Nasdaq

Investing in America's Security and Critical Infrastructure

The Launch of the DEFENSE Index

The Nasdaq Yewno Aerospace & Defense Index (Ticker: DEFENSE) was launched on October 19, 2020 with a base value of 1,000.00 and 50 constituents. The index employs a novel, alternative data-based approach to define the universe of companies that are critical to maintaining and enhancing the national security of the United States. By disregarding traditional sector classifications from the likes of S&P and MSCI (GICS), the index methodology instead focuses on the underlying data that captures the full extent of economic relationships between various companies and defense-related arms of the US government. The index methodology also considers an important indicator of any company's prospects for growth in the industry: research and development efforts as quantified by patent filings. The "patent factor" leverages machine learning – developed by Nasdaq's product partner, Yewno – to identify the multipronged, thematic relationships between individual scientific advances and their real-world applications across commerce and investment. As a result, DEFENSE represents a highly differentiated, dynamic evolution in constructing an Aerospace & Defense index for the economy and geopolitics of the 21st century.

Methodology

The methodology entails a multistep process of identifying the broader universe of potentially eligible companies, followed by a straightforward ranking of alternative data inputs from Nasdaq's product partner Yewno, and as a final step, applying a series of simple screens. Starting with the Nasdaq Global Index (NQGI) of approximately 9,000 equities as well as any non-NQGI US-listed equities, Yewno appends revenue contract data from four US government agencies: Department of Defense, Department of Homeland Security, Department of Energy, and NASA (collectively deemed "National Security Revenue"). Contract amounts are adjusted depending on:

• Whether there are multiple contractors on a given contract;

• Whether the contract has ever been modified;

• Whether contracts were awarded at the company parent or subsidiary level;

• Whether they are truly "outstanding," i.e. selected based on clearly defined start and end dates.

More specifically, the methodology only considers contracts that are live as of the reference date for the index, which is every February and August month-end, and only those that were awarded at most 12 months prior to the reference date. Yewno's approach to this publicly-available data yields prorated "current" and "projected" revenue amounts based on where a company is in the lifecycle of its government contract, and ensures that companies with government contracts that have recently expired will no longer be considered eligible for the index.

In addition to appending contract revenue, Yewno downloads patent filings data from the US Patent Office and the World International Patents Office on a rolling one-year window, using Yewno's proprietary A.I.-derived patent classification to screen for only those relating to: Aerospace, Ammunition, Communications, Explosives, Heavy Weapons, Infrastructure, Naval Equipment, Small Arms and Training, Nuclear, and Personal Equipment. [1] Yewno then calculates for each company in the universe (NQGI + non-NQGI US-listed) patent "contribution" and "exposure" ratios at the parent level. In other words, the data show what percentage of the aggregate Aerospace & Defense patent activity each company was responsible for in the most recent one-year timeframe, as well as what percentage of each company's total patent activity related specifically to Aerospace & Defense (respectively). Both the patent and contract revenue datasets are updated on a monthly basis, but again, for purposes of this index, only data as of February or August month-end are considered.

With Yewno's real-world, alternative data at hand, three separate rankings are determined for each company: total (i.e. "current" + "projected") national security revenue; patent contribution; and patent exposure. For companies with multiple listings in both the US and internationally, only the most liquid US listing is ranked to ensure one security per company qualifies for the next stage of the eligibility criteria, which are as follows:

1. Top 50 Companies by Revenue are automatically included;

2. Companies ranked 51-200 by Revenue, but ranked in the Top 50 by either Patent Exposure or Patent Contribution ratio are also included;

3. Finally, firms without any listings in the US are removed.

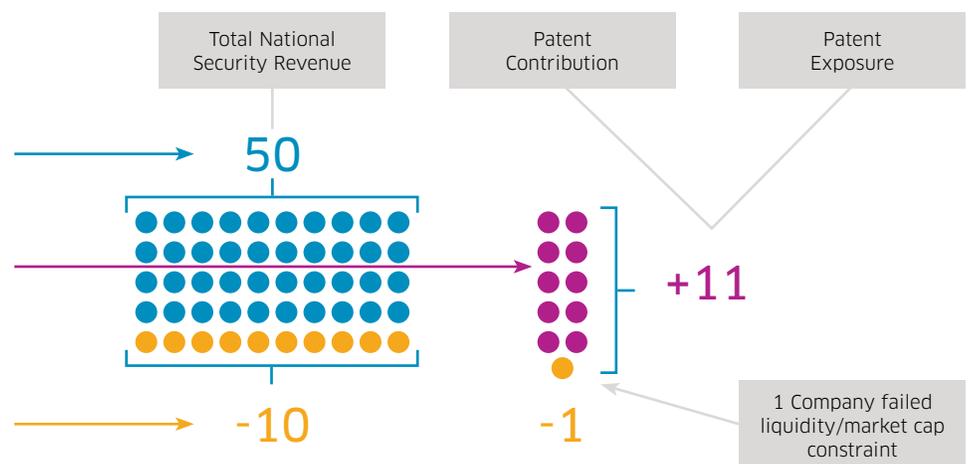## Index Launch: Constituent Selection Process
August 2020

Universe: Nasdaq Global Index (~9,000 equities) + Non-NQGI US-listed equities

Yewno appends revenue contract data from four US government agencies:

- Department of Defense
- Department of Homeland Security
- Department of Energy
- NASA

Three separate rankings are determined for each company

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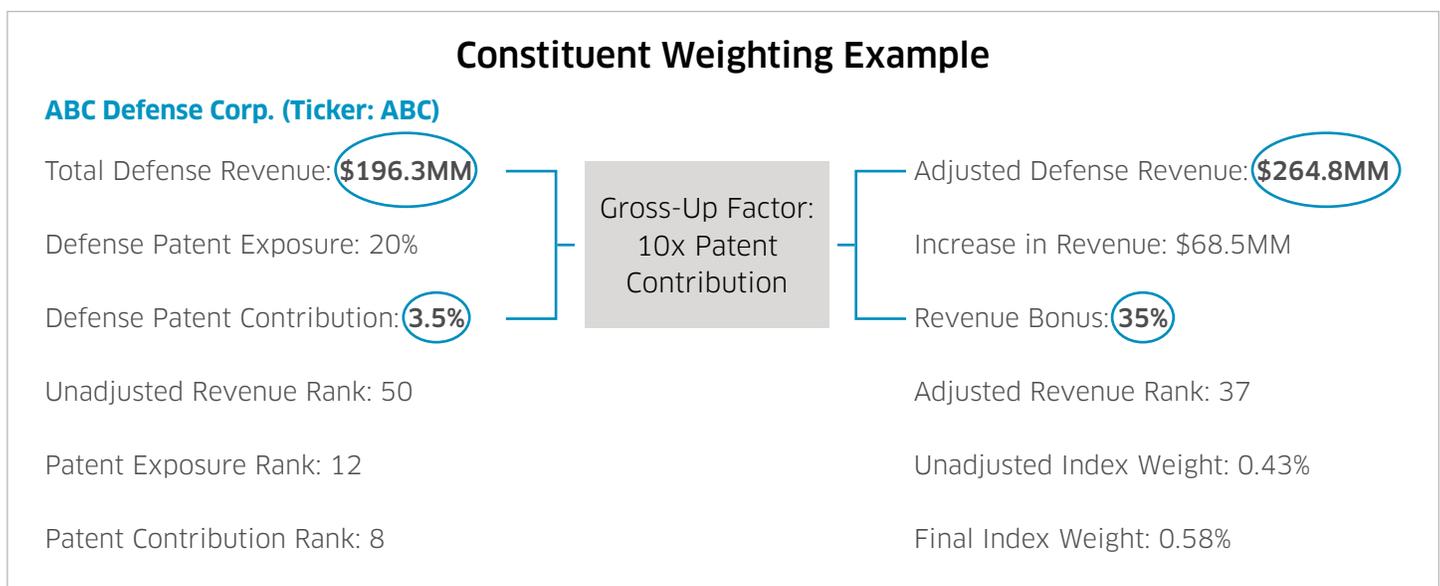3. Finally, firms without any listings in the US are removed

Total National Security Revenue

Patent Contribution

Patent Exposure

50

+11

-10

-1

1 Company failed liquidity/market cap constraint

50 Final Constituents in Nasdaq Yewno Aerospace & Defense Index

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The index methodology considers all firms globally with competitive rankings in revenue and patents, but ultimately selects only US listings for the index. The remainder of the screens applied include fairly standard constraints around minimum market capitalization ($100MM), minimum liquidity (3-month average daily dollar trading volume of at least $1MM), seasoning criteria (minimum of 3 months of trading history), and listing exchange (The Nasdaq Stock Market, the New York Stock Exchange, NYSE American, or CBOE BZX Exchange). Notably, OTC ADRs of international firms are ineligible.

With the constituents finalized, the methodology then applies the weighting scheme, which mirrors the modified market-cap weighting approach of several other Nasdaq indexes such as the Nasdaq Biotechnology Index (NBI), wherein the Top 5 constituents are capped at a maximum weight of 8% while the rest are capped at 4%. Instead of using market capitalization, however, the DEFENSE Index uses the national security revenue amounts of each company in the index to determine relative weights, with one unique element. Companies with patent activity receive a revenue "bonus" based on their contribution ratio, to reflect an expectation that revenues in the future will increase as a function of recent investments in R&D. The gross-up factor is always 10 times the patent contribution percentage, meaning a hypothetical company contributing 50% of all Aerospace & Defense patents will see its revenue increase by 500%. In practice, the bonus function works as in the following real-world example:

Constituent Weighting Example

ABC Defense Corp. (Ticker: ABC)

Total Defense Revenue: **$196.3MM**	Gross-Up Factor: 10x Patent Contribution	Adjusted Defense Revenue: **$264.8MM**
Defense Patent Exposure: 20%		Increase in Revenue: $68.5MM
Defense Patent Contribution: **3.5%**		Revenue Bonus: **35%**
Unadjusted Revenue Rank: 50		Adjusted Revenue Rank: 37
Patent Exposure Rank: 12		Unadjusted Index Weight: 0.43%
Patent Contribution Rank: 8		Final Index Weight: 0.58%

The patent adjustment does not, in any case, supersede the capping constraints of 8% and 4% on the Top 5 constituents vs. the rest of the index, respectively.
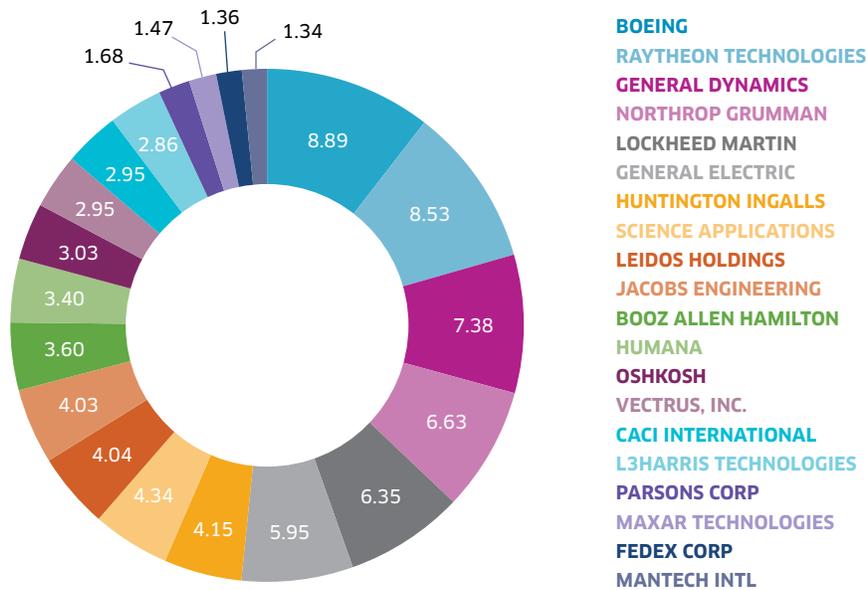
Composition

As one may reasonably expect, the methodology for DEFENSE yields a fairly concentrated index, owing to the real-world concentration in the industry among the largest firms. Without capping, the 5 largest firms (Lockheed Martin, Boeing, Raytheon Technologies, General Dynamics, and Northrop Grumman) would earn a collective weight of approximately 85% in the index. Since they were each capped at 8% at index launch, their collective initial weight was only 40%.
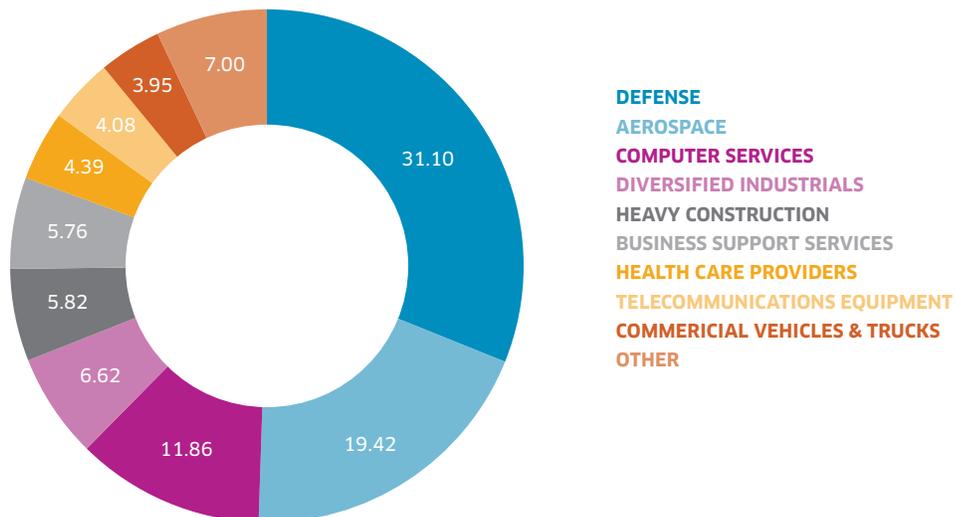
As of December 31, 2020, the Top 20 largest constituents represented 85% of the index weights. Beyond the Top 5, they included some other well-known names in the space such as General Electric and Booz Allen Hamilton, as well as some names less frequently associated with Aerospace & Defense, such as the health insurer Humana and FedEx. As a result of the index methodology being agnostic about traditional industry classifications such as GICS or ICB, as well as valuing above all else the raw dollar amount of national security revenue – irrespective of the percentage of a company's total revenue – DEFENSE stays true to its underlying goal, which is to track the companies that have the most consequential impact on the ability of the US government to fulfill its national security obligations. Instead of focusing solely on aircraft, weapons and the like, DEFENSE also considers companies that provide

logistics, food, shelter, insurance, fuel, and any other technology or service that these government agencies need private sector assistance to deliver. The result is an index that is more diversified than its competitor indexes, which tend to be limited by rigid sector classifications. Whereas indexes such as the S&P Aerospace and Defense Select Industry Index (SPSIAD) and the Dow Jones U.S. Select Aerospace & Defense Index (DJSASD) allocate 80-90% of their weights to Aerospace & Defense (as defined by ICB classifications of Subsector; 98%-100% as defined by GICS classifications of Sub Industry), DEFENSE allocates only slightly more than 50% (ICB or GICS).

Top 20 Constituents as of December 31, 2020

Pie chart values: 8.89, 8.53, 7.38, 6.63, 6.35, 5.95, 4.15, 4.34, 4.04, 4.03, 3.60, 3.40, 2.95, 2.95, 3.03, 2.86, 1.68, 1.47, 1.36, 1.34

Legend:
- BOEING
- RAYTHEON TECHNOLOGIES
- GENERAL DYNAMICS
- NORTHROP GRUMMAN
- LOCKHEED MARTIN
- GENERAL ELECTRIC
- HUNTINGTON INGALLS
- SCIENCE APPLICATIONS
- LEIDOS HOLDINGS
- JACOBS ENGINEERING
- BOOZ ALLEN HAMILTON
- HUMANA
- OSHKOSH
- VECTRUS, INC.
- CACI INTERNATIONAL
- L3HARRIS TECHNOLOGIES
- PARSONS CORP
- MAXAR TECHNOLOGIES
- FEDEX CORP
- MANTECH INTL

Index Weight by ICB Subsector as of December 31, 2020

Pie chart values: 31.10, 19.42, 11.86, 6.62, 5.82, 5.76, 4.39, 4.08, 3.95, 7.00

Legend:
- DEFENSE
- AEROSPACE
- COMPUTER SERVICES
- DIVERSIFIED INDUSTRIALS
- HEAVY CONSTRUCTION
- BUSINESS SUPPORT SERVICES
- HEALTH CARE PROVIDERS
- TELECOMMUNICATIONS EQUIPMENT
- COMMERICIAL VEHICLES & TRUCKS
- OTHER

Performance

Backtested performance from April 19, 2013 through October 16, 2020 compares favorably with other Aerospace & Defense indexes. The simulated total return for DEFENSE was 219% over the period vs. 205% for SPSIAD, and only 157% for DJSASD. One other notable index in the space – the SPADE Defense Index (DXS) – generated total returns of 196%; it tends to feature a less homogeneous sector exposure than its S&P/Dow Jones counterparts, with recent allocations to Aerospace & Defense of 67% per GICS Sub Industry and 61% per ICB Subsector. Approximately three months since launching, the DEFENSE Index continues to outpace DXS and DJSASD on a cumulative basis, with live total returns of 14.1% for investors tracking (as of January 12, 2021). Meanwhile, SPSIAD has notably outperformed, up 26.6% – but not as a result of weighting differentials in overlapping constituents. Instead, it generated 13.4% of outperformance during this timeframe from 7 of its 8 top-performing constituents (in terms of contribution to portfolio returns) that did not overlap with DEFENSE. Among these 7 companies, two had no active contracts with the four defense-related US government agencies, while the remaining firms were ranked 62nd, 66th, 184th, 263rd, and 327th in terms of revenue. Of the three ranked in the top 200 by revenue, none had any Aerospace & Defense-related patent activity.[2]

Cumulative Total Returns vs. Competitor Indexes (thru Jan 12, 2021)
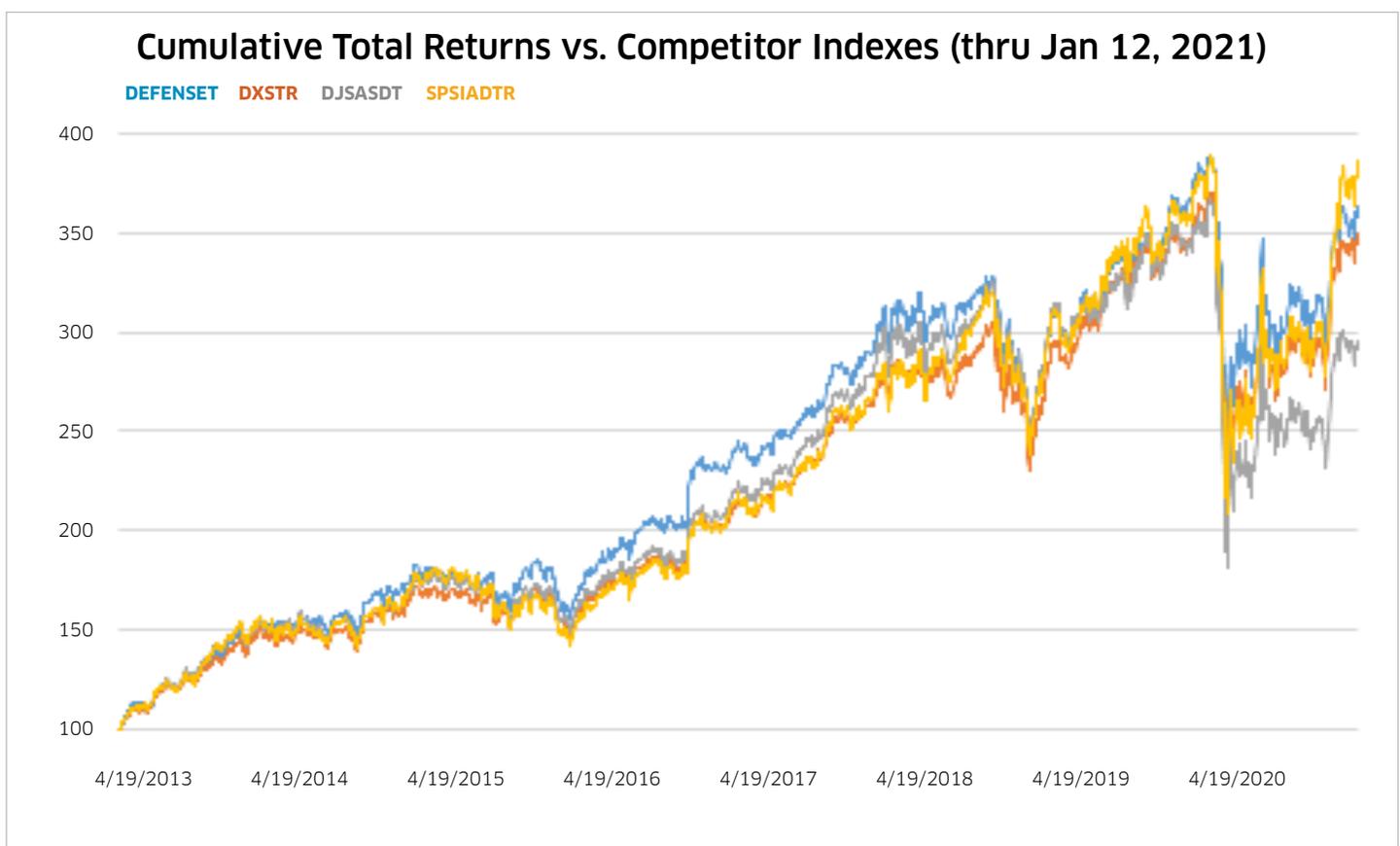
In terms of individual constituent price performance, 2020 could not appear more different from the preceding year. In 2019, all but one of the 20 largest index constituents registered positive returns over the full year, up 46% on average. Performance in 2020 has been disappointing, with an average gain of only 7% across the same group of companies. Several names outside of the traditional Aerospace & Defense classification – Booz Allen Hamilton, Jacobs Engineering, and FedEx most notably – nonetheless registered strongly positive returns, up 23%, 21%, and 72% respectively.

2   The 7 firms unique to SPSIAD, in order of their contribution to portfolio return between 10/16/20-1/12/21: Spirit Aerosystems Holdings, Triumph Group, Howmet Aerospace, Hexcel Corp, AAR Corp, Kratos Defense & Security, and Axon Enterprise.

Broadly speaking, 2020 has not been the most auspicious of years for many of the Aerospace-exposed companies in the index, especially Boeing and General Electric. The Covid-19 pandemic severely crimped demand for business and leisure travel alike, clouding the longer-run outlook for airlines and all of their related suppliers. Thankfully, with multiple successful vaccines already in the pipeline, investors can look towards the second half of 2021 for a likely recovery to begin in earnest. In the meantime, government support for many of the impacted firms in the index is all but assured, given the stickiness of much of their government contract revenue, as well their status as national security-critical firms. Unless the United States reverses a decades-long trend of steadily increasing military expenditures, DEFENSE should continue to benefit from this implicit "government put" (i.e., backstop) on both the topline revenue outlook as well as the long-run solvency risk of some of the largest companies.

Top 20 FY 2020 % Performance vs. FY'19
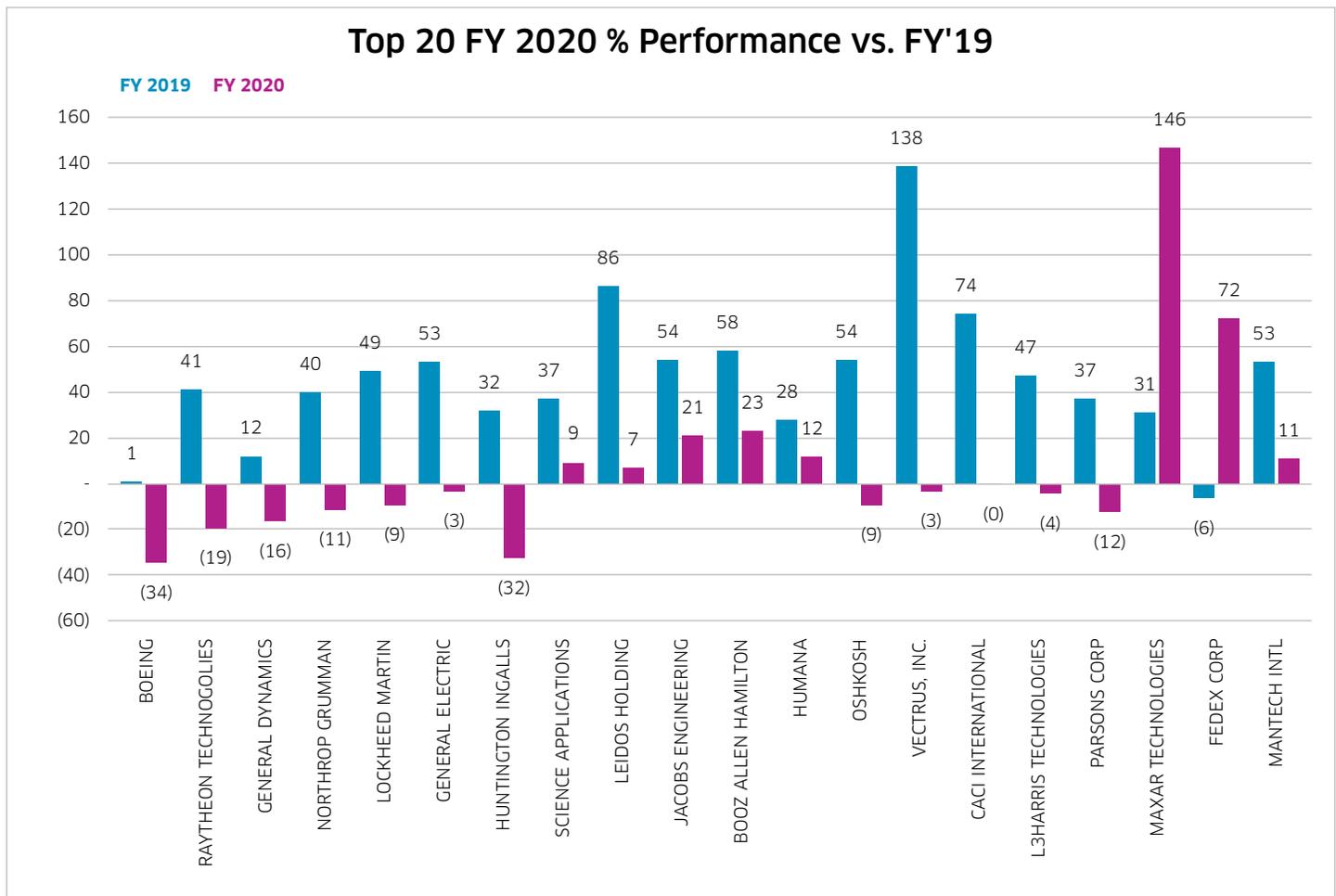
Innovation

As a group, the index launch basket of 50 companies represented just over 40% of all Aerospace & Defense patent activity in the one-year period ending August 31, 2020. Keeping in mind that the patent dataset encompasses nearly 9,000 companies globally, this represents a disproportionate, outsized slice of the R&D pie within the space. On average, the 25 companies in the index with mapped activity devoted 9.2% of all their patent filings to Aerospace & Defense-related endeavors. General Dynamics devoted 50% of its patent filings to this one area – the most "exposure" of any constituent. Lesser-known names such as Viasat, Maxar Technologies, and Gogo also devoted in excess of 20%. In terms of patent "contribution" it was Boeing that scored the highest, filing just over 10% of all Aerospace & Defense patents.

Summary

The Nasdaq Yewno Aerospace & Defense Index differentiates itself by ignoring the traditional industry classifications relied upon by competitor indexes, instead focusing its methodology on alternative, real-world data that does not show up in financial statements. As devised, the DEFENSE Index selects and weights companies according to the strength of their contributions to the national security of the United States. It accomplishes its goal by analyzing publicly available information on active government contracts between four crucial government agencies and their private sector partners, irrespective of the type of product or service a company may be providing. These agencies that are tasked with safeguarding the country's national security look to the constituents of the DEFENSE Index to provide not only the most obvious products associated with warfare, but also a wider array of goods and services, whether traditionally defense-related or not. The US government's process for awarding defense-related contracts is reflected by the index in real time, ensuring that its portfolio of companies will evolve to meet the continually changing demands for keeping America safe. The index further considers the contributions of companies towards research & development – as it relates specifically to Aerospace & Defense – in selecting and weighting certain index constituents more so than others. The unique "patent factor" thus orients the index toward an innovation bent, and anticipates future growth arising from today's investments in R&D. The end result is a relatively diversified portfolio of investments and a more accurate representation of the corporate leaders in the industry.

ETFs currently tracking DEFENSE include the VictoryShares Protect America ETF (Ticker: SHLD).

Sources: Nasdaq Global Indexes, Yewno, FactSet, Bloomberg.