering, and data science. A recent Morning Consult analysis found that over one-third of industry workers are more likely to work on military projects compared with a year ago, as the tech sector faces mounting layoffs.[23] This influx of talent contributes to industry growth and innovation, as companies gain access to a broader pool of expertise. Of the 441 US tech workers surveyed by Morning Consult, 34% said they are more likely to apply their skills to military projects, and 48% support their employer considering defense contracts involving battlefield technologies. As the demand for skilled professionals in the defense tech sector grows, companies may invest in training and development programs to cultivate a highly skilled workforce capable of driving innovation and maintaining a competitive edge in the industry.

Navigating the ever-evolving landscape of emerging threats and avoiding reliance on technologies that won the last war are driving the demand for advanced defense solutions. The defense tech market is fueled by groundbreaking innovations, such as energy weapons and swarming drones, as well as the growing prominence of unconventional warfare tactics employed by nonstate actors. The proliferation of mass-market, inexpensive drones, such as "Costco drones" costing as little as $1,000, presents new challenges, as current capabilities to counter them often incur significant costs to defense systems.[24] To maintain military capabilities and counter these evolving challenges, countries are compelled to invest in cutting-edge solutions that go beyond traditional warfare technologies. This dynamic landscape drives growth and innovation in the defense tech market as governments and industry players collaborate to enhance security and maintain a technological edge in an increasingly complex strategic environment.

20: "Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution," The White House, Jake Sullivan, April 23, 2023.
21: "World Military Expenditure Reaches New Record High as European Spending Surges," Stockholm International Peace Research Institute, April 24, 2023.
22: Ibid.
23: "Tech Workers Take Another Look at Defense in Light of Layoffs," Morning Consult, Sonnet Frisbie and Jordan Marlatt, March 17, 2023.
24: "Low-Cost Warfare: US Military Battles With 'Costco Drones,'" The Financial Times, Katrina Manson, January 4, 2022.

Remarkable breakthroughs in artificial intelligence, quantum computing, robotics, and biotechnology are unlocking cutting-edge applications for defense and security. As these technologies rapidly evolve, the defense tech industry has witnessed a surge in innovation and market growth. The development of AI models has become increasingly cost-effective, machine learning is now revolutionizing drug discovery, and advancements in robotics enhance the capabilities of autonomous systems. Integrating these groundbreaking technologies into defense systems and platforms is anticipated to boost capabilities and operational efficiency, making them highly appealing to governments seeking a technological edge in national security.

Rapid advancements in space technology and growing geopolitical competition are propelling the defense industry beyond the stratosphere. The booming commercial space industry has experienced significant growth in recent years, with the democratization of access to space due to lower launch costs, smaller and cheaper satellite components, and the rise of private space companies. Companies like SpaceX and Rocket Lab have created a competitive market, reducing the price of rides to space. For instance, SpaceX's Falcon 9 rocket currently costs around $67 million per launch, or about $1,200 per pound of payload, compared with NASA's space shuttles, which cost an average of $1.6 billion per flight or nearly $30,000 per pound of payload (in 2021 dollars).[25] As the US, China, and other nations vie for orbital dominance, governments are channeling significant investments into space security, fostering commercial partnerships to develop advanced satellite technologies, surveillance systems, and anti-satellite weapons. The establishment of the US Space Force and China's rapid growth in the commercial space sector, which is forecasted to make them a global competitor by 2030,[26] highlight the urgency to maintain a competitive edge in this fast-paced strategic landscape.

25: "To Cheaply Go: How Falling Launch Costs Fueled a Thriving Economy in Orbit," NBC News, Denise Chow, April 8, 2022.
26: "Annual Threat Assessment of the U.S. Intelligence Community," Office of the Director of National Intelligence, February 6, 2023.

Cyber warfare is now the norm—the public and private sector will need the tools to fight. The increasing prevalence of cyberattacks, such as the SolarWinds hack, espionage, and cyber warfare has underscored the urgent need for robust cybersecurity solutions. State-sponsored cyber threats have become more sophisticated, posing significant risks to national security. In response, governments and private enterprises are investing heavily in advanced cybersecurity technologies and systems, such as the DoD's embrace of zero-trust architecture, to protect its critical infrastructure and sensitive information. The DoD has reserved $20 million for small businesses and academic institutions to comply with its cybersecurity model—just one example of the plethora of opportunity that exists for companies providing innovative cybersecurity solutions.[27]

Emerging challenges posed by climate change and resource scarcity are propelling the defense tech industry to seek innovative solutions that enhance resilience and sustainability. Governments and defense agencies are investing heavily in renewable energy sources, advanced materials, and other technologies to mitigate these risks. The global demand for rare earth elements, crucial for numerous advanced technologies, underlines the significance of resource security. With China controlling 60% of production and 85% of processing capacity, the need for diversification becomes more apparent.[28] Meanwhile, the DoD, as one of the world's largest energy consumers, is working toward a carbon-free status by 2035.[29] This commitment to addressing environmental and resource challenges is driving growth, innovation, and competition in the market, making it an increasingly attractive sector for governments focused on maintaining a technological edge in national security.

27: "Money Flows for Technology, Cybersecurity in New Defense Department Budget," Federal News Network, Alexandra Lohr, December 22, 2022.
28: "Could Africa Replace China as the World's Source of Rare Earth Elements?" The Brookings Institution, Gracelin Baskaran, December 29, 2022.
29: "DoD Solicits Carbon Pollution-Free Electricity," United States Department of Defense, December 16, 2022.

Outlook

The future of the defense tech industry is inextricably linked to the changing geopolitical landscape and a multitude of factors that impact its growth and direction. One such factor is increased defense spending, which has the potential to drive investments and collaborations between traditional defense contractors, tech firms, and startups. Such collaborations could accelerate the development of advanced defense technologies, especially in cybersecurity and AI-driven sectors. Furthermore, emerging markets such as quantum computing and human-machine interfaces could foster innovation and competition, challenging established industry players.

Recent policy initiatives like the CHIPS Act and the broader intellectual shift toward "friendshoring" and onshoring could increase manufacturing knowledge among the defense industrial base—serving as a wellspring for innovation and optimization. The need to hedge against supply chain risk will drive startups to develop ingenious solutions to problems brought about by resource scarcity.

Innovation in artificial intelligence, quantum computing, and advanced materials has the potential to transform the defense tech industry. Breakthroughs in these areas could enable new defense applications, contributing to growth across various market segments. For example, AI could revolutionize autonomous systems, while advanced materials may facilitate the development of next-generation armor and weaponry. The rush to capitalize on these developments could stimulate rapid growth and intense competition in the defense tech market.

The alignment of Five Eyes governments in streamlining the acquisition process further supports growth. This collaboration aims to reduce bureaucratic barriers and enable faster implementation of advanced defense technologies.

To succeed in this competitive landscape, startups must secure sufficient funding, establish a federal go-to-market strategy, and form strategic partnerships with established industry players. They must also navigate the complex government acquisition process and advocate for more efficient procurement policies. In this context, it's important to consider the role of the Committee on Foreign Investment in the United States (CFIUS), which reviews foreign investments in American companies to assess potential national security implications. CFIUS can impose restrictions on international investments and collaborations, potentially affecting the defense tech industry's access to capital and partnerships.

Addressing talent shortages and maintaining a culture of agility and innovation will also be crucial for startups to thrive in the defense tech market. However, the industry also faces challenges such as security vulnerabilities in COTS products and potential limitations on technology sharing. Stricter regulations on defense tech exports could hamper international collaboration, restricting the exchange of knowledge and resources between nations and ultimately constraining innovation.

Moreover, the impacts of climate change, such as increased frequency and intensity of natural disasters, may create a greater need for advanced defense tech to protect borders, critical infrastructure, and access to essential resources.

In conclusion, the future of the defense tech market is shaped by a complex interplay of factors that has the potential to create swift growth and heightened competition. As nations seek to maintain their strategic edge, adapt to evolving threats, and tackle emerging challenges, the defense tech market is poised to remain at the forefront of innovation and transformation. Navigating the industry's dynamic and uncertain future will require a keen analytical approach to these factors, including CFIUS implications and efforts by Five Eyes governments to streamline acquisition processes.

Defense tech taxonomy

Our taxonomy is built around 14 critical technology areas identified by the Office of the Undersecretary of Defense for Research and Engineering and the White House's National Science and Technology Council.[30, 31] We focused on companies headquartered in Five Eyes countries that operate in the VC universe. Companies were chosen based on a range of factors, including prior government funding, existing government clients, and potential defense applications. Public companies were included only if they received government funding as a startup. However, we note that certain sectors, such as renewable energy and information security, may be underrepresented due to the sheer scale of their respective markets, and we encourage readers to consult our other Emerging Technology Reports that cover those segments in detail.

We would like to emphasize, for the sake of nuance, that we have adopted a broad definition of "dual-use" in this report. Our goal is to assess funding levels across a wide array of critical technologies that could potentially serve national security objectives. We acknowledge that the term dual-use is contested and encourage readers to stay informed about ontological debates when evaluating the defense tech market.[32] This report incorporates insights from various categories of dual-use technology, including commercial-commercial, defense-commercial, defense-defense, and commercial-defense, to provide a comprehensive understanding of the defense tech landscape.

The following data covers VC activity from 2016 to 2022, starting at 2016 to match the year of the DIU's founding.

Autonomous systems

Segment/category	Description	Example company
Unmanned ground vehicles	Companies in this space develop self-driving land vehicles for military and civilian applications, such as cargo transport, reconnaissance, and security.	RRAI
Unmanned surface vehicles	Businesses in this sector create autonomous surface and underwater vehicles, used for tasks like surveillance, mine detection, and oceanographic research.	SAILDRONE
Unmanned aerial vehicles	Companies in this space focus on unmanned aerial systems, including drones and aerial platforms for purposes such as reconnaissance, communications, and payload delivery.	SWARM
Defense systems integration & optimization	Businesses in this sector develop software, algorithms, and systems that integrate different domains of defense technologies, enhance situational awareness, and optimize the overall effectiveness of defense and security operations.	falkonry
Autonomous manufacturing	Companies in this category develop and deploy technologies that enable machines to operate with little or no human intervention in manufacturing processes, including assembly, quality control, and logistics.	FORMIC

30: "Critical Technology Areas," Office of the Under Secretary of Defense, n.d., accessed May 10, 2023.
31: "Critical and Emerging Technologies List Update," National Science and Technology Council, February 2022.
32: "Reliance on Dual-Use Technology Is a Trap," War on the Rocks, Jake Chapman, September 8, 2022.

DEFENSE TECH TAXONOMY

Quantum sciences

Segment/category	Description	Example company
Quantum sensing & networking	Companies in this category develop sensors and networks that leverage quantum properties to enhance measurement and communication capabilities.	ColdQuanta
Quantum computing	Companies in this space work on the development of quantum computers, which have the potential to solve complex problems faster than classical computers.	MemComputing
Post-quantum cryptography	Firms in this sector focus on cryptographic methods that are designed to be secure against attacks from quantum computers.	NU QUANTUM

Sensing, connectivity & security

Segment/category	Description	Example company
Next-generation wireless networks	Companies in this space are developing advanced wireless communication technologies, such as 5G and beyond, for improved connectivity and data transfer.	DEEPSIG
Advanced sensors	Organizations in this sector work on innovative sensor technologies for applications like environmental monitoring, intelligence gathering, and navigation.	LUNEWAVE
Electronic warfare	Companies in this category focus on tools and systems for disrupting, exploiting, or degrading enemy electronic systems.	CITADEL DEFENSE
Information security	Companies in this space work on securing communication networks and systems against cyber threats.	AUTHENTIC8

DEFENSE TECH TAXONOMY

Advanced materials & manufacturing

Segment/category	Description	Example company
Additive manufacturing & maintenance	Companies in this sector specialize in 3D printing and "digital twin" technologies for rapid prototyping, manufacturing, and repair of defense and civilian components.	gecko robotics
Advanced armor & structural materials	Companies in this category develop and manufacture advanced ceramic and composite materials for defense applications, including armor, structural components, electronics, and optics. The focus is on improving strength, weight, durability, and protection to enhance the capabilities of defense systems.	KoBold Metals

Semiconductors & microelectronics

Segment/category	Description	Example company
Semiconductors	Companies in this sector specialize in the design, manufacturing, and supply of semiconductor components and equipment, as well as software and automation tools for the design and simulation of microelectronic systems used in a range of applications, including modern electronics and defense systems.	Pallidus
Nanotechnology	Businesses in this category work on the development and application of nanoscale materials and devices, which can enhance the performance of various defense systems.	Radiant Nano

DEFENSE TECH TAXONOMY

Human-machine interfaces

Segment/category	Description	Example company
Augmented & virtual reality	Companies in this sector develop augmented reality (AR) and virtual reality (VR) technologies for applications such as training, simulation, and remote operation of defense systems.	RAVN
Brain-computer interfaces	Organizations in this category work on systems that enable direct communication between the human brain and computers, allowing for improved control and interaction with defense technologies.	NEURABLE
Wearable technology	Companies in this space create wearable devices that enhance human performance, communication, and situational awareness in defense and security operations.	PISON

Biotechnology

Segment/category	Description	Example company
Synthetic biology	Businesses in this sector focus on the engineering of biological systems for applications like biofuels, materials, and drug development.	CAMBIUM
Biodefense	Companies in this space work on technologies and solutions for detecting, monitoring, and mitigating the impacts of infectious diseases and pandemics.	ZeteoTech

DEFENSE TECH TAXONOMY

Advanced computing & software

Segment/category	Description	Example company
Novel computing architectures	This category includes companies providing cloud-based infrastructure, platforms, and services for defense and security applications, as well as developing edge computing solutions that enable data processing closer to the source, reducing latency and bandwidth requirements in defense applications.	HADEAN
Data management & analysis	Businesses in this space work on technologies and solutions for efficient data storage, processing, and analysis in defense operations.	Primer
Development, security & operations (DevSecOps)	This category includes platforms that enable software developers to embed security protections within their code, test their code's vulnerabilities on a regular basis, and deploy application updates securely.	ROBUST INTELLIGENCE
Supply chain management	Companies in this space develop software and technology solutions to help manage and optimize the movement of goods and materials through the supply chain. This includes inventory tracking, logistics management, and demand planning, among other functions.	decision sciences

Space technology

Segment/category	Description	Example company
Satellite systems	Organizations in this sector design, manufacture, and operate satellite systems for applications like communications, surveillance, and navigation.	HawkEye 360
Space launch, re-entry & navigation	Companies in this space specialize in launch and re-entry vehicles as well as technologies for delivering payloads and personnel to and from space.	RADIAN AEROSPACE
In-space services	Businesses in this category focus on providing various services for orbital operations and space exploration. This includes satellite maintenance, in-orbit refueling, debris removal, and space-based manufacturing capabilities.	SCOUT

DEFENSE TECH TAXONOMY

Renewable energy generation & storage

Segment/category	Description	Example company
Alternative energy generation	Companies in this sector develop renewable energy sources, such as solar, wind, and geothermal, for use in defense and civilian applications.	TerraPower
Advanced energy storage	Businesses in this category work on innovative energy storage solutions, including batteries and capacitors, for improving the efficiency and reliability of energy systems.	Factorial
Power systems	Companies in this category develop technologies and solutions for efficient power conversion, management, and grid resiliency, serving both defense and civilian applications.	Heila

Defense-specific

Segment/category	Description	Example company
Directed energy	Companies in this category specialize in directed energy technologies, such as high-energy lasers and microwave weapons, for defense applications.	BLUEHALO
Hypersonics	Businesses in this sector work on the development and deployment of hypersonic systems, including missiles and vehicles, capable of traveling at speeds greater than Mach 5.	HERMEUS

Defense tech market map

Click to view the interactive market map on the PitchBook Platform.

Market map is a representative overview of venture-backed or growth-stage providers in each segment. Companies listed have received venture capital or other notable private investments.

Autonomous systems

Unmanned aerial vehicles

Skydio · Modal AI · Shield AI · Elroy Air · SkySafe · Auterion · Tomahawk Robotics · uAvionix · Firestorm

Defense systems integration & optimization

Anduril · falkonry · Palantir · rebellion · percipient.ai · Unanimous AI · Modern Intelligence · TurbineOne

Unmanned surface vehicles

seasats · Riptide Autonomous Solutions · Saildrone · Ocean Aero · Saronic · Progeny Systems

Unmanned ground vehicles

cruise · Zoox · Applied Intuition · May Mobility · RRAI

Autonomous manufacturing

Formic · Soft Robotics · Apptronik · Hadrian

Advanced materials & manufacturing

Advanced armor & structural materials

KoBold Metals · AREVO · PLOTLOGIC · Boston Materials · ATOMIC-6

Additive manufacturing & maintenance

ICON · nTop · gecko robotics · Fortify

Quantum sciences

Quantum computing

MemComputing · D-Wave · Maybell

Post-quantum cryptography

QUANTUM · SandboxAQ · Optalysys · QuSecure

Quantum sensing & networking

ColdQuanta · Q-CTRL · Aliro · QDTI

Sensing, connectivity & security

Information security

Authentic8 · CounterCraft · Anomali · Redseal · Shift5 · ENVEIL · Quokka · GreyNoise · Mission Secure

Advanced senors

Echodyne · CHAOS · Spartan · Voyant Photonics · compoundeye · SAFESENSE Technologies · silverside · ALLOSENSE

Next-generation wireless networks

DEEPSIG · EDGEQ · goTenna · GXC · FINWAVE · mesh+ · BEARTOOTH · Bandwidth10 · ESPRE Technologies · AALYRIA

Electronic warfare

Citadel Defense · EPIRUS · Dedrone

Human-machine interfaces

Augmented & virtual reality

RAVN · 6 · innovega

Wearable technology

PISON · SARCOS · strive HEALTH

Brain-computer interfaces

NEURABLE · synchron · Paradromics

Defense tech market map

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Market map is a representative overview of venture-backed or growth-stage providers in each segment. Companies listed have received venture capital or other notable private investments.

Semiconductors & microelectronics

Semiconductors

Nanotechnology

Biotechnology

Synthetic biology

Biodefense

Advanced computing & software

Data management & analysis

Novel computing architectures

DevSecOps

Supply chain management

Space technology

Space launch, re-entry & navigation

In-space services

Satellite systems

Renewable energy generation & storage

Advanced energy storage

Alternative energy generation

Power systems

Defense-specific

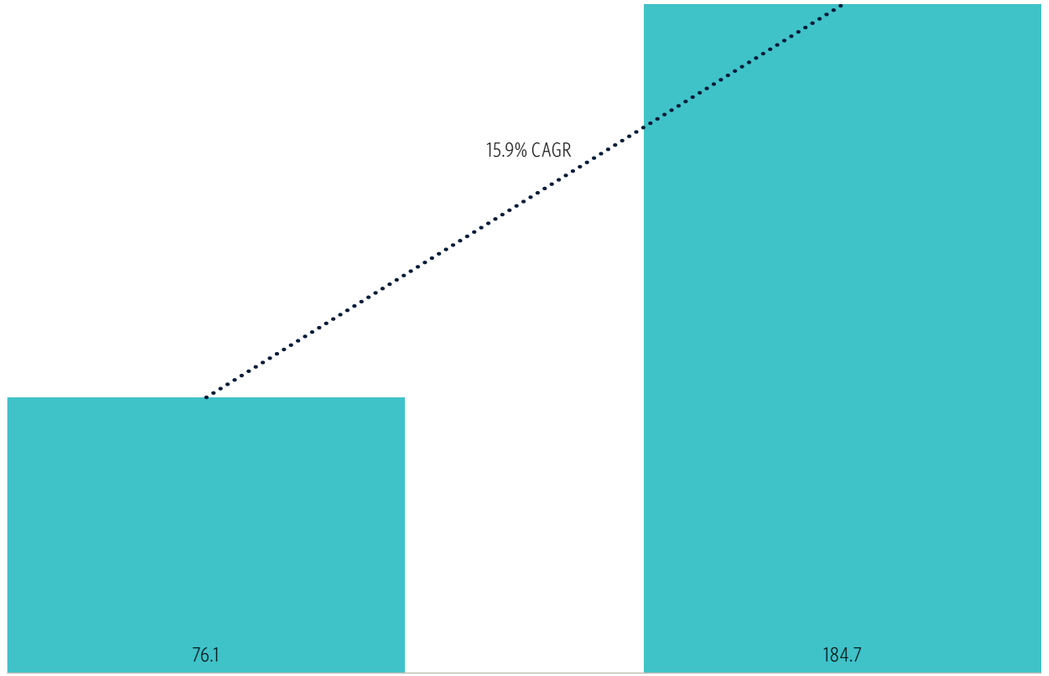
Directed energy

Hypersonics

Market size

We estimate that the US defense tech market will grow to $184.7 billion by 2027 at a CAGR of 15.9%. This estimate is based on relatively stable levels of DoD early-stage research and development funding of approximately $40 billion and VC funding growing as more players enter the space.[33]

Defense tech market size estimate ($B)*

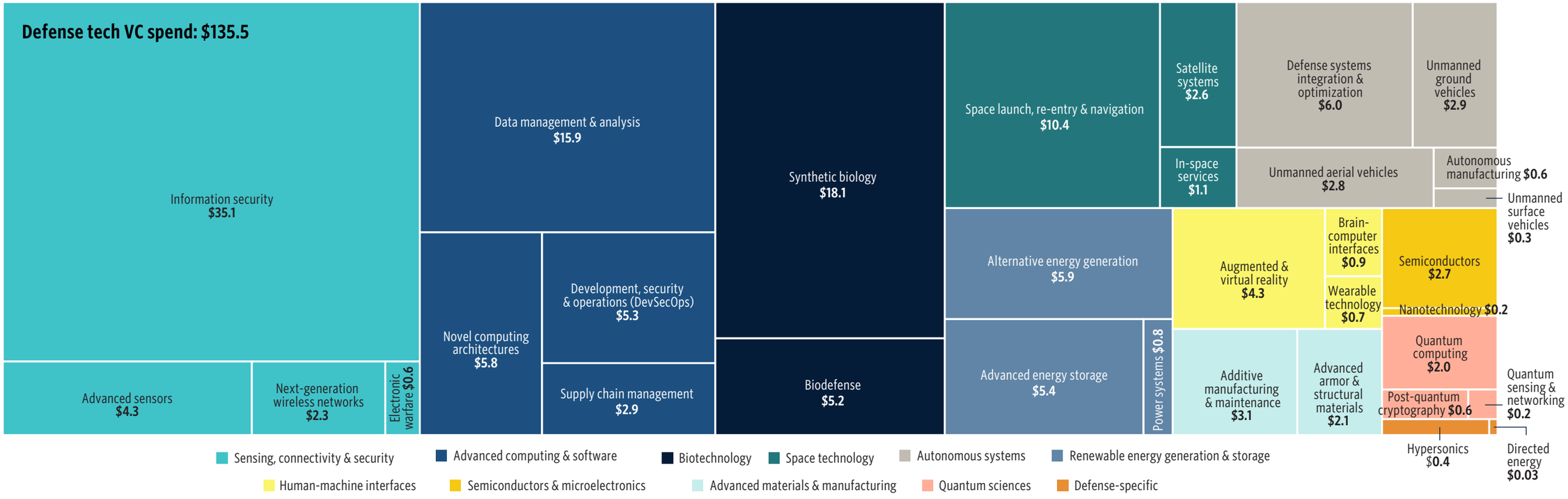


Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand
*As of April 28, 2023

33: "How Will US Funding for Defense Technology Innovation Evolve?" McKinsey & Company, Eric Chewning, et al., November 4, 2022.

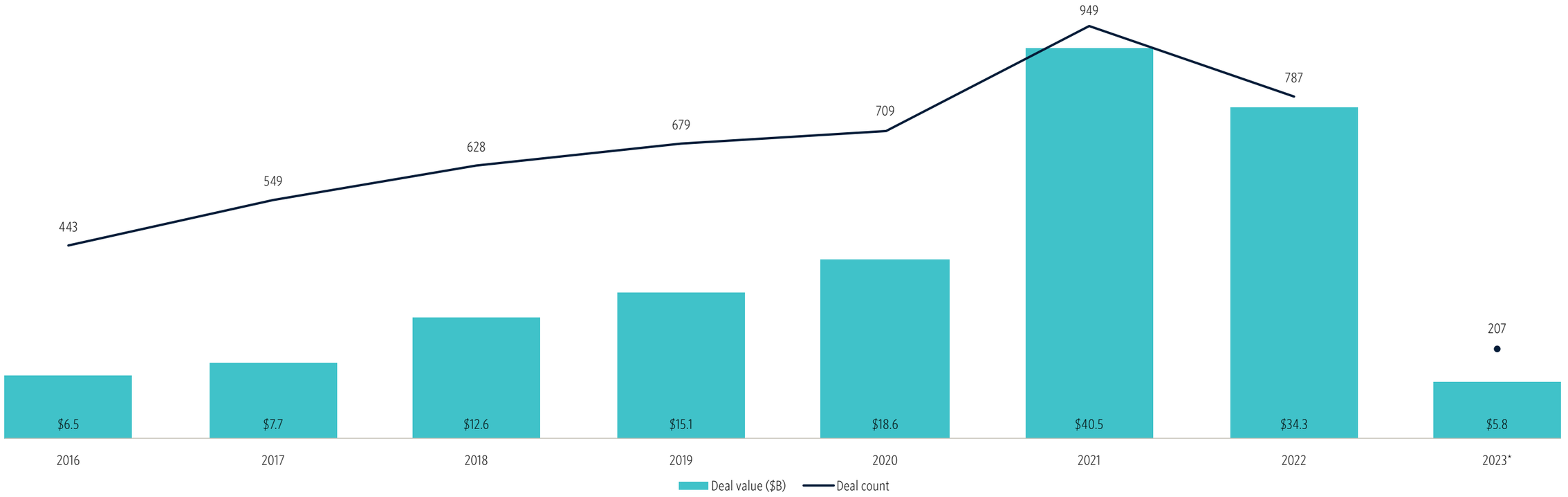
VC activity

Total VC invested ($B) by category from 2016 to 2022*



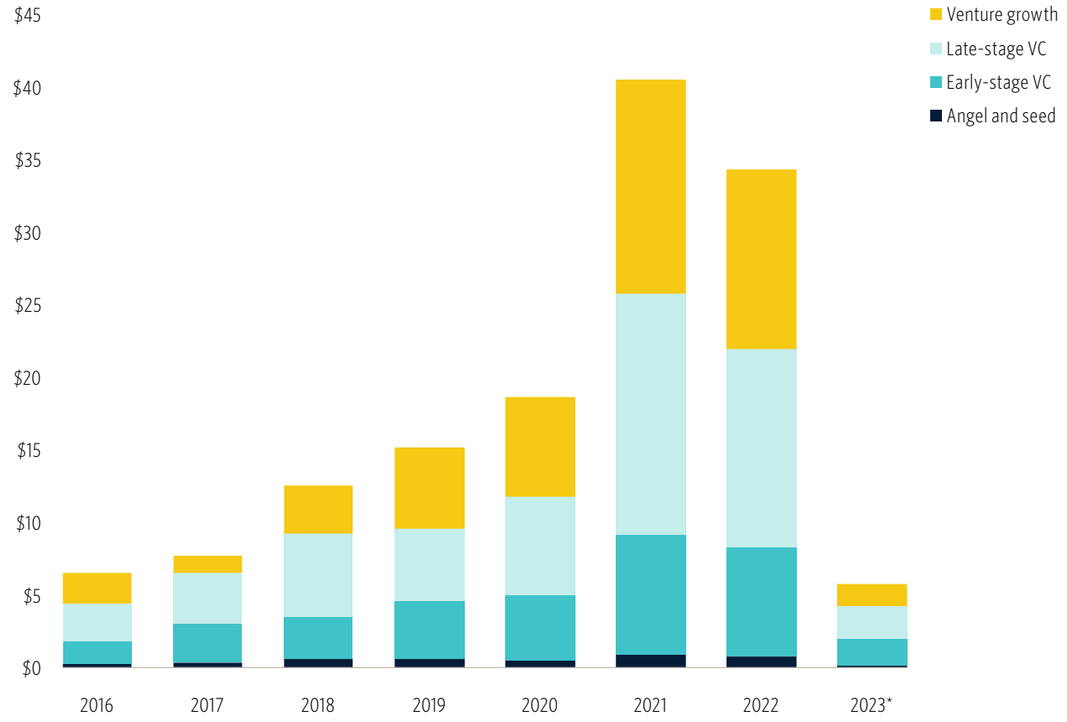
Source: PitchBook • Geography: US • *As of April 28, 2023

Defense tech VC deal activity



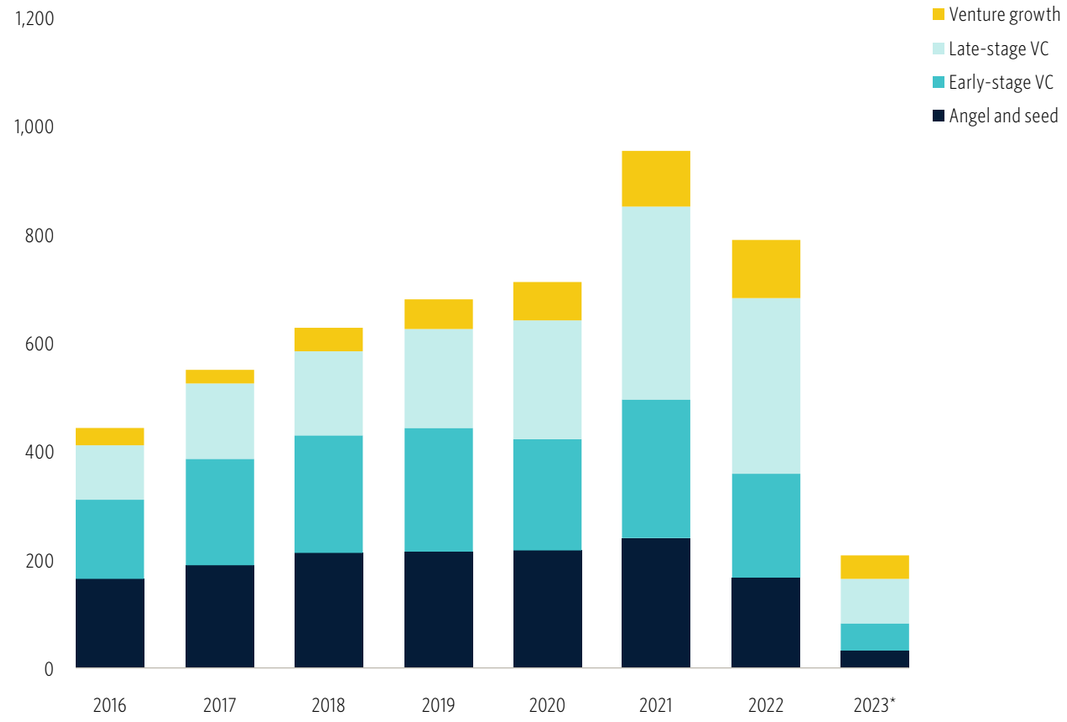
Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Defense tech VC deal value ($B) by stage



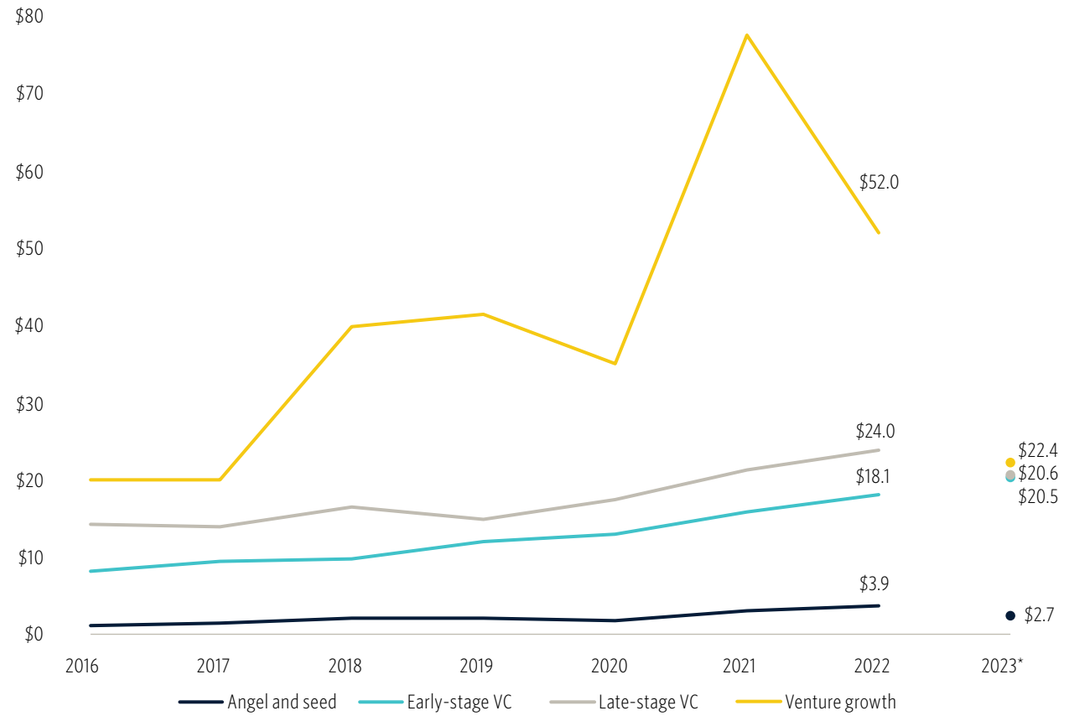
Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand
*As of April 28, 2023

Defense tech VC deal count by stage



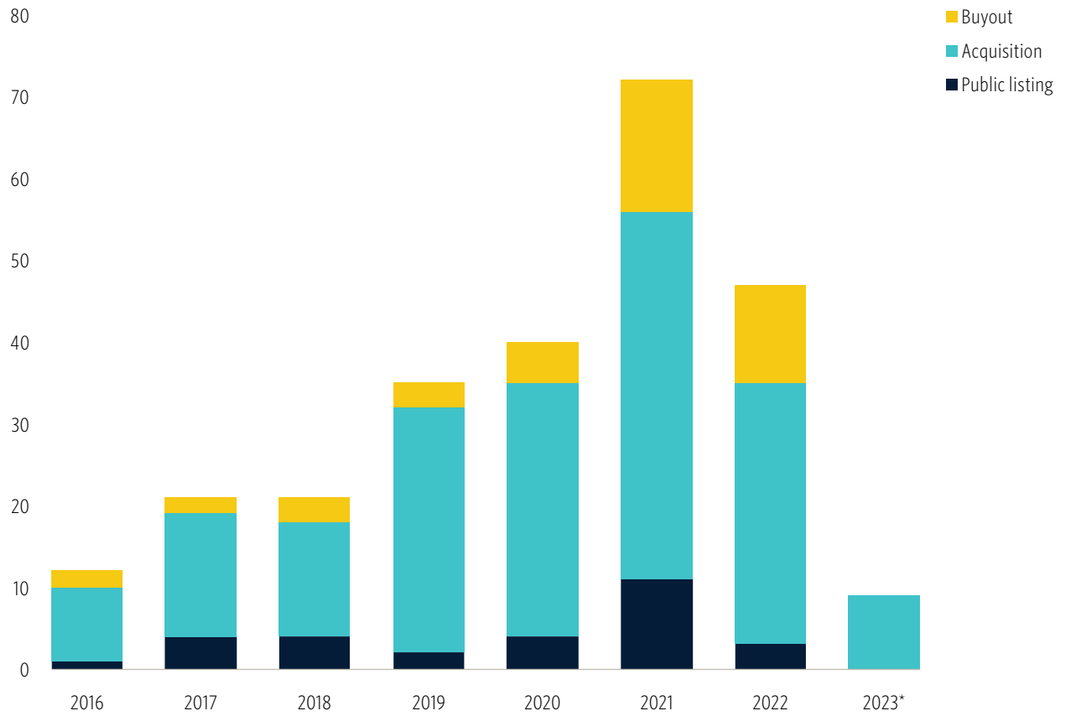
Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand
*As of April 28, 2023

Median defense tech VC deal value ($M) by stage



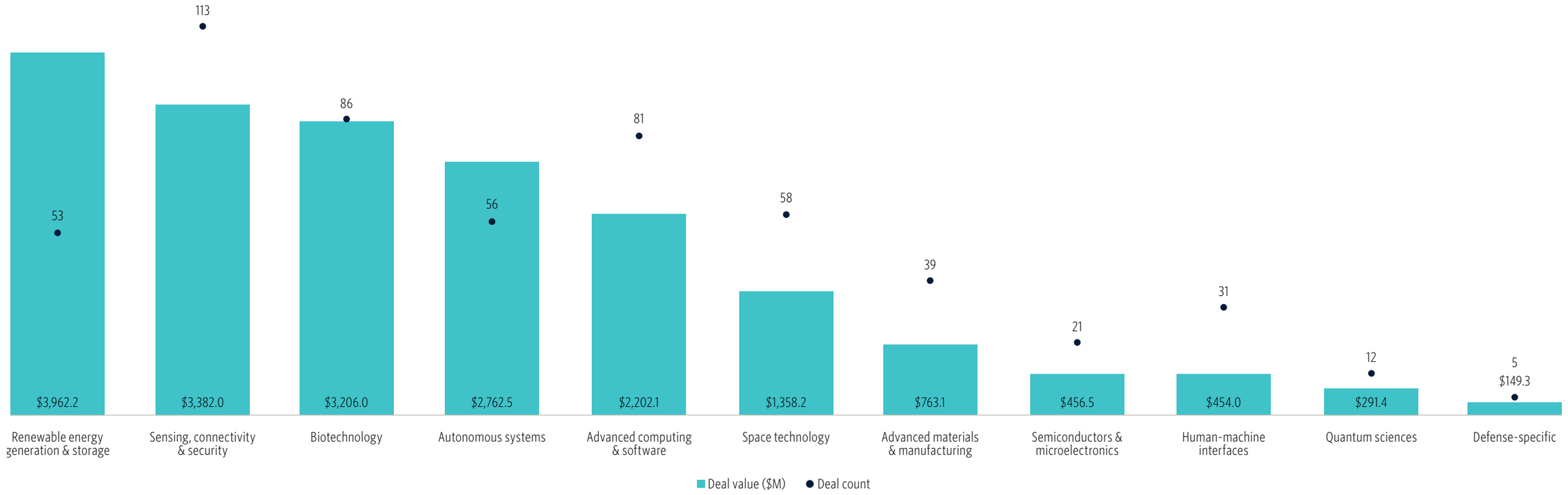
Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand
*As of April 28, 2023

Defense tech VC exit count by type



Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand
*As of April 28, 2023

TTM defense tech VC deal activity by segment*



Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Key players

Notable defense tech unicorns

Palantir

Market cap
$16.1 billion

Segment
Autonomous systems

Time to $1 billion valuation
Eight years

Category
Defense systems integration and optimization

Palantir is an analytical software company that focuses on leveraging data to create efficiencies in its clients' organizations. The firm serves commercial and government clients via its Foundry and Gotham platforms, respectively. The Denver-based company was founded in 2003 and went public in 2020.

PitchBook VC Exit Predictor
Publicly listed

ANDURIL

Market cap
$8.5 billion

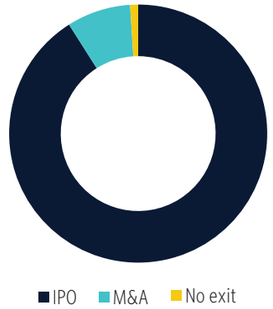
Segment
Autonomous systems

Time to $1 billion valuation
Two years

Category
Defense systems integration and optimization

Developer of AI-based hardware and software technology designed to solve critical challenges in the national security sector. The company's technology leverages virtual and augmented reality algorithms, computer vision, sensor fusion, optics, and automation to monitor threats and improve surveillance, enabling clients to radically transform defense capabilities and solve complex national security challenges.

PitchBook VC Exit Predictor
IPO: 92% probability



Notable defense tech unicorns

SHIELD AI

Market cap
$2.3 billion

Segment
Autonomous systems

Time to $1 billion valuation
Six years

Category
Unmanned aerial vehicles

Developer of an AI-based drone technology designed to protect service members and civilians with intelligent systems. The company's systems use machines to execute complex, unscripted tasks in enemy-controlled and dynamic environments without direct operator inputs. The company offers an integrated AI framework for data management and analysis, scalable simulation, and self-directed learning, which radically accelerates product development workflows, resolving critical information deficiencies and enabling teams of aircraft to perform missions ranging from room clearance to penetrating air defense systems and carrying out air-to-air combat.

PitchBook VC Exit Predictor
IPO: 80% probability

rebellion

Market cap
$1.2 billion

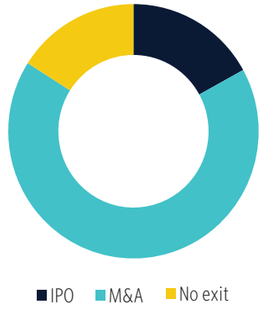
Segment
Autonomous systems

Time to $1 billion valuation
Two years

Category
Defense systems integration and optimization

Operator of a mission-focused AI platform designed for the defense and security industry. The company's platform provides a fused view of the threat environment and adversary capabilities, automates orchestration and execution of operations across distributed hardware and software platforms, and strengthens cyber readiness for critical military assets against adversarial attacks, enabling clients to deter threats and drive mission success.

PitchBook VC Exit Predictor
M&A: 67% probability



Notable defense tech unicorns

Skydio

Market cap
$2.3 billion

Time to $1 billion valuation
Seven years

Segment
Autonomous systems

Category
Unmanned aerial vehicles

Developer of AI-powered drones designed to deliver power and flying cameras without much complexity. The company's drones use an array of cameras and proprietary computer vision technology to recognize and avoid objects in real time, and predict the future to make intelligent decisions, enabling users to fly through various tasks and remain safe from obstacles when they want to take control.

PitchBook VC Exit Predictor
IPO: 73% probability

EPIRUS

Market cap
$1.4 billion

Time to $1 billion valuation
Four years

Segment
Sensing, connectivity, and security

Category
Electronic warfare

Developer of software-defined, high-power microwave technology designed to counter unmanned aircraft systems. The company's technology addresses threats such as drones and other asymmetric technologies, enabling defense organizations to stun drones with a hard reset or knock swarms out of the sky.

PitchBook VC Exit Predictor
IPO: 70% probability

Notable defense tech unicorns

scale

Market cap
$7.3 billion

Time to $1 billion valuation
Three years

Segment
Advanced computing and software

Category
Data management and analysis

Developer of a data-oriented platform designed to provide training and validation data for AI applications. The company's platform offers a data-centric, end-to-end service to manage the entire machine learning lifecycle by combining technology to develop complex datasets that enable clients to accelerate the development of artificial intelligence applications through ground-truth data.

PitchBook VC Exit Predictor
IPO: 81% probability

Prime defense contractor deal activity*

Prime	Company	Segment	Category	Deal value ($M)	Deal type	Deal date
LOCKHEED MARTIN	EdgeQ	Sensing, connectivity & security	Next-generation wireless networks	$11.5	Series B	September 26, 2022
BOEING	Axion Ray	Advanced computing & software	Data management & analysis	$7.6 (estimated)	Seed	February 15, 2023
Raytheon Technologies	Strangeworks	Quantum sciences	Quantum computing	$24.0	Series A	March 21, 2023
NORTHROP GRUMMAN	Echodyne	Sensing, connectivity & security	Advanced sensors	$135.0	Series C	June 13, 2022
GENERAL DYNAMICS	Medico Construction Equipment, INC.	N/A	N/A	N/A	M&A	June 15, 2020

Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Key defense tech angel and seed companies*

Company	Segment	Category	VC raised to date ($M)	Year founded
Stoke Space Technologies	Space technology	Satellite systems	$74.5	2019
TripleBlind	Sensing, connectivity & security	Network security	$32.2	2019
EDJX	Advanced computing & software	Novel computing architectures	$30.7	2018
Neo Cybernetica	Human-machine interfaces	Brain-computer interfaces	$30.0	2021
Link Immunotherapeutics	Biotechnology	Synthetic biology	$29.2	2019
Gravitics	Space technology	In-space services	$24.0	2021
Avicena	Sensing, connectivity & security	Next-generation wireless networks	$46.6	2019
ImmuneBridge	Biotechnology	Synthetic biology	$20.1	2018
Trotana Therapeutics	Biotechnology	Synthetic biology	$18.0	2019
PRENAV	Advanced materials & manufacturing	Additive manufacturing & maintenance	$17.6	2013

Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Key defense tech early-stage companies*

Company	Segment	Category	VC raised to date ($M)	Year founded
Commonwealth Fusion Systems	Renewable energy generation & storage	Alternative energy generation	$1,999.0	2017
ABL Space Systems	Space technology	Space launch, re-entry & navigation	$419.3	2017
OneTrust	Sensing, connectivity & security	Network security	$970.0	2016
ONE	Renewable energy generation & storage	Advanced energy storage	$390.0	2020
Immunai	Biotechnology	Synthetic biology	$583.5	2018
Orbital Therapeutics	Biotechnology	Synthetic biology	$320.0	2022
Maze Therapeutics	Biotechnology	Synthetic biology	$481.0	2018
Umoja Biopharma	Biotechnology	Synthetic biology	$271.0	2019
Inflection	Advanced computing & software	Data management & analysis	$265.0	2022
Merlin Labs	Autonomous systems	Unmanned aerial vehicles	$246.0	2018

Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Key defense tech late-stage companies*

Company	Segment	Category	VC raised to date ($M)	Year founded
SpaceX	Space technology	Space launch, re-entry & navigation	$8,687.9	2002
Databricks	Advanced computing & software	Data management & analysis	$3,497.4	2013
Anduril	Autonomous systems	Defense systems integration & optimization	$2,315.1	2017
Flexport	Advanced computing & software	Supply chain management	$2,246.9	2013
Netskope	Sensing, connectivity & security	Network security	$1,445.3	2012
Tempus Labs	Biotechnology	Synthetic biology	$1,411.8	2015
TAE Technologies	Renewable energy generation & storage	Alternative energy generation	$1,344.8	1998
Relativity	Space technology	Space launch, re-entry & navigation	$1,334.5	2015
Snyk	Sensing, connectivity & security	DevSecOps	$1,071.0	2015
DataRobot	Advanced computing & software	Data management & analysis	$1,048.1	2012

Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Top defense tech investors (2016-2023)*

Investor	Deal count	Angel and seed	Early-stage VC	Late-stage VC	Venture growth	Investor type
Andreessen Horowitz	165	26	69	51	19	VC
In-Q-Tel	156	17	58	70	11	Not-for-profit VC
New Enterprise Associates	154	15	60	60	19	VC
Alumni Ventures	119	22	37	51	9	VC
8VC	117	36	46	28	7	VC
GV	111	3	54	37	17	CVC
Lux Capital	103	12	56	29	6	VC
Founders Fund	97	23	28	40	6	VC
SOSV	97	61	19	17	0	VC
General Catalyst	85	11	35	30	9	VC

Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Key deals and contracts

Top recent VC deals by deal value ($M)*

Company	Close date (2022)	Segment	Category	Deal value ($M)	Deal type	Lead investor(s)
Altos Labs	January 20	Biotechnology	Synthetic biology	$3,000.0	Early-stage VC	ARCH Venture Partners
SpaceX	June 30	Space technology	Space launch, re-entry & navigation	$1,725.0	Late-stage VC	Mirae Asset Venture Investment
Anduril	December 2	Autonomous systems	Defense systems integration & optimization	$1,480.0	Late-stage VC	Valor Equity Partners
Flexport	March 28	Advanced computing & software	Supply chain management	$935.0	Late-stage VC	Andreessen Horowitz, MSD Partners
TerraPower	November 3	Renewable energy generation & storage	Alternative energy generation	$830.0	Late-stage VC	Bill Gates, SK Group, SK Innovation
Resilience	June 6	Biotechnology	Synthetic biology	$625.0	Late-stage VC	N/A
Group14 Technologies	December 14	Renewable energy generation & storage	Advanced energy storage	$614.0	Late-stage VC	Microsoft Climate Fund, Porsche Ventures
SandboxAQ	March 22	Quantum sciences	Post-quantum cryptography	$500.0	Late-stage VC	N/A
Form Energy	October 4	Renewable energy generation & storage	Advanced energy storage	$450.0	Late-stage VC	TPG
Arctic Wolf	October 6	Sensing, connectivity & security	Network security	$401.0	Late-stage VC	Owl Rock Capital Group

Source: PitchBook • Geography: US, UK, Canada, Australia, and New Zealand • *As of April 28, 2023

Key recent contract awards

Varda Space Industries raised $60 million for factory satellites and partnered with the US Air Force on hypersonic testing.[34] In March 2023, Varda Space Industries secured $60 million from a STRATFI contract to launch factory satellites for zero-gravity manufacturing. The US Air Force will use Varda's re-entry capsules as hypersonic flight test platforms. The California-based startup plans to send 120-kilogram satellites into orbit to produce products like pharmaceuticals and optical fiber. The collaboration aims to test components and materials at hypersonic speeds, supporting the development of future hypersonic missiles and aircraft.

Kodiak robotics secured a $50 million DoD agreement for autonomous US Army ground vehicles.[35] In December 2022, Kodiak Robotics won a $49.9 million, 24-month DoD agreement to develop autonomous technology for future US Army ground vehicles, particularly for the Army's Robotic Combat Vehicle (RCV) program. The project, awarded by the DoD's DIU on behalf of the RCV program office, aims to reduce risk to troops by using autonomous vehicles for high-risk missions, such as reconnaissance and surveillance. Kodiak will focus on developing autonomous navigation capabilities for complex terrain and GPS-challenged environments, as well as remote vehicle operation technology.

CounterCraft won a $26 million DoD contract for advanced cyber operations.[36] In October 2022, CounterCraft raised $26 million for its deception platform, which will be deployed throughout the DoD. The contract, awarded through the General Services Administration, aims to enhance defense networks by detecting and monitoring network traffic from malicious hackers. Developed in collaboration with the DIU, the platform will provide deception capabilities, enable integration into US government networks, and train agencies on deployment and bolstering threat intelligence.

Scale AI was awarded a $250 million federal contract for AI data management solutions.[37] In January 2022, Scale AI won a nearly $250 million blanket purchasing agreement from the DoD's Joint Artificial Intelligence Center (JAIC). The contract aims to provide all federal agencies access to Scale AI's technology, with the company set to develop a range of AI test and evaluation products for image analysis, autonomy, natural language processing, and augmented reality interfaces.

Applied Intuition was awarded a $49 million contract to drive autonomy development for the US Army's robotic combat vehicle (RCV) program.[38] In November 2022, Applied Intuition secured a substantial contract valued at $49 million by the US Army and the DIU. Their role involves delivering a comprehensive autonomy software development and test platform for the Army's RCV program. Under this 24-month contract, Applied Intuition will provide a modeling and simulation platform to facilitate effective software development and testing, enabling mission and mobility autonomy across various RCV variants. The partnership aims to enhance the Army's approach to stack development for autonomous technology and enable the safe and efficient scaling of autonomous systems.

34: "U.S. Air Force to Test Hardware at Hypersonic Speeds on Varda's Space Capsules," SpaceNews, Sandra Erwin, March 21, 2023.
35: "U.S. Department of Defense Awards $50 Million Contract to Kodiak Robotics for Autonomous U.S. Army Ground Reconnaissance Vehicles," PR Newswire, December 6, 2022.
36: "CounterCraft Awarded $26 Million Contract From U.S. Government to Support Advanced Cyber Operations," CounterCraft, October 6, 2022.
37: "Scale AI Awarded $250M Contract by Department of Defense," FedScoop, Jackson Barnett, January 31, 2022.
38: "Army Selects Applied Intuition to Accelerate Autonomy Development for Robotic Combat Vehicle (RCV)," Applied Intuition, November 14, 2022.

Recommended reads

1) "Strengthening the Defense Innovation Ecosystem," RAND Corporation, Brodi Kotila, et al., September 2022.

2) "Commission on Defense Innovation Adoption Interim Report," Atlantic Council, Eric Lofgren, Whitney M. McNamara, and Peter Modigliani, April 2023.

3) "DIU's FY22 Year in Review," Defense Innovation Unit, 2022.

4) "Rebooting the Arsenal of Democracy: Anduril Mission Document," Anduril Industries, June 5, 2022.

5) "Seven Critical Technologies for Winning the Next War," Center for Strategic & International Studies, Emily Harding and Harshana Ghoorhoo, April 2023.

6) "Silicon Valley Wants to Power the U.S. War Machine," Fast Company, Mark Sullivan, November 1, 2021.

7) "State of Competition Within the Defense Industrial Base," Office of the Under Secretary of Defense for Acquisition and Sustainment, February 2022.

About PitchBook Emerging Tech Research

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As the private markets continue to grow in complexity and competition, it's essential for investors to understand the industries, sectors and companies driving the asset class.

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