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I. EXECUTIVE SUMMARY

"We live in a world in which we need to share responsibility. It's easy to say 'It's not … my community, not my world, not my problem.' Then there are those who see the need and respond. I consider those people my heroes."
Mister Rogers.

We sit now at the dawn of a new era. Companies like Anduril and SpaceX are reshaping life on Earth. In the future, they could reshape life off Earth. At Balerion Space Ventures we invest in private space & defense tech companies. We see space & defense tech as an important asset class for the country and for humanity. Right here and right now there are companies generating revenues, generating profits, and being acquired. Right here and right now is the time for space & defense tech. Right here and right now is the time for Patriot Capital.

War and defense are in the midst of a digital transformation and disruption. The United States (US) enjoyed post-cold war technological superiority based on large, high-cost hardware systems. In that time, top technical talent was drawn to non-defense technological challenges. Recent changes in technology and warfare are demonstrating that a low-cost, high-volume approach (i.e. "mass") with the use of drones in several domains and controlled by sophisticated command and control software and hardware, in addition to autonomous capabilities, can outcompete legacy systems, and do so at lower cost. Cutting edge software, artificial intelligence (AI), modern manufacturing expertise, and development speed will create a competitive advantage. Anduril Industries is positioned to be the leading company in what will be the new paradigm in defense technology and ultimately will be the protector of the free world. "All's well that ends better." — Hamfast Gamgee, Lord of the Rings.

II: DEFENSE TECH: HISTORY

1776 TO 1940S - GOVERNMENT AND INDUSTRIAL BASE

The earliest US defense technologies predate the founding of the country. The first technologies were essentially ammunition and navy ships. Following US independence, states established official militias. They built associated storage facilities and supply bases, which then became customers of local shipyards and ammunition factories.

Prior to World War I, US defense policy, which was initially outlined by George Washington, was border defense. In the late 1800s, there was an explosion of growth in the production of private market goods. The following decades saw the emergence of new technologies including electric lighting, telephone and radio communication, and large-scale automobile manufacturing. This private industrial base was harnessed upon the outbreak of World War I and made the US the major supplier of military equipment to allied nations. Once the US entered the war, this manufacturing base was well established to produce military vehicles and supplies (with the exception of aircraft, which were purchased from foreign producers at this time).

Following this war, anticipating the second world war, the government created the Defense Plant Corporation in 1940 to facilitate large-scale production capabilities for military equipment. The Defense Plant Corporation was given the authority to direct private industry to public defense needs. World War II followed as expected. Shortly after, using these production capabilities, destroyers were provided to Great Britain using the lend-lease program. During this war, the Defense Plant Corporation built many of what were called government-owned, contractor-operated (GOCO) facilities. In addition, the US government helped private industry retool for military production. For example, it was during this period that the US was able to begin aircraft production starting with B-24 bombers (Figure 1) at a Ford-built factory. Following the war, industry that had been focused on military production redirected back to commercial products. Many of the GOCO facilities later shut down; six GOCO plants remain in operation today down from a peak of seventy-three.

## 1940S TO 1970S - DEFENSE PRODUCTION ACT AND MANTECH

Following World War II, in 1947, the Department of Defense (DOD) was created via the National Security Act and Executive Order 9877. The purpose was to create an integrated military establishment with civilian support. This was being established during the post-war period of demobilization and downsizing. Despite that, modernization progressed.

The Korean War followed in 1950. In response, the Defense Production Act was enacted and went farther than the prior Defense Production Corporation. It has since been reauthorized over 50 times. This law allows the government to require businesses to accept and prioritize national defense contracts even if they incur a business loss, it allows the president to directly use loans or purchase guarantees to expand private production in service of national defense, it grants authority over corporate governance (to prevent a merger with an unfavorable foreign company for example), and allows executives to be pulled into government service (National defense can be interpreted broadly and was recently applied to the COVID-19 response and clean energy technologies). Overall, the act provided the US executive branch of government a powerful tool to direct resource allocation to a given set of priorities.

At this point the cold war was firmly underway with a military and technological power rivalry between the United States (and allies) and the Soviet Union (and allies). World War II had solidified the consensus that technological superiority was critical to effective defense. The Cold War with the Soviet Union added pressure. The US aggressively pursued the development of a high-technology

Military expenditure as a share of GDP, 1949 to 2020

Military expenditures include military and civil personnel, operation and maintenance, procurement, military research and development, and military aid. Civil defense and current expenditures for previous military activities are excluded.
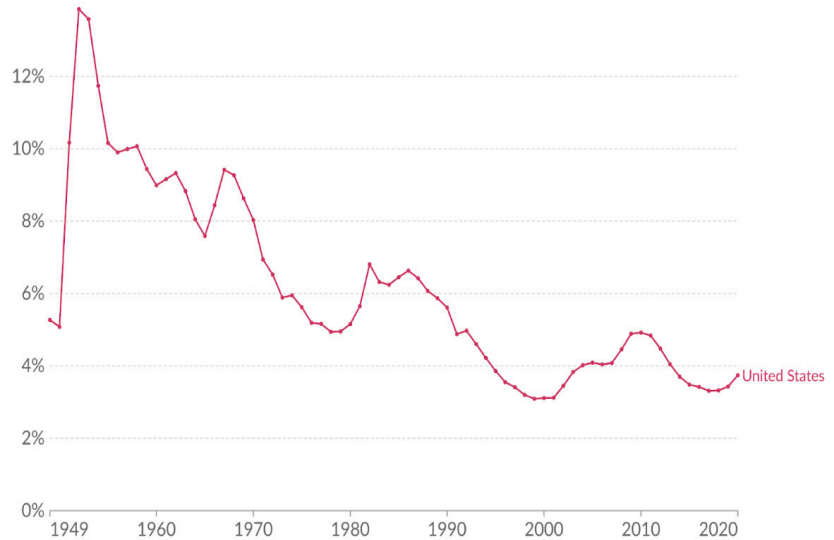
Data source: Stockholm International Peace Research Institute   OurWorldInData.org/military-personnel-spending | CC BY

Figure 2 - Military expenditure as a share of GDP, 1949-2020
(adapted from www.OurWorldinData.org/military-personnel-spending)

industrial base and dedicated a large proportion of defense funding to research and development (R&D). The defense budget had risen from 5% of GDP in 1940 to 10% and over in the decades following World War II (Figure 2). The majority of this increase in funding went to R&D. A major example of success had been the Manhattan Project in World War II which lended credibility to the idea of large, government-funded, technological projects. The idea of defense technology leading to beneficial spin-offs (i.e. "dual-use" technology) became popular and accepted, and helped justify ongoing large defense budgets.

In 1956, the DOD established the Manufacturing Technology Program (ManTech) to support and invest in the defense industrial base to encourage innovative manufacturing. This program has received increased support over the decades and remains an integral part of getting new manufacturing technology to the point of government acquisition. Indeed, this approach can be credited

with dual-use successes such as the development of Global Positioning System (GPS), microelectronics, nuclear power, and the internet. Between the 1940s and the 1990s, major advances were made in air and space including jets, missiles, and access to low-earth orbit and beyond.

"The idea of defense technology leading to beneficial spin-offs (i.e. "dual-use" technology) became popular and accepted, and helped justify ongoing large defense budgets. "

1940S TO 1990S - GOVERNMENT AND PRIVATE ROLES IN MODERN AIR AND SPACE

After military aircraft transitioned from propeller to jet power, emphasis was given to increasing speed and capability. In the process, the successful coordination of large organizations was demonstrated. This coordination was led by the military and included the aerospace industry and university research organizations. The Bell X-1, with Chuck Yeager as test pilot, is an example. This rocket-engine aircraft achieved the first supersonic flight in 1947. It was a joint effort between the US Army Air Forces, the US Air Force, the National Advisory Committee for Aeronautics, and Bell Aircraft.

The government entities had completed R&D, Reaction Motors Inc had built the rocket engine, and Bell Aircraft had completed the build and testing. Similar partnerships produced ever faster aircraft. The Bell X-2 reached Mach 3.2 in 1956. The X15, made in partnership between US Air Force, National Aeronautics and Space Administration (NASA), and North American Aviation, achieved Mach 6.7 and reached the edge to outer space by 1967. For decades, this system had repeated success. For example, the Grumman F-14 Tomcat (figure 3) developed in the 1970s, and the McDonnell Douglas F/A-18 hornet both of which guaranteed US air dominance for decades lasting for years after the end of the Cold War.

Figure 3 - Grumman F-14A Tomcat
(https://www.history.navy.mil/content/history/museums/nnam/explore/collections/aircraft/f/f-14a-tomcat.html)

The space domain, in contrast, began for many years with minimal private corporate involvement. In 1957, Sputnik 1, the first satellite to low-earth orbit (LEO), was launched by the Soviet Union. The first Intercontinental Ballistic Missile (ICBM) was also designed by the Soviets, a rocket called the R7. It was the R7 that took Sputnik 1 to orbit. The following month, a living creature, a dog named Laika, successfully launched to space. This pressed a redoubling of focus into space systems by the US. The Space Race had begun. The next year in 1958, the California Institute of Techology's Jet Propulsion Laboratory (JPL), launched the first US satellite to LEO, Explorer 1 (Figure 4), on an Army-developed Jupiter-C rocket. At the end of 1958, the US government consolidated space efforts, including those of the Army and Navy, into the National Aeronautics and Space Administration (NASA). In 1961 President John F. Kennedy called for NASA to land a person on the moon and return them safely by the end of the 1960s. Apollo 8, in 1968 was the first manned spacecraft to go beyond LEO and orbited the moon. Apollo 11 landed on the moon in 1969 and five more moon landings occurred before the end of the program in 1972. These efforts represented a large government focus; prior to 1958, NASA and its predecessors typically received less than 0.1% of the federal budget and by the mid-1960s NASA was receiving over 4%.

Beginning around 1970, NASA's budget decreased to around 1% of the federal budget, and this period marked the beginning of private corporate involvement in space in earnest. The space shuttle program, officially the Space Transportation System (STS), began in 1972 and flew for thirty years from 1981 to 2011. This program involved several private manufacturers contracted by NASA including Thiokol/Alliant Techsystems, Lockheed Martin/Martin Marietta, Boeing, and Rockwell. This program enabled the launching of commercial satellites for charge. It also supported the chief defense missions for early warning of a nuclear attack, and command, control, and communications functions. The expanded ability to get satellites in orbit was critical to providing communications, surveillance and reconnaissance for intelligence, and geographic positioning.

1990S - END OF THE COLD WAR AND DECLINING VIBRANCE

For the last three or four decades of the cold war, spending on large government programs, while expensive, paid for the help of a large number of defense contractors who successfully contributed to achieving the R&D and production of an extensive cache of leading technologically advanced hardware in land, sea, air, and space domains. This system was so successful that these products and programs effectively maintained this dominance for another three decades or so after the end of the cold war.

The end of the Cold War also marked the beginning of a decline in effectiveness of this system with a new period of slower, more expensive, and less dynamic development. This period of decreased spending brought an associated consolidation of defense contracting firms with several years of significant mergers

Figure 4 - Explorer 1
(https://airandspace.si.edu/stories/editorial/missing-history-explorer-1-satellite)

and acquisitions in the 1990s. The post Cold War period saw the consolidation of over fifty companies into five prime contractors receiving the largest portion of DoD spending: Lockheed Martin Corporation, The Boeing Company, Raytheon Technologies Corporation (name changed to RTX in June 2023), General Dynamics Corporation, and Northrop Grumman Corporation. (Figure 5)

The post Cold War period saw the consolidation of over fifty companies into five prime contractors receiving the largest portion of DoD spending: Lockheed Martin Corporation, The Boeing Company, Raytheon Technologies Corporation (name changed to RTX in June 2023), General Dynamics Corporation, and Northrop Grumman Corporation. (Figure 5)
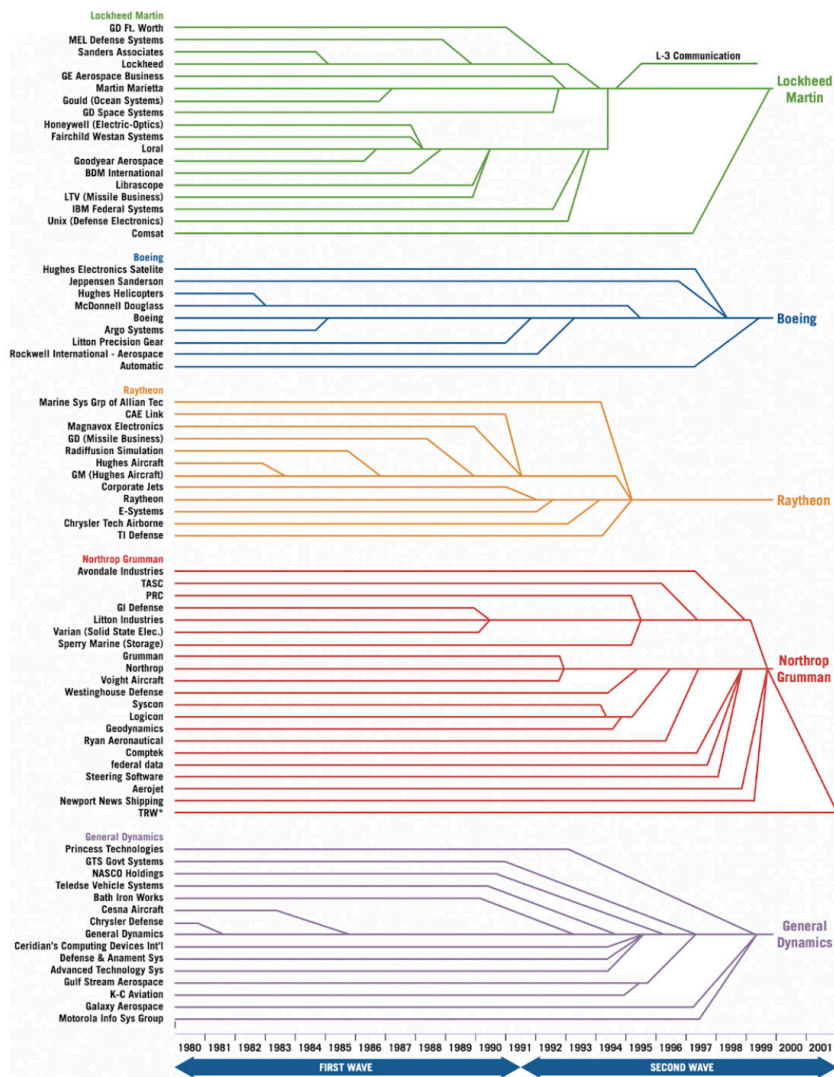
7

Lockheed Martin
GD Ft. Worth
MEL Defense Systems
Sanders Associates
Lockheed
GE Aerospace Business
Martin Marietta
Gould (Ocean Systems)
GD Space Systems
Honeywell (Electric-Optics)
Fairchild Westan Systems
Loral
Goodyear Aerospace
BDM International
Librascope
LTV (Missile Business)
IBM Federal Systems
Unix (Defense Electronics)
Comsat
L-3 Communication
Lockheed Martin

Boeing
Hughes Electronics Satelite
Jeppesen Sanderson
Hughes Helicopters
McDonnell Douglass
Boeing
Argo Systems
Litton Precision Gear
Rockwell International - Aerospace
Automatic
Boeing

Raytheon
Marine Sys Grp of Allian Tec
CAE Link
Magnavox Electronics
GD (Missile Business)
Radiffusion Simulation
Hughes Aircraft
GM (Hughes Aircraft)
Corporate Jets
Raytheon
E-Systems
Chrysler Tech Airborne
TI Defense
Raytheon

Northrop Grumman
Avondale Industries
TASC
PRC
GI Defense
Litton Industries
Varian (Solid State Elec.)
Sperry Marine (Storage)
Grumman
Northrop
Voight Aircraft
Westinghouse Defense
Syscon
Logicon
Geodynamics
Ryan Aeronautical
Comptek
federal data
Steering Software
Aerojet
Newport News Shipping
TRW*
Northrop Grumman

General Dynamics
Princess Technologies
GTS Govt Systems
NASCO Holdings
Teledse Vehicle Systems
Bath Iron Works
Cesna Aircraft
Chrysler Defense
General Dynamics
Ceridian's Computing Devices Int'l
Defense & Anament Sys
Advanced Technology Sys
Gulf Stream Aerospace
K-C Aviation
Galaxy Aerospace
Motorola Info Sys Group
General Dynamics

1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001

FIRST WAVE | SECOND WAVE

Figure 5 - Defense Contractor Mergers and Acquisitions 1980-2001
(https://history.nasa.gov/AeroCommissionFinalReport.pdf)

Although a driver of this consolidation was reduction in defense spending, the armed forces continued to invest in R&D to maintain technological superiority. Consolidation brought new challenges. Costs grew faster than inflation, diversity of suppliers decreased (e.g. the entire strategic nuclear triad was dependent on one company: Northrop Grumman), a bulk of military contracts received a single bidder, and offshoring of processes increased. Most importantly, dynamism and innovation in defense failed to keep pace with the civilian technology sector, which saw an explosion in growth and talent, particularly in software, during this period. In spite of this, an early counter example provided a template of what would come.

2000S TO 2010S - SPACEX AND LAUNCH DISRUPTION

During a time when demand for space launch increased, a robust competitive market to provide these services had not emerged. In an echo of the earlier GOCOs, the government partnered with private industry and the United Launch Alliance (ULA) was formed in 2005. This joint venture combined the two major military launch providers, Lockheed and Boeing, into one entity for the purpose of designing, engineering, producing, and operating expendable launch vehicles and services for the government. Under this entity, all fixed costs would be covered by the government, and the streamlining into one company was promised to provide savings. Space Exploration Technologies Corporation (SpaceX, Figure 6), founded by Elon Musk in 2002, sued Lockheed and Boeing in 2005 immediately prior to the formation claiming a violation of antitrust laws and that the formation would lock SpaceX out of military launch competition. A year earlier, SpaceX had successfully protested the Government Accountability Office (GAO) for access to NASA launch contracts. SpaceX had also received funding from the Defense Advanced Research Projects Agency (DARPA) to purchase the Falcon 1 rocket. Over the next decade, SpaceX became increasingly competitive in the launch market while the costs for military payloads under ULA had significantly risen. SpaceX sued ULA again in 2014, a suit that was eventually settled, and over the following years the launch industry became competitive. By 2018, SpaceX had 18 successful launches in a year while ULA only had 8. Overall, launch numbers continued to increase after that time. Recently, new companies entered the market to meet unmet demand. A vibrant competitive launch market emerged.

2000S TO 2010S - PALANTIR AND DEFENSE SOFTWARE DISRUPTION

A second counter-example company emerged during the same period: Palantir Technologies, founded by Peter Thiel, Nathan Gettings, Joe Lonsdale, Stephen Cohen, and Alex Karp in 2003. Palantir, with talent from Silicon Valley, over the following decade grew to an over $9 billion business serving all branches of the armed forces and intelligence agencies with software born from PayPal anti-fraud software and evolved to an antiterrorism mission. Where the major five defense prime contractors were providing the bulk of military hardware services, talent from the civilian technology sector found a leading role in solving defense problems with software. Echoing SpaceX, Palantir sued the US Army in 2016 for an intelligence software procurement that appeared to be deliberately crafted in a way that precluded commercial competition for the contract. The lawsuit pointed out that, in Title 10 of the United States Code, there was a law that requirements be defined such that procurement of already-developed commercial products could be done "to the maximum extent possible". Palantir argued that the intent of this law was to require the government to take advantage of private sector innovation and expertise when possible instead of spending to develop a similar product themselves. Indeed, the Army had already sunk three billion dollars and ten years into developing this intelligence software suite and did not have a finished product. Palantir argued that they already had a product for the intended service ready and at a much lower cost. The court ruled in favor of Palantir and ordered the Army to look for commercial products that would meet its needs. Ultimately, Palantir was awarded the contract in 2019.

DEFENSE DISRUPTION AND INNOVATION

SpaceX and Palantir - companies that had broken into defense and had reached over a billion dollar market valuation, also called "defense unicorns" - had formed a new path. A third company, Anduril Industries, was to follow. Before reviewing their story, a current snapshot of the defense technology industry follows.

Courtesy of Anduril Industries

III: DEFENSE TECH: CURRENT

2010S TO 2020S - DEFENSE CONTRACTOR OVERVIEW

Global defense spending rose over the past several years. Revenues correspondingly increased every year at the top defense firms between 2017 and 2022. In 2022, DOD spending on contracts totalled $390.5 billion. According to the US Cybersecurity & Infrastructure Security Agency, there are over 100,000 defense contractor and subcontractor companies. Over the past several years, the five aforementioned companies - Lockheed Martin, RTX, General Dynamics, Boeing Co, and Northrop Grumman - received about 30% of DOD contract spending (Table 1) and earned about 70% of total defense profit (Figure 7). Annual defense revenue to these large companies ranged from about $30 billion to over $60 billion each.
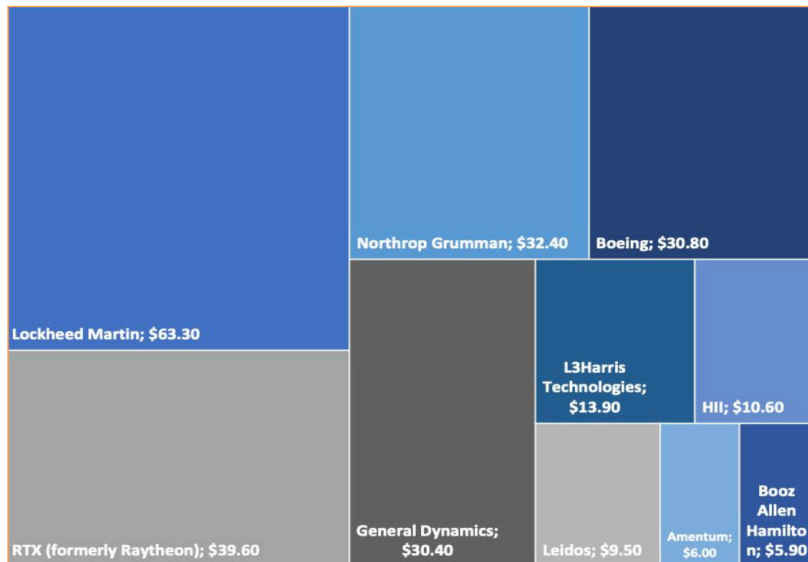

Table 1 - Top 10 US defense contractors by defense revenue (adapted from https://people.defensenews.com/top-100/)

DEFENSE VC INVESTMENT

Defense tech had not been a large area for Venture Capital investment until the past several years although total capital remains somewhat low. For example, a Crunchbase report compared $10B in seed and series funding to Cybersecurity with $2.2B to Defense Tech in 2022. Increased innovation in space and AI in defense is likely to continue to draw new capital. Table 2 summarizes Defense Tech funding rounds from 2017 to 2023. It is worth noting that a bulk of total funding went to Anduril Industries, particularly in 2021 and 2022.

FIGURE 1: PRIME CONTRACTOR ECONOMIC PROFIT: 2018 − 2026 FORECASTED
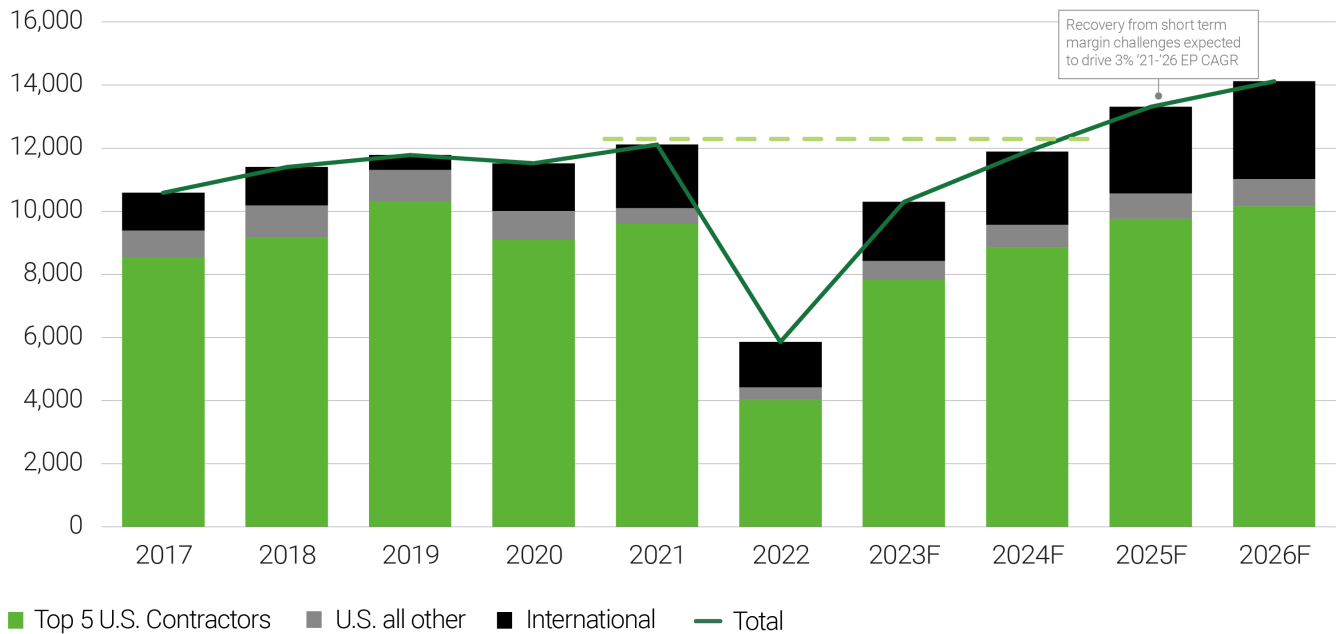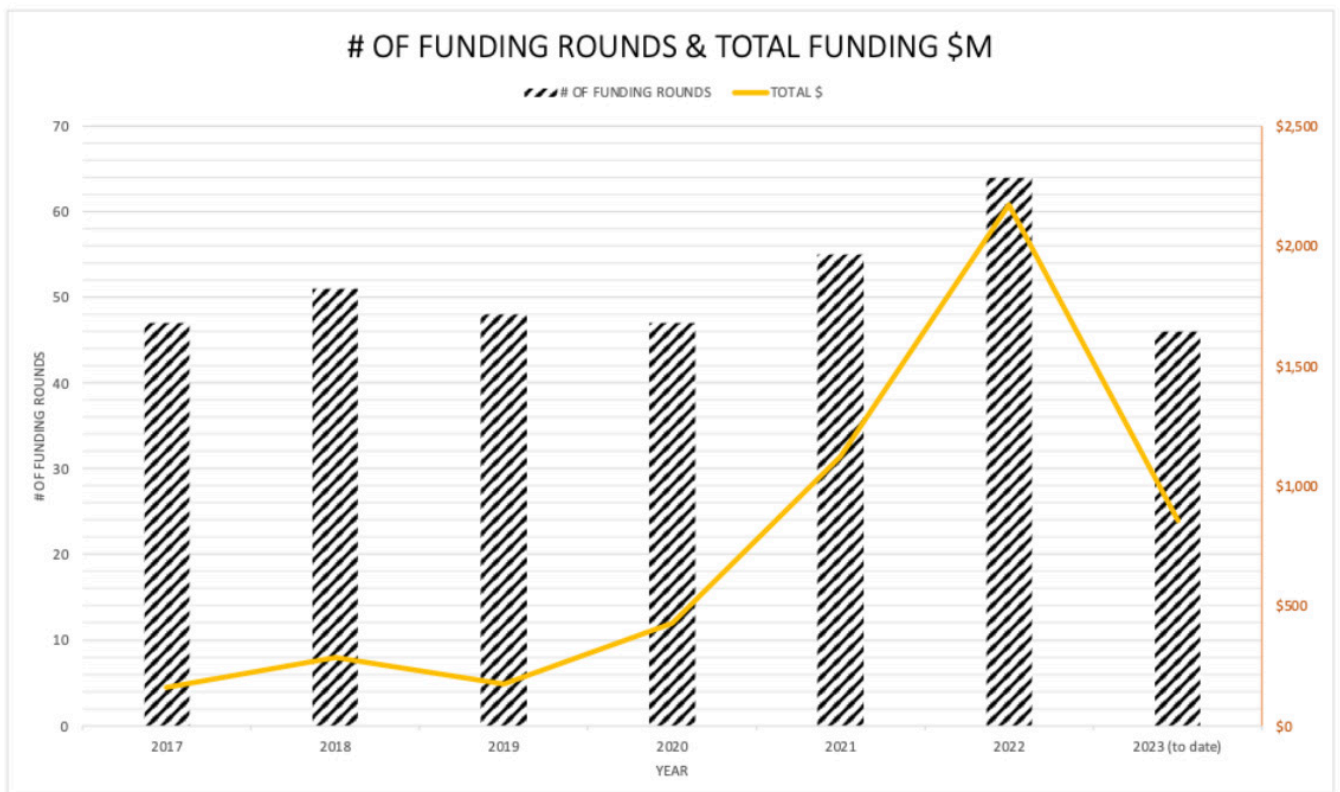
Economic profit ($M)

Figure 7 - Top 5 defense prime economic profit

(https://insights.alixpartners.com/post/102ishv/expectations-remain-high-for-defense-profit-pool-despite-a-challenging-2022-and-2)

Defense Tech funding rounds announced 2017 - 2023

(from Crunchbase data search)

IV: THE STORY OF ANDURIL INDUSTRIES:

SOFTWARE SUPERIORITY FOR TOMORROW'S WARS

Figure 1 - B-24 in 1943
Courtesy of American Air Museum

BACKGROUND

Anduril Industries, which is named after Lord of the Rings hero Aragorn's lethal weapon, was founded in 2017 with the explicit goal of becoming the next great defense prime by accelerating innovation in the defense industry. Anduril differentiates itself from legacy defense contractors in two chief ways: first by prioritizing software and second by having products already developed at the time of approaching a government agency for a contract; they have completed a bulk of the R&D prior to contracting with the government instead of competing for that R&D to be funded as in the common cost-plus contracting system.

Historically the defense industry focused on high-cost, low-volume products like aircraft carriers, fighter jets, and similar. In this model, hardware was the focus and supporting software was developed later. Anduril's thesis was that modern combat would be won by a high-volume low-cost-approach. In the few years following the founding of Anduril, case studies accumulated demonstrating the prescience of that thesis. For example, when the war in Ukraine began in February 2022, it became marked by a primacy of drone warfare at a level quite beyond what had occurred in the long history of drone warfare. One estimate had it that Ukraine was losing 10,000 drones per month. That number of drones lost, suggesting a much higher number of drones in operation, was staggering when compared to, for example, the entire US military arsenal of planes being about 14,000. Many, if not most, of these drones were commercially made and originally purchased by civilian consumers. Consumer drones ranged in price from around $100 to $1000 and military drones cost on the order of $100,000. In comparison, a military aircraft could cost between $100 million and up to $300 million. In other words, roughly one thousand drones could be purchased for the price of one military aircraft. A corollary is that an unmanned drone is far more expendable than a manned aircraft, even without accounting for human life. The war in Ukraine also saw an emergence of sea- and land-based drones. In addition to the irreversible contribution drone warfare will make, it is clear that the command, control, communication, and autonomous capability of the drone drives competitive advantage on the battlefield. A drone that does not require constant piloting, and associated constant communication, will be more effective in a fast moving, high volume battlefield, and less vulnerable to electronic warfare countermeasures. With an established command and control and autonomous software system developed, it can be relatively easier to develop and deploy new physical assets within that system.

> *"Artificial intelligence should be the linchpin of our efforts to re-armor ourselves for a new kind of fight." – Anduril CEO Brian Schimpf*

HISTORY

The story of Anduril Industries begins with Trae Stephens, one of Anduril's co-founders, who had experience on Capitol Hill prior to joining Palantir as an engineer. He later joined Peter Thiel's Founders Fund where he had hoped to find another great defense technology disrupting start-up like SpaceX or Palantir. In 2013, Founders Fund had made a Series A investment in Oculus VR Incorporated, a virtual reality firm started by Palmer Luckey that was sold in 2014 to Facebook for $2B.

Stephens developed a relationship with Luckey and, by 2017, had not found another defense start-up to invest in. He discussed with Luckey his thesis that software would be the decisive element to technological superiority in future warfare and that the nation's top technical talent was not being drawn into defense work as it had in the past. Stephens and Luckey set out to build a defense start-up and began by building a team. Matt Grimm, who had been an engineer at Palantir and deployed to Afghanistan and Iraq in support of forces there, joined Anduril as Chief Operating Officer. Joe Chen joined as a co-founder and had a background as an Army National Guard Airborne paratrooper who later worked in product development at Oculus VR and at a Hollywood Virtual Reality start-up. Brian Schimpf, Chief Executive Officer, came to Anduril also from Palantir where he had risen to become the director of engineering during a time period when the company grew from 60 to over 2000 employees.

ANDURIL'S DISTINCT CAPACITIES

1. Each operator is a battlefield commander - Advanced command and control systems allow a single person to assess the battlefield and direct high numbers of assets within it.
2. Software as a crew - AI driven autonomous operation within each asset allows execution of complex missions without crew or pilot.
3. Ready products - Company-funded R&D upends the old cost-plus contracting system.
4. Mass - Innovative production capability for high numbers of high-technology low-cost assets.
5. Brains - Attracting the best minds in technology. Renewing excitement for patriotic defense work.

Anduril: A History

2017
- Company launched June 2017
- Goal: to become the next major defense prime by bringing top technical talent and AI expertise to the mission
- Founders: Joseph Chen, Matt Grimm, Palmer Luckey, Brian Schimpf, Trae Stephens

2018
- Series A $41M
- Hired Christian Brose as Head of Strategy
- Sentry project with Jamie Hyneman (known from TV series MythBusters) which built VR-driven firefighting tanks and moved progressed toward autonomous function
- Portable border towers with radar, communications, antenna, and cameras with laser functions integrated by Lattice software

2019
- Series B $?
- Valuation $1B
- Several contracts for US border and US and UK base perimeter security including funding from DOD Project Maven
- cUAS interceptor drone introduced

2020
- Series C $200M
- Valuation $1.9B
- Christian Brose published "The Kill Chain" book
- Introduced Ghost 4 VTOL unmanned surveillance vehicle able to be carried in a military backpack
- Introduced autonomous cruise missile defense sentry towers to detect and track missiles

2021
- Series D $450M
- Valuation $4.6B
- DIU contract given for up to $99M for counter-drone technology using AI in cUAS £3.8M force protection contract from UK MOD Project TALOS
- Acquired Atlanta-based Area-I producer of ALTIUS tube-launched air-launched expendable drones

2022
- Series E $1.5B
- Valuation $8.5B
- Acquired Dive Technologies producer of large UUVs
- $100M contract with Australia DOD for 3 prototype XL-AUVs
- New $60M research and manufacturing facility for former Area-I
- Introduced remote command & control center, Menace, transportable to virtually anywhere in the world by C-130
- ~$1B US SOCOM counter-drone contract

2023
- Partnership with Aalyria for laser-connected 600 satellite network with AI battlefield management software
- Acquired Adranos rocket manufacturer
- Partnership with GM defense for battlefield land vehicles using innovative power sources and Anduril Software (e.g. Infantry Squad Vehicle)
- Acquired Blue Force Technologies producer of high-performance autonomous aircraft
- Introduced Roadrunner high-performance twin-jet AUV and Roadrunner-M explosive interceptor version

Figure10 - Timeline of Anduril Industries history

Anduril Industries launched in June 2017 with seed funding from four investors led by Founders Fund. Then, in 2018, Founders Fund led a 41 million dollar Series A funding round. That year, Anduril hired Christian Brose, a former Senate Armed Services Committee staff director under Senator John McCain, as head of strategy. Anduril's first product proposal was a "smart wall" (Figure 11) for the Department of Homeland Security, which provided technological border security at a claimed cost of 2% of more traditional physical wall proposals. On the smart wall, a network of cameras, radar, and communications antennae was directed to an area of interest and monitored by an operator with the assistance Virtual Reality headset, which assisted the user in identifying persons. This was the first application of the system Anduril named Lattice. Rather than developing expensive hardware, the aim was to use off-the-shelf commercial technology and leverage it with artificial intelligence (AI). In the company's Lattice OS, a network of supporting hardware, including sensors, cameras, and drones, is deployed while software - including mesh networking, virtual reality, and artificial intelligence - can be constantly upgraded in the background to advance the technology. In the same year, they worked on a firefighting tank project (Figure 12), coordinated with MythBusters Jamie Hyneman's tank to make a VR-piloted remote tank for firefighting, and worked to implement autonomous capabilities.

Figure 11 - Autonomous Sentry tower (https://fedscoop.com/anduril-sentry-towers-cbp/)
Figure 12 - Firefighting tank concept with Jamie Hyneman (https://www.cnet.com/tech/tech-industry/mythbusters-jamie-hyneman-is-building-autonomous-firefighting-tanks-for-palmer-luckeys-anduril/)

By 2019, Anduril was awarded several government contracts for lattice technology including US Customs and Border Protection, the US Marine Corps, and the U.K. Royal Marines. The company was providing perimeter security with several contracts for the US border and military bases. Anduril reached a one billion dollar valuation that year, only two years after its founding. Awarded contracts included funding from the DOD AI initiative Project Maven. The next step was to develop the ability to detect and destroy drones. Anduril released the Interceptor drone, counter Unmanned Aerial System (cUAS) (Figure 13) which was designed to strike fixed and rotary wing aircraft (Of note, in 2023, the Army requested over $300 million in funding for this category of system). 2019 also saw Series B funding with investors including Founders Fund, General Catalyst, and Andreessen Horowitz.
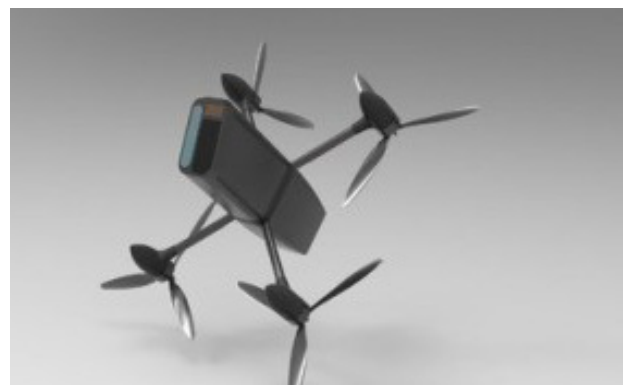

Figure 13 - Anduril counter Unmanned Aerial System (cUAS) (https://militaryembedded.com/unmanned/counter-uas/counter-uas-system-announced-by-anduril-industries)
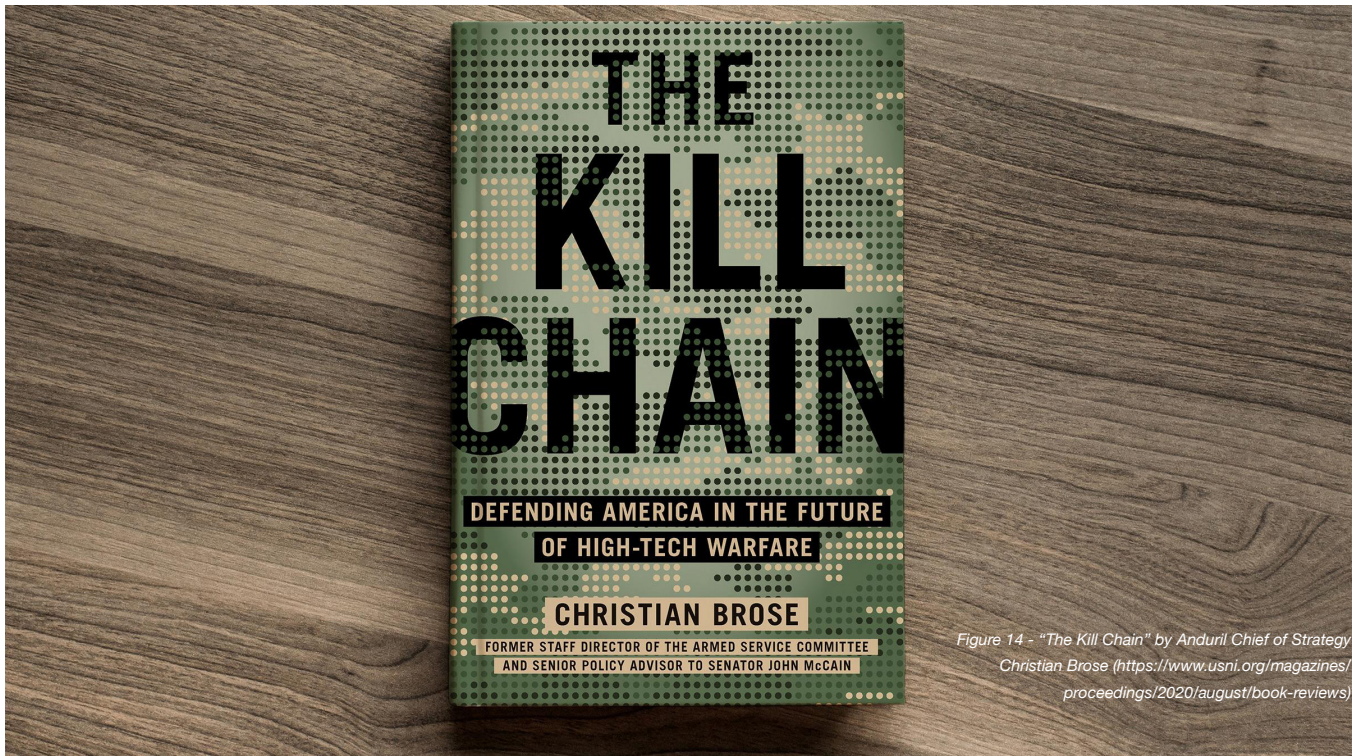
By 2020, Anduril had over thirty federal contracts and was valued at $1.9 billion. That year, Brose published his book "The Kill Chain: Defending America in the Future of High-Tech Warfare" (Figure 14) where he argued that the US had fallen behind China in military superiority due to a focus on legacy systems; "the United States got ambushed by the future." He outlined the technological threat to legacy systems and the alternative modern model, embodied by Anduril and consistent with DARPA's "mosaic Warfare" concept, of building cheap, numerous, and technologically advanced systems also referred to as "mass" (The 2023 DOD Replicator Program further supported US government recognition of and demand for this advance in warfare). 2020 brought series C funding for $200M. Ghost 4 (Figure 15) was introduced; this was a vertical take-off and landing (VTOL) surveillance unmanned aerial vehicle to integrate into the Lattice OS and had a reportedly low radio frequency signature. It had multiple payload bays for flexible configuration options depending on contract. The vehicle was small enough to be carried in a military backpack for assembly in the field. Later in 2020, the company developed the autonomous Cruise Missile Defense Sentry Towers (Figure 16) to detect and track cruise missiles.

In 2021, Series D funding raised $450M and valuation had increased to $4.6B. The Defense Innovation Unit awarded Anduril a contract for up to $99 million for counter-drone AI technology which would use the cUAS system. Anduril acquired the aerospace company Area-I, in metro Atlanta, Georgia, which built the Agile-Launched, Tactically-Integrated, Unmanned System (ALTIUS) for the Army Air-Launched Effects (ALE). These were tube-launched, air-launched, expendable drones. A second acquisition, Copious Imaging, was completed which brought leading passive sensing technology to the company. This provided a hard-to-detect AI-supported long-wave infrared motion imaging system to detect, track, and classify objects. Two more key members joined: Zachary Mears, a Pentagon public policy practitioner to guide strategy and Dr. Scott Goldstein, a Major General in the USAF reserve with extensive background in engineering leadership, as Chief Scientist. That year, Anduril was awarded £3.8 million from Project TALOS by the UK Ministry of Defence (MOD) for advanced force protection technology.

Figure 15 - Anduril Ghost 4 (https://blog.anduril.com/anduril-introduces-ghost-4-c12d8c783930)

In 2022 Series E funding brought $1.5B, and valuation increased to $8.5B. In this year, Anduril purchased the Boston-area company, Dive Technologies. This company built a large displacement unmanned underwater vehicle. Anduril later entered into a three year $100 million dollar deal with Australia to build three prototype Extra Large Autonomous Undersea Vehicles (XL-AUV) in three years. This program would see long-endurance AUVs integrated with multi-mission payloads for military and non-military missions such as "advanced intelligence, infrastructure inspection, surveillance, reconnaissance and targeting." The plan would aim to commence production in year four and entry to service in year five. These products would be designed, developed, and manufactured in Australia. "We're a software-first company. The XL-AUV will be inexpensive and attritable, and it will be able to be updated on a regular basis to give it more flexibility." said David Goodrich, the CEO and Chairman of Anduril Australia. The XL-AUV (Figure 17) would complement the manned Australian submarine fleet which would be developing nuclear power capabilities in parallel as part of AUKUS. Similar to the land models of modern warfare, a manned submarine could function as a command center for a fleet of unmanned vehicles. In 2022, Anduril invested $60 million in a new manufacturing and research facility in Atlanta, GA. The purpose was to house Area-I, the

manufacturer of advanced unmanned aircraft systems acquired by Anduril in 2021.

Figure 18 - Anduril Menace platform (https://blog.anduril.com/anduril-launches-menace-8a3ad854c8e0)

Also in 2022, Anduril announced Menace (Figure 18), a command-and-control center that can be loaded into a C-130 aircraft, deployed to austere locations, and set up in about 10 minutes. It is an expeditionary command, control, communications and computing platform that would allow commanders to plan and execute missions virtually anywhere. Menace is set up with heating, cooling, and ventilation to allow for a comfortable workspace even in extreme environments. Further, it is equipped to run on its own power generation unit if needed. Anduril was also awarded a $1B contract from US SOCOM to lead counter-drone efforts.

In 2023, Anduril announced a partnership with Aalyria. Aalyria, a spin-off from Google, managed a 600 satellite network interconnected by laser links. Their software, Spacetime, used AI to manage this network in combination with other units including ground stations, aircraft, satellites, and ships. When this is combined with Lattice, which uses AI to synthesize data from an extensive network of sensors and sources, a large expansion of battlefield understanding and awareness could be achieved.

Also in 2023, Anduril acquired solid rocket motor manufacturer Adranos Energetics noting that the company had a faster and more efficient rocket manufacturing process. This positioned Anduril as a supplier for other defense primes and with the capability to power hypersonic weapons, missiles, and rockets.

Anduril introduced significant new hardware entries in 2023. First, they partnered with GM defense to collaborate on battlefield land vehicles using innovative power sources and benefitting from Anduril software (Figure 19). They acquired Blue Force Technologies which built high-performance autonomous aircraft. Anduril followed-up, ending the year with the introduction of Roadrunner (Figure 20), a high performance twin-jet AAV with a flexible payload system to be applicable to a broad range of missions, and the related Roadrunner-M, an explosive-interceptor version for ground-based air defense.

Figure 19 - GM Defense and Anduril Infantry Squad Vehicle (https://www.defensenews.com/unmanned/2023/10/10/gm-defense-anduril-team-up-on-emerging-battlefield-needs/)

Figure 20 - Anduril Roadrunner AAV with Palmer Luckey (https://www.bloomberg.com/news/articles/2023-12-01/anduril-roadrunner-drone-killer-could-change-tactics-in-iraq-syria)

In only six years, Anduril transformed from a nascent company into a large and rapidly expanding defense prime. They are built on a foundation of leading software technology, enabling autonomy and command and control, with both established and emerging competence in land, air, sea, and space hardware. In fact, what had started as a software first approach led to what are now advanced hardware manufacturing ability for modern defense products. Anduril has developed innovative and leading manufacturing solutions to develop and scale production of military hardware for the land, sea, and air domains. Most importantly, Anduril, with Lattice OS, has developed a real-time operational mastery capability in all of these domains as a functioning unit. It is likely that their technology foundation is without peer in the western defense world and will underpin significant continued expansion.

ANDURIL'S CURRENT ORDER OF BATTLE

Anduril Industries combines leading software expertise in information systems and AI with innovative high-volume low-cost hardware to create autonomous-based systems for the national security mission. Anduril practices first principles engineering; they conceive novel products that are best suited to a given defense mission. They largely fund and complete their own R&D prior to approaching government customers with a near-complete solution. With time, both the software and hardware have become more sophisticated.

ANDURIL'S CURRENT ORDER OF BATTLE

AIR

Anvil + Anvil-M
Ghost + Ghost-X
Fury
Roadrunner + Roadrunner-M

Agile-Launched, Tactically-
Integrated Unmanned System
(ALTIUS)

**LATTICE
OS**

LAND

Standard/Long Range/Mari-
time/ Mobile/Cold Weather
Sentry Towers

Wide-Area Infrared System
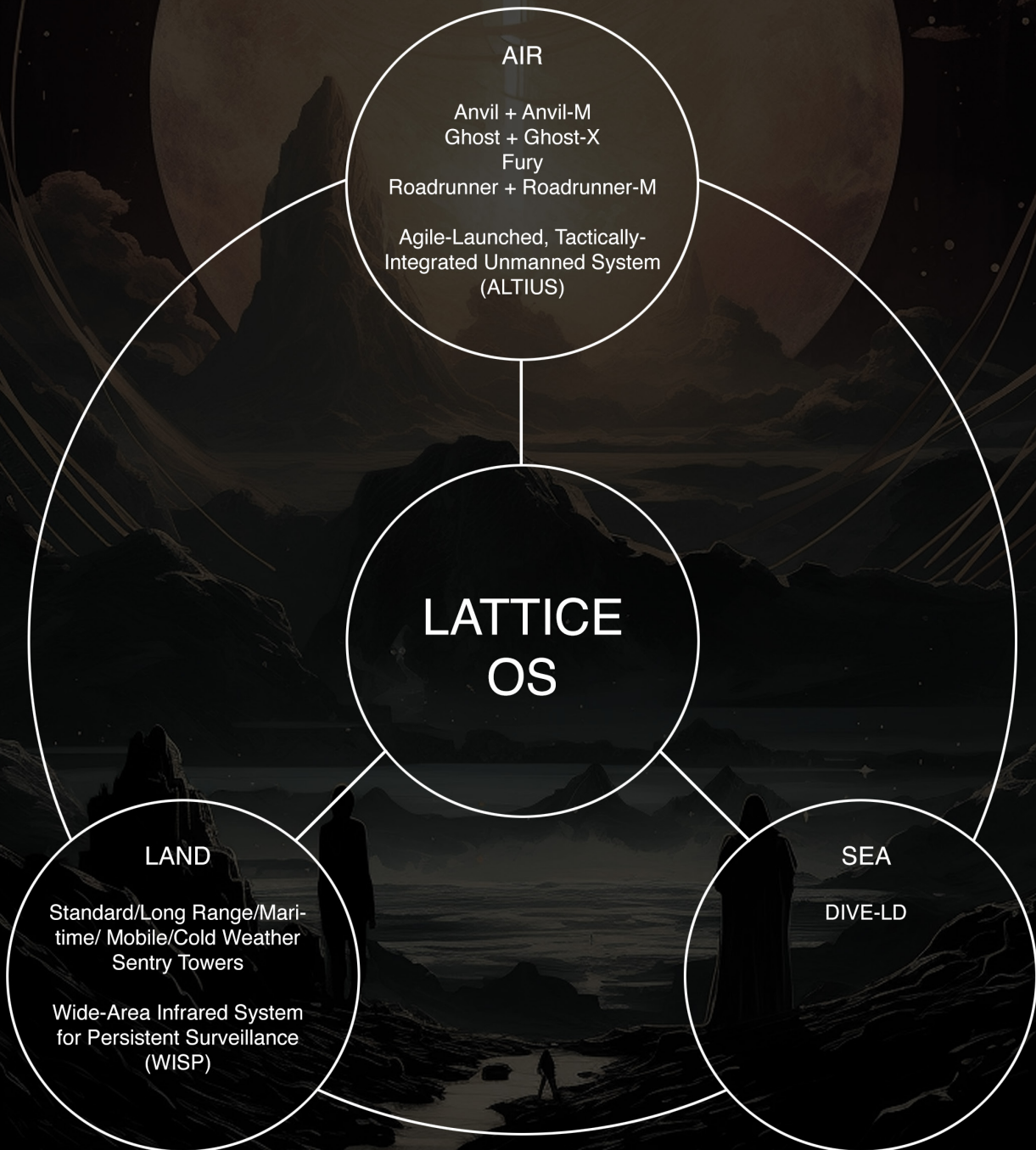for Persistent Surveillance
(WISP)

SEA

DIVE-LD

Figure 21 - Anduril Industries Product Line

Lattice OS

The Lattice AI platform is Anduril's core product. Every piece of hardware run by Anduril is run by Lattice technology. Lattice OS can be operated by computer, tablet, or VR headset. It fuses data from various sensors (drones, cameras, radars, etc.) to provide actionable insights in real-time. In addition to offering real-time understanding of the battlefield, Lattice OS provides decision making assistance by providing options for next moves. This decision making assistance also allows for quicker execution by giving the option for operator selection of a pre-developed sequence of action. Where a prior defense system would allow an operator to execute a function through a single command or button to produce a single action (e.g. change a course or fire a weapon), lattice allows an operator to execute complex functions as if they were giving an order to another human or team of humans. Lattice is able to synthesize large numbers of inputs to give an operator a comprehensive assessment of the battlefield and, as noted, provide suggested courses of action to assist quick decision making. Lattice allows a small number of operators to command a large number of assets in mission execution.

Lattice OS also supports autonomous operation of assets. The assets operating under the Lattice command and control software have AI-driven autonomous capabilities. The capability for these assets to independently execute more complex mission orders allows operators to divert less cognitive attention to each single asset. One of the major defenses against drones is electronic disruption of the communication tether; when an asset is able to operate autonomously, that communication tether is less of a vulnerability. Autonomy provides more resilient drone units and further enables a single operator to guide a larger number of assets.

Lattice can scale to integrate thousands of sensors and assets globally across land, air, sea, and space domains. Lattice was built and refined through real-world experiences and exercises.

Lattice OS was developed to meet the requirements for the DOD's Joint All-Domain Command and Control (JADC2) concept which called for the use of automation and AI to integrate battlefield inputs, provide assessment, and enable execution of outputs.

Sentry Towers

Sentry towers provide autonomous surveillance of the land, sea, and air domains for a variety of border and perimeter applications. The units are self-powered by solar. The Standard Range option provides ground surveillance and can detect a person to 2.8 km and a vehicle to 3.5 km. The Long Range option is configured to detect small, low-flying drones at ranges of up to 2 to 15 km depending on the drone. The Maritime option is configured for sea surveillance and can detect surface vessels to a range of over 15 km. A Mobile option places the Sentry Tower into a trailer form. A cold weather option provided with a generator and internal lens heaters to prevent frost on cameras.

Wide-Area Infrared System for Persistent Surveillance (WISP)

WISP is a compact, 360-degree, infrared passive monitoring system that uses AI to provide constant autonomous surveillance. WISP can be applied to the land, sea, and air domains. It can detect humans up to 5 km, vehicles up to 15 km, and drones from 5 to over 20 km away depending on type. It can detect commercial aircraft up to 150 km away.

Anvil and Anvil-M

Anvil is a small four-rotor aerial drone that provides the interception capability for the cUAS system. It can intercept and provide visual feedback or, in Anvil-M munition form, neutralize a threat. The Anvil is launched from a small portable rugged box hangar set up to carry two units. This allows easy transport to remote areas on demand.

Ghost and Ghost-X

Ghost is a small single-rotor style helicopter drone. It collapses into a small rifle case to be carried by a single human operator, and can reportedly be prepared for use in under 2 minutes and without tools. It is a UAV for surveillance and targeting applications. It weighs 37 pounds, can operate for up to 55 minutes, with a 7.5 mile range, and a 10 pound payload. There is a more capable 55 pound Ghost-X variant which can operate for up to 75 minutes with a range of 15.5 miles and 20 pound payload.

Fury

The purchase of Blue Force Technologies in 2023 provided Anduril with an expanded air systems capability. The Fury high-performance AAV product introduction followed. At 20 feet long, its design is as a small drone-version of a 5th generation fighter jet. It can be configured to different payloads depending on the mission. Previous reporting stated that Blue Force had designed it to fly at up to 50,000 feet and up to Mach 0.95.

Roadrunner and Roadrunner-M

Roadrunner is a twin-turbojet operator-supported AAV with vertical take-off and landing capability. Roadrunner-M is an explosive interceptor variant. Smaller than fury, it boasts of extreme maneuverability with similar subsonic top speeds. Roadrunner is provided with an automated, transportable hangar called Nest.

Agile-Launched, Tactically-Integrated Unmanned System (ALTIUS)

Altius is a tube-launched, 27 pound, AAV with more autonomy capability and a 4 hour operating time to enable loitering as-needed for surveillance or coordinated strike. There is a warhead-equipped Altius-M version for strikes. The versatile launch capability allows it to be used from land, sea, or air platforms. ALTIUS, and its Lattice OS integration, was demonstrated at the Army's EDGE23.

Dive-LD

Dive-LD is a small, 19 foot, unmanned submarine capable of both littoral and deep water operation providing for a wide range of undersea applications including surveillance, anti-submarine, anti-mine, and seafloor mapping. The vehicle can operate for up to 10 days and is set up to scale up to multi-week missions. It can operate as deep as 6000 meters and at speeds of 2 to 7 knots.
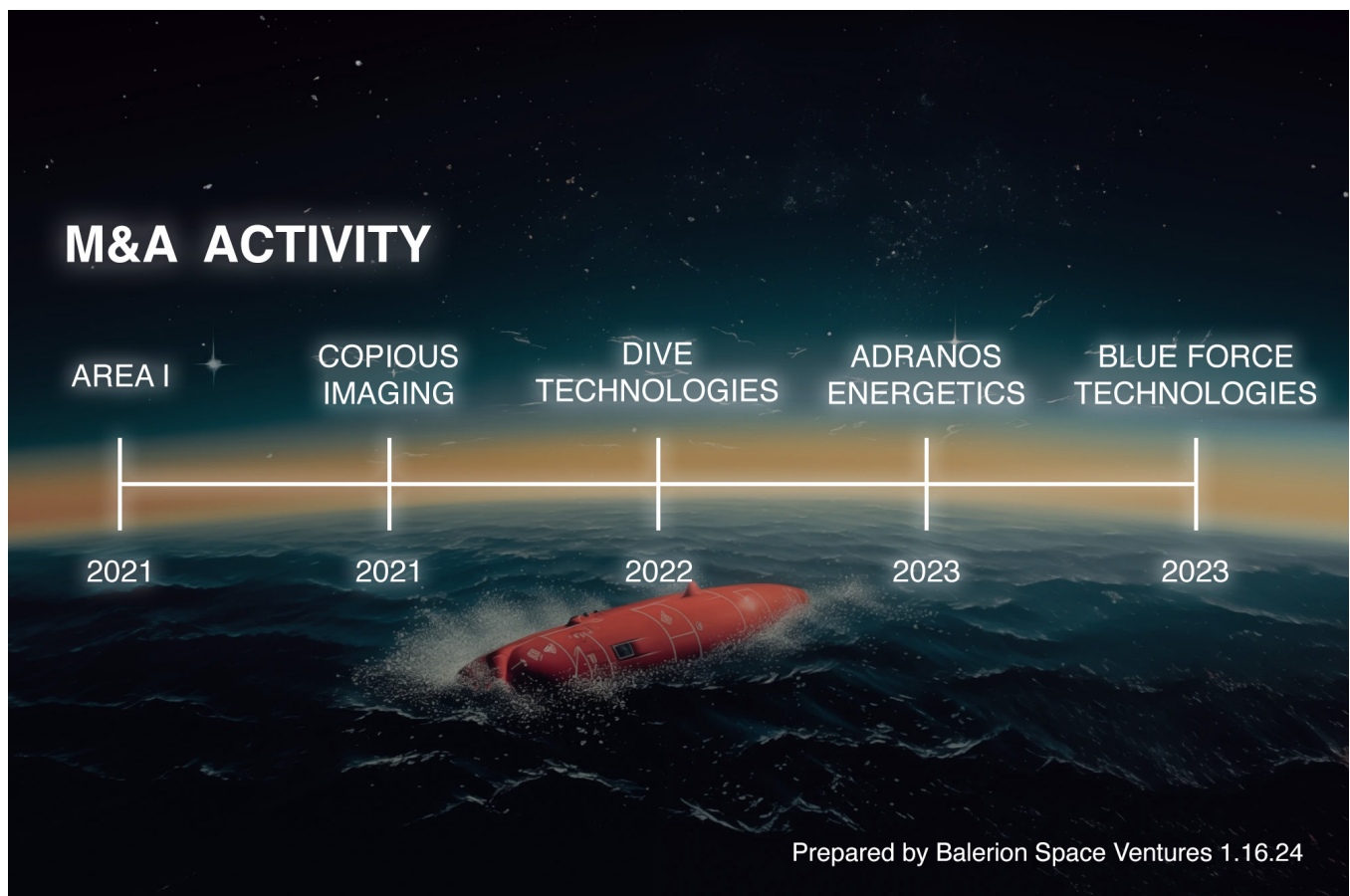
V: INVESTMENT PERSPECTIVE

We sit now at the dawn of a new era. Right here and right now there are space & defense companies building a better and safer world. They are pushing boundaries of what we thought was possible. In doing so, they are demonstrating to investors the transformational potential of allocating capital to this emerging category. Thinking through some of the future expansion opportunity areas for Anduril (Commercial Security, Disaster Management and Emergency Services, International Expansion, Space Surveillance, Infrastructure Monitoring) the design of Lattice will enable the addition of new technologies, domains, and requirements. Anduril's future market can potentially extend beyond defense and law enforcement, given the versatility of their technology.

The vital anchors to an investment in Anduril are as follows:

1.   Agility: Anduril innovative culture can potentially drive strong future revenues growth through its pipeline of innovative products – "pioneering solutions for the software-defined conflicts of tomorrow". As a technology company, Anduril's software and hardware processes have the advantage of quicker development cycles compared to traditional defense companies;

2.   Attractive Industry Dynamics: By leading a shift away from the status quo cost plus market model, Anduril is poised to capture market share in an industry with large revenue opportunities;

3.   Visionary Leadership: The combination of Palmer Luckey & Trae Stephens has delivered a dynamic duo of entrepreneurs focused on rebuilding the hardware base of the US. The strong leadership and novel approach to defense, Anduril can draw from the top talent in the tech industry;

4.   Integrated Hardware: While Anduril has software as an enabling and competitive advantage, it provides hardware to integrate in these systems;

5.   Technological Prowess: Anduril's facility with artificial intelligence and machine learning sets them apart from traditional

defense contractors and provides segment redefining capabilities in systems. More recently, Anduril has developed leading manufacturing innovations to complement the development and production of new forms of defense hardware;

6. Increased Demand for AI in Defense: As the world, including defense, continues to digitalize, the demand for AI-driven defense solutions has risen and will continue to. The software prowess in AI and robotics at Anduril is relatively unmatched in western defense markets;

7. Expanding International Market: Anduril primarily serves the US government. There is potential for growth in international markets as other nations seek to modernize their defense infrastructure. Although it is regulated, Foreign Military Sales (FMS), administratively handled by the US DOD, can be a significant source of revenue. For example, Lockheed Martin has 28% of 2021 net sales in international, including FMS;

8. Potential Commercial Applications: The technologies developed by Anduril may have uses outside of defense. They could potentially adapt their products for commercial sectors like security, logistics, or disaster management. For example, they have already participated in projects related to firefighting.

9. The Defense Mission in Space: As the defense mission grows to include assets in space for communication and intelligence, Anduril is positioned to provide for this expanding market.

10. M&A Activity: 1+1 = 3.

M&A ACTIVITY

AREA I	COPIOUS IMAGING	DIVE TECHNOLOGIES	ADRANOS ENERGETICS	BLUE FORCE TECHNOLOGIES
2021	2021	2022	2023	2023

Prepared by Balerion Space Ventures 1.16.24

Geopolitical Conflict Has Depleted Munitions

- Rising tensions globally have created an arms race, with Ukraine becoming a proving ground for new defense technology.

- The U.S. must grow stockpiles to replenish those sent to Ukraine.

- Private industry aims to bring new and cutting-edge technologies to meet the demand for defense capabilities.

- Munitions Spending Growth 2030E:
  Stinger (420%)
  Next Gen Std Missile (233%)

Inventory Replacement Times for Key Systems

	Number transferred to Ukraine	Production rate (year)	Manufacturing lead time (months)	Production time (months)	Total time to rebuild (months)
155 mm ammunition (recent rate)	1,074,000	93,000	Inventory rebuild not possible because of U.S. training requirements		
155 mm ammunition (surge rate)	1,074,000	240,000	12–18	44	59 (5 years)
155 mm precision munition—Excalibur (recent rate)	5,200	1,000	22	56	84 (7 years)
155 mm precision munition—Excalibur (surge rate)	5,200	2,400	22	23	48 (4 years)
Javelin (recent rate)	8,500	1,000	24	12	149 (~8 years)
Javelin (surge rate)	8,500	2,100	24	12	56 (~5.5 years)
HIMARS (recent rate)	20	20	26	12	37 (3 years)
HIMARS (surge rate)	20	72+	26	5	30 (2.5 years)
GMLRS (recent rate)	"Thousands"	5,000	17+	?	?
GMLRS (surge rate)	"Thousands"	10,000+	17+	?	?
Stinger (recent rate)	1,600	100?	24+	192	216 (18 years)
Stinger (historical rate)	1,600	350?	24+	55	79 (6.5 years)

Source: https://www.csis.org/analysis/rebuilding-us-inventories-six-critical-systems

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Company Overviews

ANDURIL

Total Raised: $2.2B | Key Investors: Founders Fund, Andreessen, General Catalyst, LUX | Last Round: Series E. HQ: Costa Mesa, CA

- **Founded** in 2017 by Oculus creator Luckey Palmer
- **Provides** critical defense capabilities, including counter-unmanned aerial systems, missile defense systems, tactical weapons, etc...
- **Supplies** the DoD through contracts with Army, Air Force, Marine Corps, & U.S Special Forces.

ADRANOS

Total Raised: $32.7m | Key Investors: Explorer 1 , Elevate, Bob Bishop, NO/LA Angel, SICA. Last Round: Series A. HQ West Lafayette, IN

- **Spun** out of Purdue University in 2018
- **Produces** propulsion systems for missile defense systems & space launch.
- **Proprietary** Aluminum-Lithium Alloy Solid Rocket Propellant **ALITEC** Enhances range, payload capacity, and speed of defense systems

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Deal Overview

Through its acquisition of **Adranos**, Anduril increases its ability to support the long-term goals of the U.S. DoD. Tactical and missile defense systems that fly longer, farther, and with heavier payloads increase the United States warfighter's capabilities and serve as a deterrent to prevent future conflict.

- Adranos' rocket motors are applicable for use on Anduril's platforms and on external major weapon systems.

- **ALITEC,** a proprietary fuel used in Anduril's rocket motors, enables advanced mission profiles.

- Anduril + Adranos = enabling faster military operations:
  - Missile Defense
  - Space launch
  - In-space capabilities.

Anduril's Multi-Mission Loitering Munition System, ALTIUS, can utilize Adranos' ALITEC to increase mission capabilities through improved distance and duration.

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4

Future Prime: Anduril in 2033

Markets that Anduril could possibly expand into could include some of the following:

1. Commercial Security: Anduril's surveillance and autonomous systems could be used in commercial security applications, such as securing large facilities or private properties.

2. Disaster Management and Emergency Services: The real-time situational awareness provided by Anduril's platforms could be invaluable in disaster response situations, helping to coordinate rescues, assess damage, and more.

3. International Expansion: There are numerous opportunities for further international expansion, as other countries look to upgrade their defense and security infrastructure.

4. Space Surveillance: As the space industry grows, there will be a need for tracking, surveillance, and possibly defense systems. Anduril's technology could potentially be adapted for these needs. Space Force awarded Anduril an $8 million contract extension to field its mesh networking software at Space Surveillance Network sites through December 2024.

5. Infrastructure Monitoring: From oil and gas pipelines to power grids, many industries require remote monitoring of infra-structure, which could be served by Anduril's technologies.