

EQUITY

Introducing the MarketVector™ Global Defense Industry Index

Discovering Global Leaders of the Defense Industry

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Investing in the Defense Industry

Since the establishment of nation-states, and especially since the late 18th Century, governments around the world have looked to maintaining a quantitative military edge as a means of deterrence and preparedness for military conflict as well as protection of economic interests. Historically, but particularly starting with World War II and the subsequent onset of the Cold War, conserving a military advantage requires enormous financial commitments including investments in research and development and massive long-term defense contracts. As national and global defense industries have privatized – a trend that accelerated from the 1970s to the present - persistent spending on military equipment and the development of new technologies presents a unique opportunity for investors.

The Russia-Ukraine war is the largest recent example of the traumas and economic burden that war and military conflict can cause. This brutal war is undeniably a humanitarian crisis and presents challenges for governments and investors, alike. Military supply chains are being put to the test, and governments are forced to respond quickly in what has evolved to be a costly conflict in terms of both loss of lives and finances. However, without the advancements in military technology, it would be significantly more difficult for Ukraine to defend against such an invasion. While it is a difficult topic to think of in financial terms, the war in Ukraine is a reminder of the vitally important role that defense-related companies play in the economy and financial markets.

In this paper, we provide insight into how investors can navigate investment opportunities and related risks by tracking global pure-play defense companies via the [MarketVector™ Global Defense Industry Index \(MVDEF\)](#). The defense industry offers investors a versatile diversification tool that is tied to geopolitical events and trends. Short-term defense spending around international conflicts, and long-term budgeting to preserve military technological advantages work to sustain demand for military equipment and services leading to the larger top and bottom lines. Additionally, military companies often have deep-rooted contracts with governments, which aids the stability of revenue streams. Finally, numerous breakthrough technological and industrial innovations of the last half century were either developed by - or initially used by - militaries or defense-related companies.

Investing in the defense industry also poses significant risks to investors, including the macro-driven nature of how supply and demand impact profits. On the supply side, critical resources and materials are typically globally outsourced which poses operational hazards as unpredictable global shocks can disrupt production. Moreover, defense companies often operate under contracts with the government, whose military budgets fluctuate.

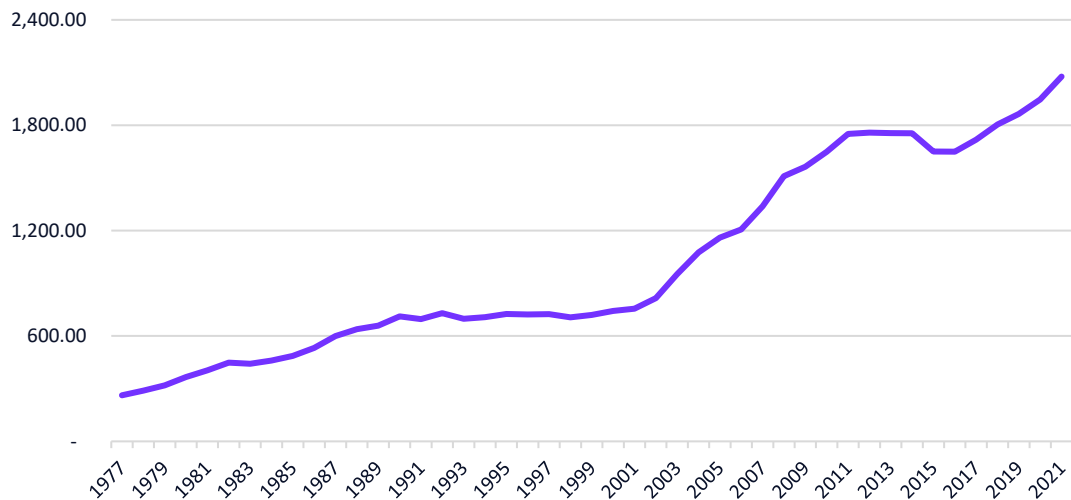
The [MarketVector™ Global Defense Industry Index \(MVDEF\)](#) is the first index that provides pure-play exposure specifically to companies that derive at least 50% of their revenue from the military or defense industries. The index is distinctive when compared to broader aerospace and defense indexes that also include companies primarily serving the civilian markets. The index takes a thematic approach, reaching across multiple traditional sectors to capture companies offering a variety of defense-related products and services including communications and command and control systems, unmanned vehicles, event response, information technology, cybersecurity, training and simulation software, digital forensics, and of course military equipment and arms.

Industry Growth and Drivers

Global Military Budget

One of the more reliable trends in global economics and politics is the persistent expansion of global military expenditures. As shown in Exhibit 1, from 1977 through 2021 world military expenditures in current USD terms have grown from roughly 250 billion to more than 2 trillion¹. In those 44 years world military spending declined only 9 times by an average of just -1.88%.

Exhibit 1: World Military Expenditures Since 1977



Source: Military Expenditure: World Bank.

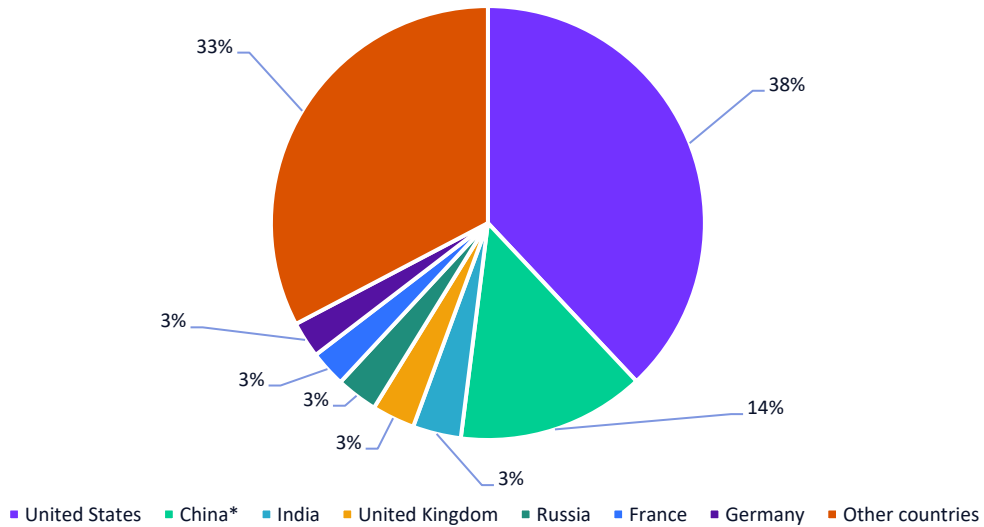
While military spending has risen in both peace and war times, military conflict can cause spikes in spending. Notably, after Russia’s military expenditure had declined from 2016 to 2019, in the run-up to the Russia-Ukraine war, Russia expanded their military expenditure by almost 3% to USD65.9 billion in 2021, which was 4.1% of their GDP at the time². Similarly, Ukraine’s military expenditure was 3.23% in 2021, while it was just 1.53% a decade prior³. On a global level, the United States is by far the world’s biggest spender as shown in **Exhibit 2**; about 38% of the world’s military budget is derived from the United States, whose budget increased 150% from 2000 through 2021. China is the next biggest contributor to the global military budget at 14% followed by India, the UK, Russia, France, and Germany which contribute between 2.7% and 3.6% each.

¹ Military Expenditure (current USD). World Bank. <https://data.worldbank.org/indicator/MS.MIL.XPND.CD>.

² World Military Expenditure Passes USD2 Trillion for First Time. Sipri. <https://www.sipri.org/media/press-release/2022/world-military-expenditure-passes-2-trillion-first-time>.

³ Ukraine: Ratio of military spending to gross domestic product (GDP) from 2011 to 2021. Statista. <https://www.statista.com/statistics/810835/ratio-of-military-expenditure-to-gross-domestic-product-gdp-ukraine/#:~:text=The%20ratio%20of%20military%20expenditure,comparison%20to%20the%20previous%20year.>

Exhibit 2: Distribution of military spending worldwide in 2021, by country



Source: Military Expenditure: World Bank.

Current Outlook

The current threat environment has been elevated following the Russian invasion of Ukraine. As a result, the US and North Atlantic Treaty Organization (NATO) nations are tapping into equipment and aid stockpiles to improve Ukraine’s prospect of holding off the offensive. Nations are also securing additional equipment and munitions to replenish depleted inventories. As the war continues, sustained demand for military resources puts pressure on available supply, which in turn benefits firms operating in this space as they ramp up production.

Aside from tensions in Europe, the China-Taiwan conflict has escalated as China continues to project power in the Western Pacific region. Although the risk of a ground invasion of Taiwan is viewed as limited, the effect of a perceived threat will drive demand for military goods and services. Taiwan mainly sources its defensive weaponry from the United States, and recently announced a USD1.1 billion arms sale for tactical air missiles, radar systems, and anti-ship missiles.⁴

Finally, the nations of the Middle East – especially in the Arab Gulf – have dramatically increased their defense spending in response to threats from Iran and its proxies, as well as ongoing sectarian warfare in Syria, Lebanon, and Yemen.

⁴ US Approves USD1.1 billion Taiwan Arms Sale. Defense News. <https://www.defensenews.com/pentagon/2022/09/06/us-approves-11-billion-taiwan-arms-sale/>.

Strategic Priorities

Defense demands are constantly evolving with modern international conflicts. The Defense Industrial Base (DIB) Sector, which is a general reference to a nation’s collection of businesses that contribute to the military-related sector, outlines areas of needed improvement and development for sustained military efficiencies. Often cited risks to defense industrial bases include materials shortages, reliance on foreign suppliers, budgeting goals, and obsolete technology. Among these risks, ensuring a technological edge is a costly endeavor that requires significant investment in research and development, as well as adaptation to keep up with the ever-changing threat landscape.

US military R&D increased by 24% from 2012 to 2021 while arms procurement funding fell by 6.4% over the same period, highlighting the tradeoff between investing in new technology and stockpiling existing arms⁵. Key drivers of R&D expenditure include those outlined to be essential by The United States Secretary of Defense for Research and Engineering: Directed Energy, Hypersonics, and Integrated Sensing and Cyber.⁶

Directed Energy	High-power lasers and microwaves provide innovative solutions for countering a wide range of threats. The main benefits include the distance and speed of these high-energy particle beams
Hypersonics	Hypersonic missiles have the capability to travel through upper-bound levels of the atmosphere at speeds of Mach 5 or greater. They are highly maneuverable making them strong tactical options
Integrated Sensing and Cyber	The use of electronic warfare in cyberspace has created a highly competitive setting where defending against sophisticated threats to communication and digital resources is essential.

⁵ IBID. World Military Expenditure Passes USD2 Trillion for First Time. Sipri. <https://www.sipri.org/media/press-release/2022/world-military-expenditure-passes-2-trillion-first-time>.

⁶ Critical Technology Areas. USD (R&E). <https://www.cto.mil/usdre-strat-vision-critical-tech-areas/>.

Military Technology Transfer

Defense-related research efforts have led in part to numerous significant innovations of modern society, ranging from cyber security to the internet and GPS to drones. While military and defense related companies earn the vast majority of their revenue directly from defense supplies, services and technologies, they also stand to benefit from the transfer of military technology to civilian use.

- ▼ Global Positioning System (GPS) was originally discovered by the U.S. Department of Defense (DoD) for military use and is now widely used in civilian navigation. In the 1960's the United States Navy used satellite navigation techniques to monitor submarines. Civilian use was not enabled until the 1980s, following the Korean Air Lines Flight 007 tragedy, when a commercial aircraft was shot down by Soviet Air Forces after a navigational incident.
- ▼ The Internet, which was also created by the DoD during the Cold War, was built as a means of communication between government agencies. The ARPAnet was the first functional prototype that enabled multiple computers to communicate on a single network. In 1969, the first message was sent from a computer located at UCLA to one at Stanford. The message sent was "LOGIN", however, the network crashed after the Stanford computer received the message's first two letters 'LO'.
- ▼ The UK's Royal Air Force commenced in 1918. To train pilots in aerial target practice, a radio-controlled drone called the de Havilland DH82B Queen Bee was used and is considered the first modern drone.
- ▼ The microwave oven was said to be stumbled upon by a Raytheon engineer in 1945. At the time, the engineer was conducting experiments with a new type of vacuum tube called a magnetron, which was being developed for radar systems during World War II.

Defense Company Examples

Safran SA

Safran SA is a French multinational company that specializes in aerospace and defense. They manufacture aircraft engines, landing gear, and other aerospace systems, as well as defense products such as missiles, drones, and electronic warfare systems. Safran SA is involved in several projects and technologies in the defense industry including: the production of the M88 engine, which powers the Dassault Rafale fighter jet, used by several countries' air forces, the development of the Oxygen Generating System (OGS) for the International Space Station (ISS), and the buildout of the European Space Agency's Ariane 6 rocket, which is set to become the main launch vehicle for European satellite launches. Safran reported about EUR19.5 billion in revenue for FY 2022, with Equipment & Defense and Military Engines constituting most of the revenue⁷.

Hensoldt AG

Hensoldt AG is a German company that specializes in defense and security technology. They provide a wide range of products and services, including airborne radar systems for fighter jets and airborne early warning and control (AWACS) aircraft, electronic warfare systems for military aircraft and ships, as well as cybersecurity solutions for government and industrial customers. They provide military solutions for land, sea, air, space, and cyber-based warfare. Hensoldt AG earned 1.474 billion in revenue for FY 2021⁸.

AeroVironment, Inc.

AeroVironment, Inc. is an American company that designs, develops, and manufactures unmanned aircraft systems (UAS), electric vehicle charging systems, and related technologies. They provide a wide range of products and services for military customers, including hand-launched UAS for reconnaissance and surveillance, and tactical missile systems for use in ground combat. In FY 2021, 60% of their USD395 million in revenue was derived from small UAS⁹.

⁷ Safran SA FY 2022 Results.

⁸ Hensoldt AG FY 2021 Results.

⁹ AeroVironment, Inc. FY 2021 Results.

Index Design and Architecture

Thematic Criteria

Companies in the [MarketVector™ Global Defense Industry Index \(MVDEF\)](#) must initially derive 50% of their revenues specifically from the military or defense industries (including related national/federal governmental departments but excluding civilian markets) related to the following products and services:

- ▼ general aerospace and defense products and services,
- ▼ communications systems and services, including satellites, unmanned vehicles, event response, security, or safety-related software,
- ▼ information technology hardware and services,
- ▼ cybersecurity software,
- ▼ training and simulation software and products, digital forensics,
- ▼ detection devices, and
- ▼ e-authentication/biometric identification.

The revenue buffer of 50% ensures that the index is comprised of pure-play defense and military companies. This threshold is unique in that it enables the [MarketVector™ Global Defense Industry Index \(MVDEF\)](#) to take a targeted approach to identifying pure defense companies as opposed to non-pure-play companies involved in commercial aviation, such as Boeing Co, who reported about 35% of revenue from Defense, Space & Security¹⁰. The constituents, therefore, offer maximum exposure to the market segment of ‘Defense’ as opposed to the generic ‘Aerospace & Defense’.

ESG Factors

While the debate continues on whether defense, as a whole, can be categorized as sustainable, a suitable index should still consider companies that meet certain minimum safeguards. Integrating ESG-related standards in index design serves to ensure that companies included in the [MarketVector™ Global Defense Industry Index \(MVDEF\)](#) are adhering to global norms on human rights standards. Screened factors include Norm-Based Research Overall Scores as well as Controversial Weapons including biological weapons, chemical weapons, cluster munitions, and depleted uranium.

¹⁰ Boeing Co FY 2021 Results.

One specific example of a chemical weapon that is screened for is White Phosphorus. Although it does not violate the Chemical Weapons Convention (CWC)¹¹, the munition is considered particularly controversial due to its potential use against civilians. Likewise, the relevant ESG filter screens for Depleted Uranium. The radioactive nature of this heavy metal is poisonous, and therefore also controversial. Among other factors, these are just two filters that establish a baseline for humanitarian considerations.

Index Components & Weight Breakdown

Listed in **Exhibit 3** are the 31 components that comprise the MarketVector™ Global Defense Industry Index (MVDEF) as of the 2023 Q1 review. The 3 main sub-themes include Military and Defense, Technology and Defense Consulting, and Space Exploration and Defense. The more traditional defense companies are categorized under Military and Defense, while those that don't mainly manufacture weapons but are still pure-play defense companies are listed as Technology and Defense Consulting.

Geographically, defense companies headquartered in the United States account for most of the weight in MVDEF, followed by France, as seen in **Exhibit 4**. Current components of MVDEF in 2023 Q1 represent nine countries, making the index uniquely global.

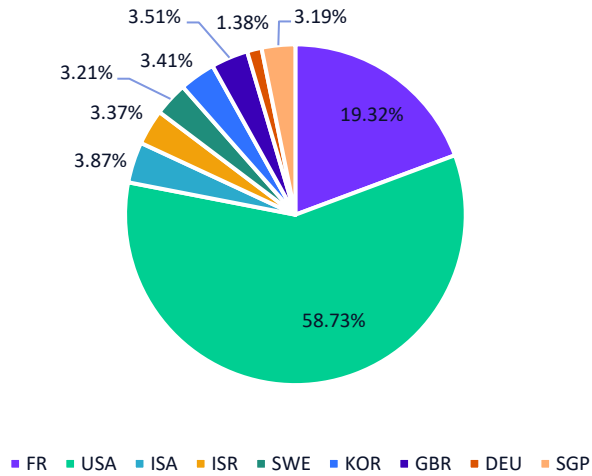
Exhibit 3: Components by themes of MVDEF

Name	Subtheme	Weight (Capped)	Country
SAFRAN SA	Military Aircraft	8.00%	FRANCE
THALES SA	Military Aircraft	8.00%	FRANCE
PALANTIR TECHNOLOGIES INC	Technology and Defense Consulting	8.00%	UNITED STATES
LEIDOS HOLDINGS INC	Technology and Defense Consulting	8.00%	UNITED STATES
BOOZ ALLEN HAMILTON HOLDING CORP	Technology and Defense Consulting	7.74%	UNITED STATES
KBR INC	Technology and Defense Consulting	4.65%	UNITED STATES
CURTISS-WRIGHT CORP	Technology and Defense Consulting	4.51%	UNITED STATES
HUNTINGTON INGALLS INDUSTRIES	Naval Shipbuilding	4.35%	UNITED STATES
LEONARDO SPA	Military Aircraft	3.87%	ITALY
CACI INTERNATIONAL INC -CL A	Technology and Defense Consulting	3.72%	UNITED STATES
ELBIT SYSTEMS LTD	General Military and Defense	3.37%	ISRAEL
DASSAULT AVIATION SA	Military Aircraft	3.32%	FRANCE

¹¹ Chemical Weapons Convention. OPCW. <https://www.opcw.org/chemical-weapons-convention>.

SAAB AB CLASS B	Military Aircraft	3.21%	SWEDEN
SINGAPORE TECH ENGINEERING	Military Aircraft	3.19%	SINGAPORE
SCIENCE APPLICATIONS INTERNATIONAL CORP	Military Electronics	2.93%	UNITED STATES
BWX TECHNOLOGIES INC	General Military and Defense	2.85%	UNITED STATES
MAXAR TECHNOLOGIES LTD	Space Communications and Defense	2.67%	UNITED STATES
KOREA AEROSPACE INDUSTRIES LTD ORD	Military Aircraft	1.76%	SOUTH KOREA
HANWHA AEROSPACE CO LTD	Military Aircraft	1.65%	SOUTH KOREA
MERCURY SYSTEMS INC	Military Electronics	1.62%	UNITED STATES
MOOG INC-CLASS A	General Military and Defense	1.55%	UNITED STATES
PARSONS CORP	Technology and Defense Consulting	1.48%	UNITED STATES
BABCOCK INTERNATIONAL GROUP PLC	General Military and Defense	1.44%	UNITED KINGDOM
HENSOLDT AG	Military Electronics	1.38%	GERMANY
QINETIQ GROUP PLC	Technology and Defense Consulting	1.37%	UNITED KINGDOM
AEROVIRONMENT INC	Unmanned Aircraft	1.24%	UNITED STATES
KRATOS DEFENSE & SECURITY SOLUTIONS INC	Space Communications and Defense	1.06%	UNITED STATES
ROCKET LAB USA INC	Space Communications and Defense	0.90%	UNITED STATES
OSI SYSTEMS INC	General Military and Defense	0.79%	UNITED STATES
CHEMRING GROUP PLC	Military Electronics	0.70%	UNITED KINGDOM
PLANET LABS PBC	Space Communications and Defense	0.68%	UNITED STATES

Exhibit 4: Components by countries of MVDEF

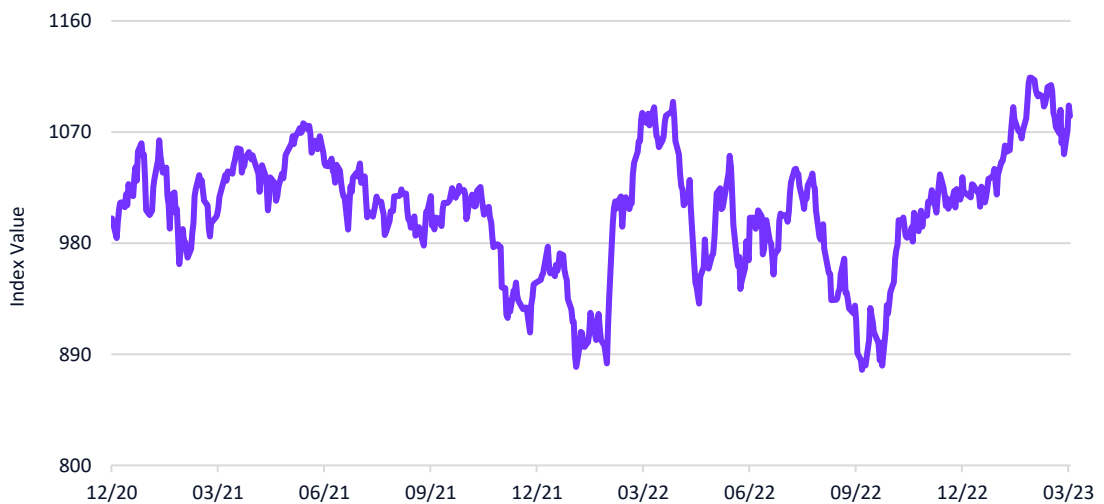


Source: MarketVector Indexes™ ("MarketVector").

Performance

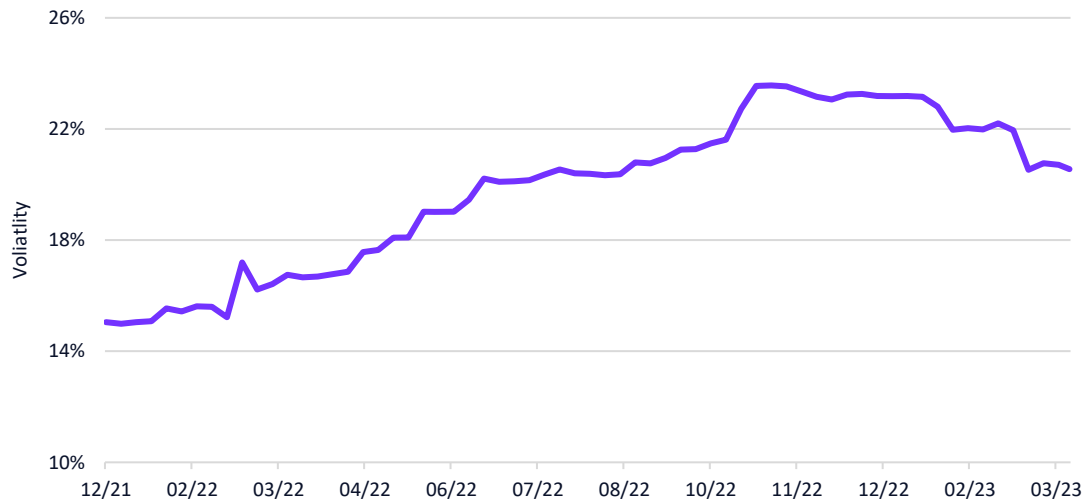
The MarketVector™ Global Defense Industry Index (MVDEF) has back-tested history from the end of 2020, as shown in **Exhibit 5**. Since inception, the index is up 10%, which is attributable to tailwinds provided by sustained defense budgeting and strong equity markets. Depicted in **Exhibit 6** is the rolling 12-month annualized volatility of MVDEF, which was 22.58% for the past year of data.

Exhibit 5: Historical Return of MVDEFTR



Source: MarketVector. Data as of March 22, 2023.

Exhibit 6: Rolling 12-Month Annualized Volatility



Source: MarketVector. Using weekly data. Data as of March 22, 2023.

Conclusion

The global defense industry is a constantly evolving and intricate sector that attempts to maintain the safety of nations and their people through technological progress. It is heavily influenced by government contracts and global politics, driven by the constant need to fulfill the leadership's responsibility of ensuring the security of their citizens. Investing in the defense industry adds diversification to a portfolio and offers exposure to a growing global industry tied to relatively stable government contracts.

The continuous commitment to modernize military technology drives demand and innovation in an industry where doing so can save lives. These efforts go beyond weaponry and munitions to include companies involved in a range of unique sub-sectors; Defense Electronics, such as UAVs, radar, and sonar; well as Defense Services, such as training, intelligence, cybersecurity, and simulation software. Investing in the defense sector is commonly perceived as having a degree of portfolio insurance against global instability. While this can well be the case, the sector also plays a pivotal role in international diplomacy and peacekeeping initiatives.

MarketVector maintains one of the largest families of thematic equity indexes, powered by a proprietary index classification methodology that allows our clients to target with unparalleled precision, going beyond the limitations of traditional benchmarks. The [MarketVector™ Global Defense Industry Index \(MVDEF\)](#) expands MarketVector™ Indexes listed under the meta theme "Thematic Industrials".

Find out more [here](#)

IMPORTANT DEFINITIONS AND DISCLOSURES

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