

Defense Industry Overview

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OLLI Winter Term F203 Investing Potpourri — Defense

Overview

- Defining Defense Industrial Base (DIB)
- Size and Scope
- Characteristics
- Key Drivers
- Defense Market Characteristics
- Investment Opportunities
- Performance
- Key Players
- Emerging Technology Areas

Defining DIB

- Popular
- Political/Legal Definition: 10 U.S. Code § 2500
- Economic
- Financial, market or investment (GICS)

Defining DIB

- **Popular**
 - **Ships, planes, tanks, things that go “boom”**
- Political/Legal Definition: 10 U.S. Code § 2500
- Economic
- Financial, market or investment (GICS)

Defining DIB

- Popular
- **Political/Legal Definition: 10 U.S. Code § 2500**
 - **The term “national technology and industrial base” means the persons and organizations that are engaged in research, development, production, integration, services, or information technology activities conducted within the United States, the United Kingdom of Great Britain and Northern Ireland, Australia, and Canada.**
- Economic
- Financial, market or investment (GICS)

Defining DIB

- Popular
- Political/Legal Definition: 10 U.S. Code § 2500
- **Economic**
 - **Money spent by DoD and the MILDEPs, especially where it's spent---states, congressional districts and the jobs that result**
- Financial, market or investment (GICS)

Defining DIB

- Popular
- Political/Legal Definition: 10 U.S. Code § 2500
- Economic
- **Financial, market or investment (GICS)**
 - **Sector: Industrials (20)**
 - **Industry Group: Capital Goods (2010)**
 - **Industry: Aerospace & Defense (A&D) (201010)**
 - **Sub-Industry: A&D (20101010)**

A&D: Size and Scope

- DoD and MILDEP contracts (FY20: \$421.8B)
 - 51% Services
 - 41% Goods
 - 8% R&D
- Foreign Military Sales (FY20: \$50.78B)
 - Projects managed by the U.S. funded by foreign governments
 - Direct Commercial Sales overseen by the U.S. government
 - Projects funded by U.S. foreign aid
- Commercial or Civil Aerospace (~\$270B)
 - Large Commercial Aircraft (Boeing, Airbus)
 - Regional Jets (Embraer)
 - Business Jets (Gulfstream, Honda, Cessna, Bombardier, et al)
 - General Aviation (Cessna, Cirrus, Piper, Bell, et al)
 - Launch vehicles (ULA, Blue Horizon, SpaceX, Boeing, Virgin, et al)
 - Satellites (LM, Telesat, Capella, Dish, et al)

Defense Characteristics

- DoD is a relatively small customer in a very large global marketplace
- DoD has cyclical needs for non-commercial, defense-unique capabilities (Boom or Bust)
 - Examples: TACAIR propulsion systems, Munitions
- Platforms and weapon systems have service lives measured in decades
 - Examples: B-52, KC-135, CVN, SSBN, MA-1A
- Since the 1990s, the number of defense contractors has shrunk considerably (M&A)

Key Drivers

Civil or Commercial Market

- Cost efficiency
 - Ability to contribute to cash flow/profits
 - Systems generally have a planned/limited life span

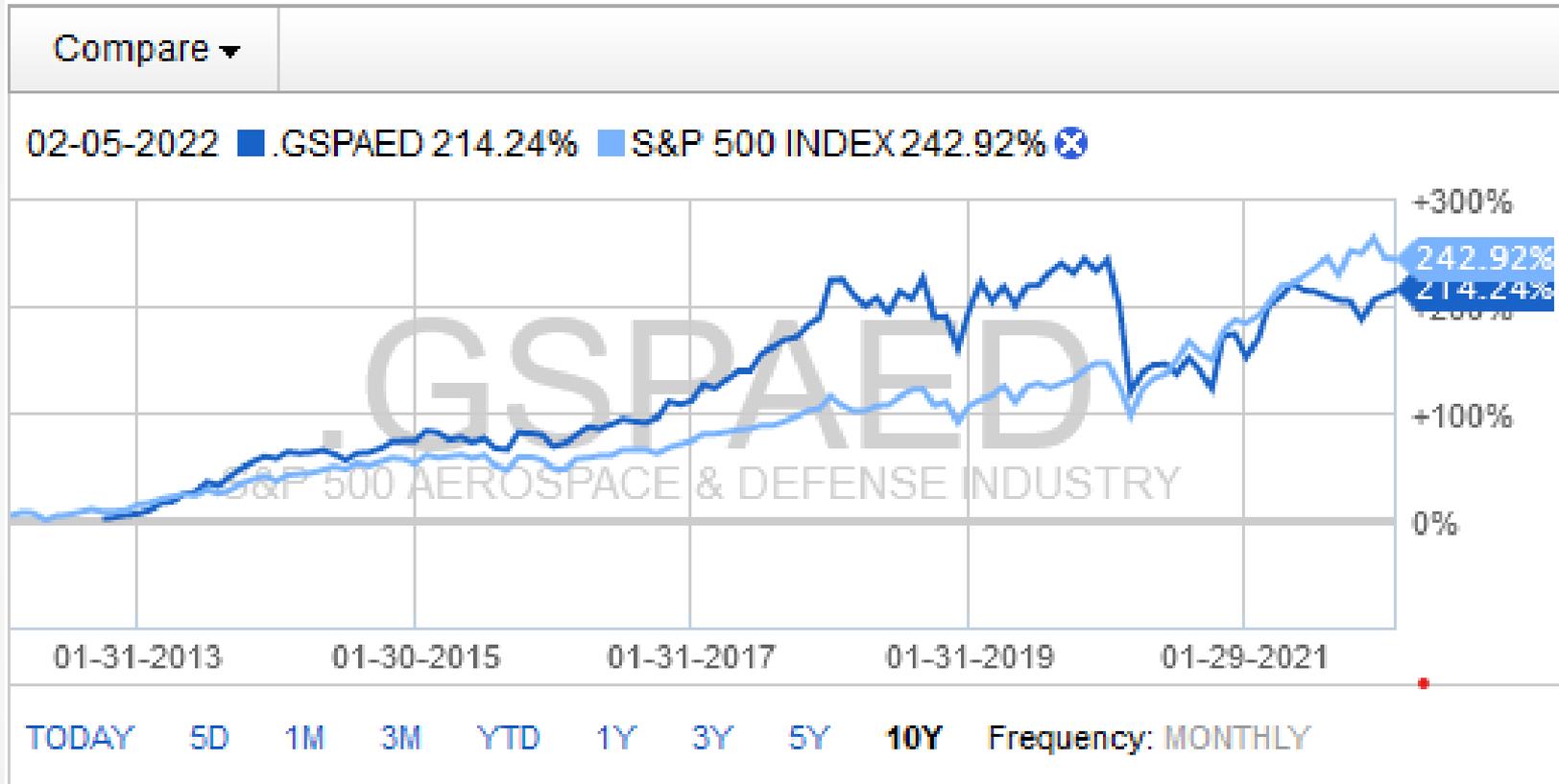
Defense Market

- Mission effectiveness
 - Operational capability
 - Sustainability
 - Affordability
 - Reliability

A&D Investment Opportunities

- Individual Stocks
 - 64 Entities in the A&D sub-Industry group
- Exchange Traded Funds
 - iShares U.S. A&D ETF (ITA)
 - Invesco A&D ETF (PPA)
 - SPDR S&P A&D ETF (XAR)
 - Direxion Daily A&D Bull 3X Shares (DFEN)
 - SPDR S&P Kensho Future Security ETF (FITE)
 - ARK Space Exploration and Innovation ETF (ARKX)
- Mutual Funds
 - Fidelity Select Defense & Aerospace Portfolio (FSDAX)

A&D 10 Year Performance



Source: Fidelity

Key Players' Rankings

Defense	F500	World
1. Lockheed Martin (LMT)	49	158
2. Raytheon Technologies (RTX)	57	104
3. Boeing (BA)	54	115
4. Northrup Grumman (NOC)	86	285
5. General Dynamics (GD)	84	307
6. L3Harris Technologies (LHX)	163	466
7. Huntington Ingalls Industries (HII)	327	2,317
8. Leidos (LDOS)	248	1,537
9. Honeywell International (HON)	94	89
10. Booz Allen Hamilton (BAH)	391	1,645

Sources: Top 10: Defense News; Fortune 500: Fortune
World rank: Valuetoday.com

Lockheed Martin (LMT)

Lockheed Martin's Products:

Fighter aircraft; Military transport/tactical airlift aircraft; logistics, upgrades, modifications, and MRO services; Air and missile defense systems; tactical missiles and air-to-ground precision strike weapon systems; logistics; fire control systems; mission operations support, readiness, engineering support and integration services; manned and unmanned ground vehicles; ship and submarine mission and combat systems; mission systems and sensors for rotary and fixed-wing aircraft; sea and land-based missile defense systems; radar systems; combat ships/frigates; simulation and training services; unmanned systems and technologies; research and development, design, engineering and production of satellites, strategic and defensive missile systems and space transportation systems.

Sikorsky (part of Rotary and Mission Systems (RMS)): Military and commercial helicopters, aftermarket helicopter and aircraft parts and services.

Lockheed Martin's DoD Defense Programs:

AEGIS BMD	AEHF	AH-64 Apache	C-5 Galaxy	C-130 Hercules			
CH-53/MH-53	CG 47	DDG 51	E-2D	E-6B	EELV	F-16	F-22
F-35 Lightning II	GMLRS	GPS	Hellfire	HIMARS	JASSM	JDAM	
JTRS	Littoral Combat Ship	MH-60R	MH-60S	UH-60M Black Hawk			
S-97 Raider	MUOS	PAC-3/MSE	Patriot/PAC-3	SBIRS			
THAAD	Trident II						

Commercial Programs:

| LM-100J | S-76, S-92 |

Raytheon Technologies (RMT)

Raytheon Products:

Air and missile defense systems; Surface-to-air missiles; Air-to-air missiles; Air-to-surface missiles; Laser-Guided Bombs; Smart munitions; Anti-radiation missiles; EW decoy/jammers; Projectiles; Anti-armor/anti-fortification weapon systems; Kinetic kill vehicles; Directed energy effectors; Close-In Weapon Systems (CIWS); Ship self-defense missiles; Maritime air and missile defense radar systems; Submarine and surface ship combat management systems; Anti-submarine, mine warfare and integrated ship systems; Sensors; Maritime naval navigation systems; Torpedoes; Intelligence, Surveillance and Reconnaissance (ISR) systems; Cybersecurity; Analytics; Training; Logistics; Mission support; Engineering; Automation and Sustainment solutions; Air Traffic Management (ATM) systems; Satellite command and control systems; Large-scale data processing and exploitation, storage architectures, and high-performance data handling and processing systems; EO/IR sensors; Airborne radars for surveillance and fire control; Lasers; Precision guidance systems; Signals intelligence systems; Processors; EW systems; Communications systems.

Raytheon's Major DoD Defense Programs A-Z:

AGM-65 Maverick	AGM-176 Griffin	A-10	AGM-88	AMRAAM			
AN/SPY-6 AMDR	B-2 Spirit	B-52	CG 47	DDG 51	DDG 1000	ESSM	E-2D
Excalibur	F-15	F-16	F/A-18E/F	EA-18G	F-22 Raptor	F-35 Lightning II	
GPS	GMD	HH-60	Javelin	JLENS	JSOW	KC-46	Littoral Combat Ship
LPD 17	MALD-J	MH-60R	MH-60S	MQ-1/MQ-9	MQ-8B	P-8A	RIM-116
Paveway	RQ-4	Sidewinder	SDB II	SM-2/SM-6	SM-3 (AEGIS BMD)		
Tomahawk	TOW	V-22 Osprey					

Commercial Programs:

No information available.

Boeing Company (BA)

Boeing Products:

Commercial wide-body jet aircraft; Commercial narrow-body jet aircraft; Commercial jet transport aircraft; Commercial aircraft financing solutions; Fighter and attack aircraft; Bombers; Military transport and tanker aircraft; Military rotorcraft and tilt-rotor aircraft; Airborne surveillance and reconnaissance aircraft; Airborne command and control aircraft; Naval warfare aircraft; UAVs/UAS; Air-to-ground missiles (AGM); Smart bombs; Smart bomb kits; Missile defense systems; Network and tactical systems; Battle management systems; Intelligence and security systems; Space and intelligence systems; Satellites; Satellite launch vehicles; Space exploration services.

Boeing's Major U.S. Defense Programs:

A-10	AH-64	AV-8B	B-1B	B-52	C-17	C-32	C-40	CH-47
E-3	E-4B	E-6B	EELV	F-15	F/A-18 Hornet	F/A-18E/F	EA-18G	
F-22 Raptor	GMD	GPS	Hellfire	KC-10	KC-46	JDAM	JTRS	
MH-139	MQ-25	P-8A Poseidon	PAR	RQ-21	SDB	T-7 (T-X)		
V-22 Osprey	VC-25	WGS						

Boeing's Commercial Programs:

| Narrow-Body Jets: 737NG, 737 MAX, BBJ |
| Wide-Body Jets: 747-8, 767, 777, 777X (dev.), 787 |

Northrop Grumman (NOC) 1/2

Northrop Grumman Products:

Tactical and long-range strike aircraft systems; Unmanned Aircraft Systems (UAS); Missile systems; Spacecraft systems; Electronic and communications payloads; Airborne early warning, surveillance, battlefield management, and electronic warfare systems; Advanced space-based radar systems; Electro-optical early warning and surveillance systems; Fire Control Radars (FCR); Sensor and protection systems; Integrated electronic warfare capability, communications, and intelligence systems; Unattended ground sensors; Automatic test equipment; Advanced threat simulators; Anti-ship missile defense and surveillance radars; Propulsion equipment and missile launch systems; Fiber optic acoustic sensors; Inertial sensors and navigation systems; Fire control radars, Multi-function apertures and pods; Airborne EO/IR targeting systems; Laser/electro-optical systems; Net-enabled Battle Management C4ISR systems; Studies & Analysis; Systems Development; Enterprise IT; Prime Systems Integration; Operations and maintenance services; Space launch services; Training Solutions; Product support and weapons system sustainment.

Northrop Grumman's Major DoD Defense Programs:

AEHF	AH-64	B-1B Lancer	B-2A Spirit	B-21 Raider	DMSP	EA-6B		
EA-18G	E-2D		E-3	F-16	F/A-18E/F	F-22	F-35 Lightning II	GMD
MQ-8 Fire Scout	JSTARS	RQ-4 Global Hawk	MQ-4C Triton	SBIRS				
Trident II	SSN 774							

Commercial Programs:

● | Airbus: A350 | Boeing: 787 | ●

Northrop Grumman (NOC) 2/2

Northrop Grumman Products:

Former Orbital ATK businesses: Antares, Pegasus, Taurus and Minotaur space launch vehicles; Interceptor launch vehicles; Target launch vehicles; Communications satellites; Science and remote sensing satellites and related subsystems; Booster vehicles; Space technical services; Human-rated spacecraft.

Rocket motors systems for human and cargo launch vehicles, conventional and strategic missiles, and missile defense interceptors; Solid rocket motors; Solid rocket motor propulsion for surface and air launched missile systems; Satellite mechanical components and assemblies; Satellite fuel and oxidizer tanks; Precision structures; Solar power arrays; Deployable structures; Spacecraft composite primary and secondary structures; Precision Guidance Kits; Mortar Guidance Kits; Medium-caliber chain guns; Small-, medium-, and large-caliber ammunition; Military precision munitions; Propellant and energetic materials; Target missiles; Missile Subsystems & Components; Missile Warning Systems (MWS); Weapons sensors and fuzes.

Composite aircraft components: upper and lower wing skins, fuselage skins, nacelles, ducts, access covers, fan cases, radomes, apertures, stringers and frames.

Northrop Grumman's Major DoD Defense Programs:

Former Orbital ATK Businesses: | AGM-88 AARGM | AMRAAM | C-17 | EELV |
| F-22 Raptor | F-35 Lightning II | GMD | Hellfire | AGM-65 Maverick | Minuteman III |
| RQ-4 Global Hawk | Sidewinder | SM-3 | MSST | THAAD | Trident II |

General Dynamics (GD)

General Dynamics Products:

Mid- and large-cabin business-jet aircraft; Maintenance, refurbishment, outfitting and aircraft services; Wheeled combat and tactical vehicles; Main battle tanks; Tracked infantry vehicles; Blast- and ballistics-protected vehicles + maintenance and repair services; Munitions and propellant; Rockets and gun systems; 120mm mortar and 155mm and 105mm artillery projectiles; Conventional bomb structures; Mortar systems and large-caliber ammunition; Nuclear-powered submarines (Virginia Class); Surface combatants; Auxiliary and combat-logistics ships; Commercial ships; Design and engineering support.

General Dynamics' Major DoD Defense Programs:

C-20	C-37	DDG 51	DDG 1000	F-35 Lightning II	GPS	GMV / ITV
JHSV	JTRS	M1 Abrams	Mobile Landing Platform	MRAP	Stryker	
SSN 774 Virginia Class	TAO-205	WIN-T				

General Dynamics' Commercial Programs:

| Gulfstream: G280, G500, G550, G600, G650, G650ER |

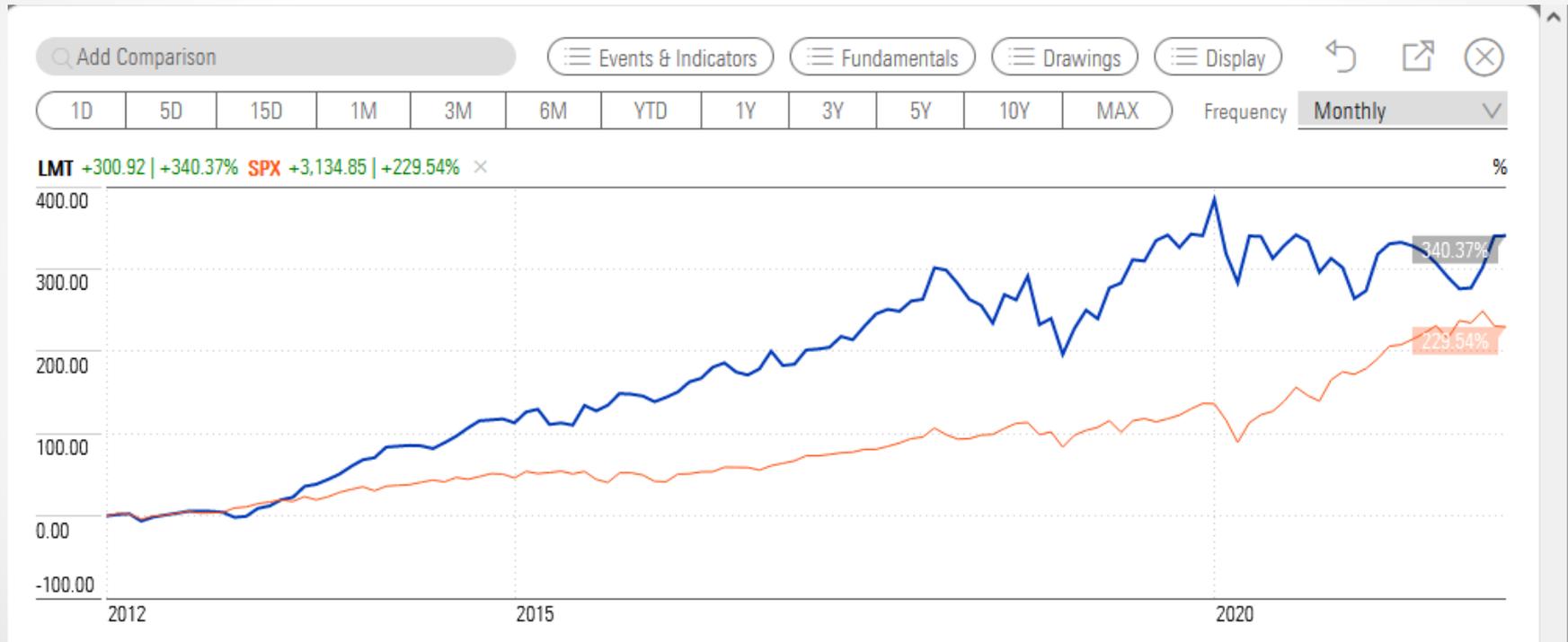
Source: Aeroweb

FY20 Top DoD Contractors

Company	DoD \$B	Cap \$B	P/E	Div Yield
Lockheed Martin (LMT)	\$65.6	\$95	15.6	3.20%
Raytheon Technologies (RTX)	\$42.0	\$130	18.8	2.40%
Boeing (BA)	\$32.4	\$123	20*	Nil
Northrup Grumman (NOC)	\$31.4	\$57.6	14.4	1.70%
General Dynamics (GD)	\$29.8	\$55.7	16.6	2.40%
L3Harris Technologies (LHX)	\$14.9	\$43.6	19.3	1.80%
Huntington Ingalls Industries (HII)	\$8.6	\$7.6	13.5	2.50%
Leidos (LDOS)	\$7.3	\$13.4	13.7	1.50%
Honeywell International(HON)	\$5.8	\$142	24.4	1.90%
Booz Allen Hamilton (BAH)	\$5.5	\$11.70	20.1	1.70%

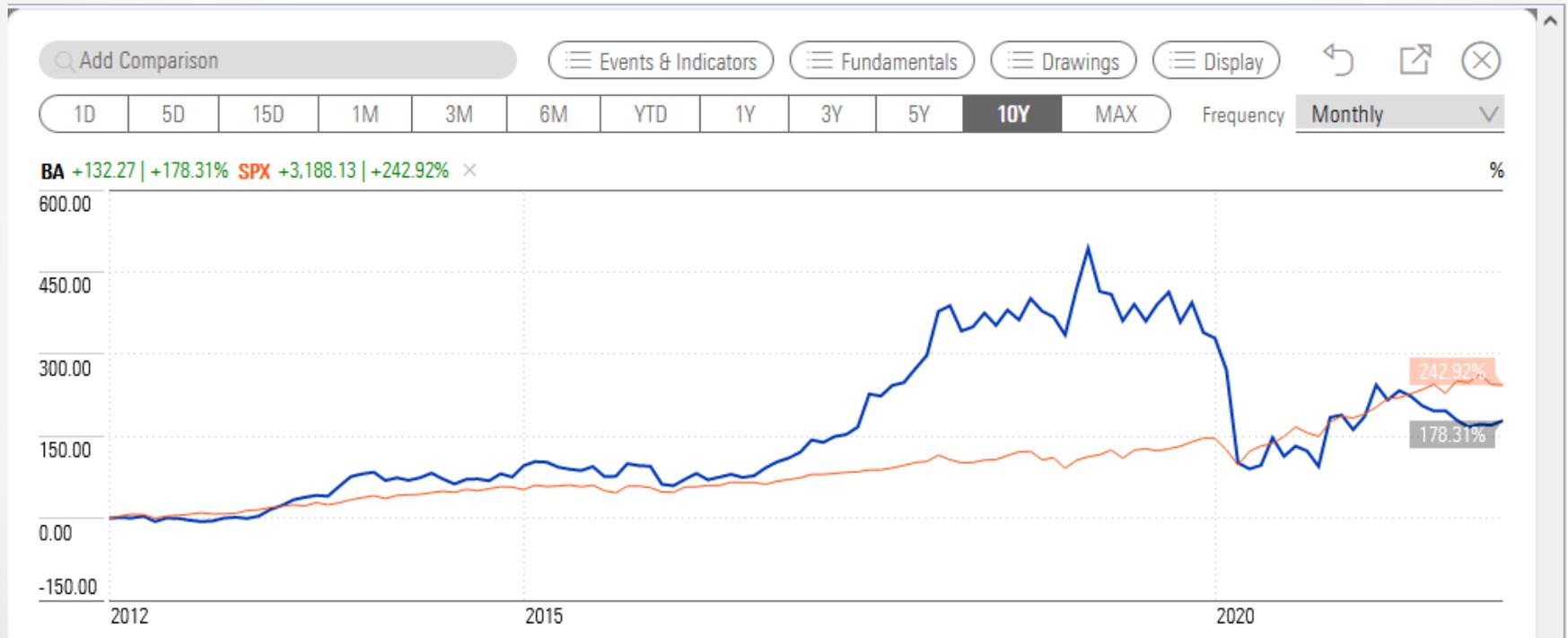
Sources: Defense News, Value Line

Lockheed Martin (LMT)



Source: Morningstar

Boeing Company (BA)



Source: Morningstar

Raytheon Technologies (RTX)



Source: Morningstar

Northrop Grumman (NOC)



Source: Morningstar

General Dynamics (GD)



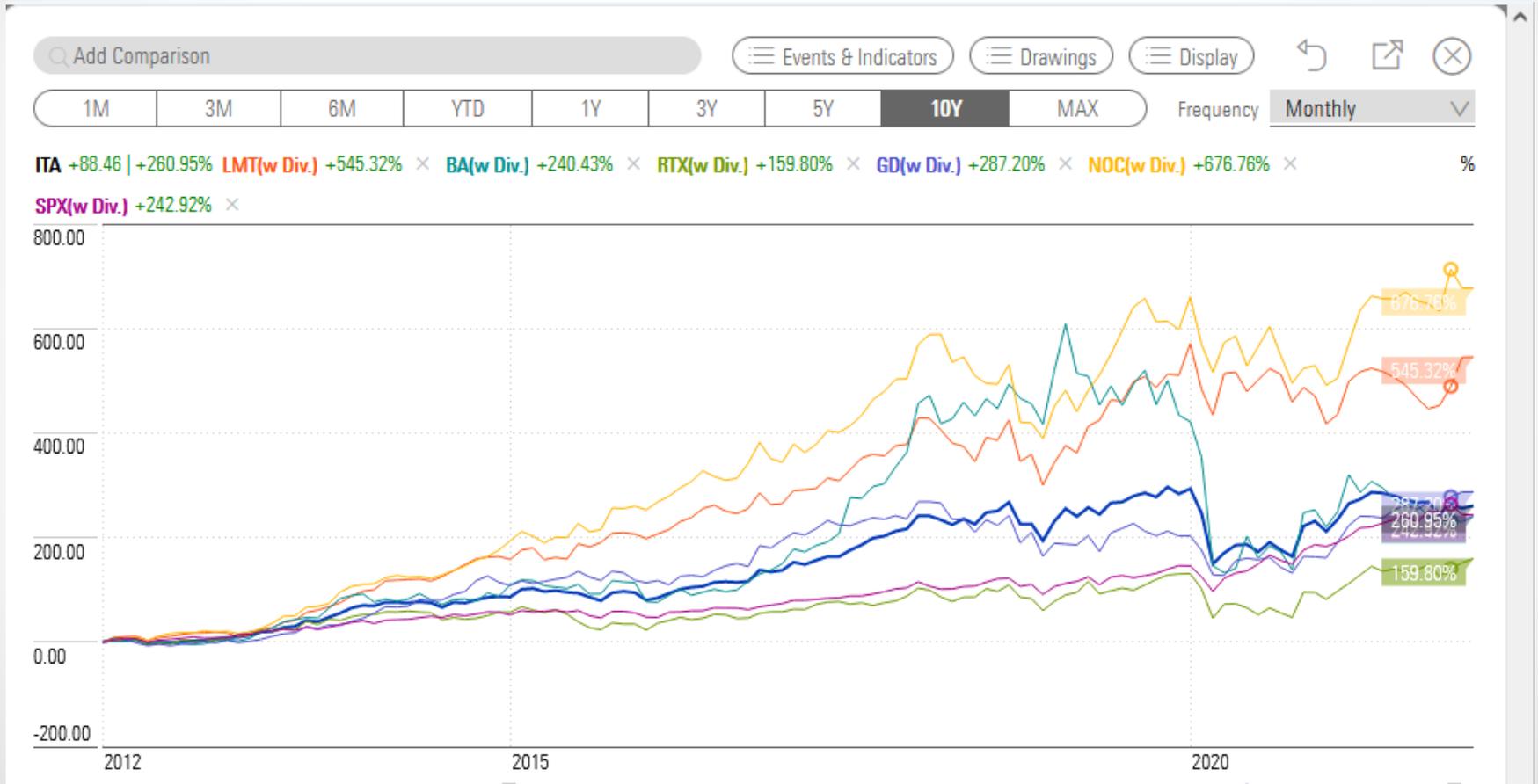
Source: Morningstar

A&D Funds

ETF Name	Size	Fees	10 year Return (NAV)
iShares U.S. A&D ETF (ITA)	\$2.5B	0.42%	13.33%
Invesco A&D ETF (PPA)	\$631.1M	0.61%	14.85%
SPDR S&P A&D ETF (XAR)	\$1.0B	0.35%	16.98%
Direxion Daily A&D Bull 3X Shares (DFEN) (Leveraged)	\$254M	1.01%	-27.88% (May 17 start)
SPDR S&P Kensho Future Security ETF (FITE)	\$25.1M	0.45%	13.26% (3 year)
ARK Space Exploration and Innovation ETF (ARKX)	\$376M	0.75%	-22.41% (Mar 21 start)
Fidelity Select D&A Portfolio (FSDAX)	\$1.39B	0.77%	12.51%

Source: Company websites and Morningstar

A&D ETF and Top 5



Source: Morningstar

Beyond the Top 5

Curtiss-Wright (CW)



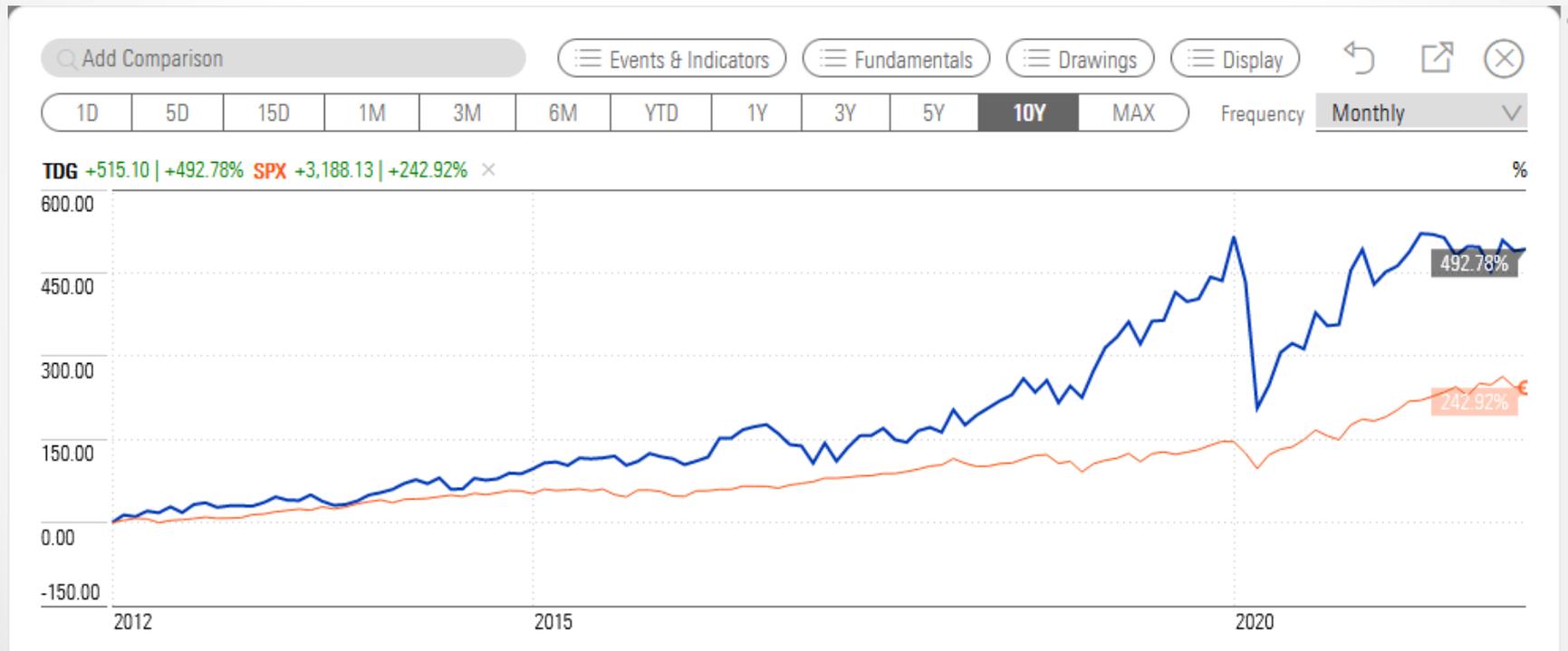
Source: Morningstar

L3Harris Technologies (LHX)



Source: Morningstar

TransDigm Group (TDG)



Source: Morningstar

What's Next?

Emerging Technology Areas

DoD has grouped emerging technologies into 3 broad categories:

- Seed Areas of Emerging Opportunity
- Effective Adoption Areas (existing private activity)
- Defense-Specific Areas

Emerging Technology Areas

- Seed Areas of Emerging Opportunity
 - Biotechnology
 - Quantum Science
 - Future Generation Wireless
 - Advanced Materials

Emerging Technology Areas

- Effective Adoption Areas (existing private activity)
 - Trusted AI and Autonomy
 - Integrated Network System-of-Systems
 - Microelectronics
 - Space Technology
 - Renewable Energy Generation and Storage
 - Advanced Computing and Software
 - Human-Machine Interfaces

Emerging Technology Areas

- Defense-Specific Areas
 - Directed Energy
 - Hypersonics
 - Integrated Sensing and Cyber

Commercial Side

Advanced Air Mobility -AAM

- Electric Vertical Takeoff and Landing (eVTOL)
- Range: about 150 miles
- Speed: 175-200 mph
- Capacity: 4-6 passengers or equivalent cargo weight
- Possibles: Archer, Beta Technologies, Joby Aviation, Kitty Hawk, and Lilium



Archer Aviation (ACHR)

- Partnered with United Airlines (\$1B potential purchase)
- Working on 4 seat production prototype
- Current prototype, Maker, 130 knots, 60 mi range



Beta Technologies

- Airworthiness approval from the U.S. Air Force
- UPS intent to purchase up to 150 aircraft



Website: beta.team

Joby Aviation (JOBY)

- Partnership with Uber
- Airworthiness approval from the U.S. Air Force
- Progressing towards FAA certification



Website: Jobyaviation.com

Kitty Hawk

- Remotely piloted, single passenger air taxi
- Airworthiness approval from the U.S. Air Force



Website: kittyhawk.aero

Lilium (LILM)

- Headquarters: Munich, GE
- 6 passenger plus one pilot
- Plan to go operational in 2024



Website: lilium.com

Sources

- Defense News
- Aeroweb
- General Aircraft Manufacturers' Association (GAMA)
- Aerospace Industries Association (AIA)
- Congressional Research Service
- Department of Defense Reports
- Morningstar
- Value Line
- Charles Schwab
- Fidelity


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Aircraft Shipments 2021 **\$148.8B** +9.0%
Aircraft New Orders 2021 **\$179.4B** +++

Aircraft Backlog 2021/12 **\$693.4B** +4.6%

GDP Q4-21 **\$23,992B** +6.7% **UNEMPL** Jan-22 **4.0%** +0.1pp


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DoD Procurement:

<u>DoD Procurement</u> FY 2022e	\$133.9B	-5.6%
<u>DoD Procurement</u> FY 2021e	\$141.9B	+0.6%

Aerospace Economic Data:

<u>Sales</u> Q3 2021	\$69.0B	+4.3%
<u>Net Profit</u> Q3 2021	\$4.9B	+34.2%
<u>Employment</u> November 2021	494,300	+1.1%

Latest Data:

U.S. Aerospace MFG Capacity 71.7% Utilized in Dec. 21 (+5.59 points from Dec. 20)

[U.S. Military Aircraft Programs](#)

[Military Aircraft Engines](#)
[Aerospace & Defense Companies](#)

Q4 2021	Deliveries ('21)	Deliveries ('20)	Deliveries ('19)
<u>Boeing</u>	340	157	380
<u>Airbus</u>	611	566	863

[Top-100 Defense Contractors 2020](#)
[Top-100 NASA Contractors 2020](#)

Q4 2021	Order Backlog	Net Orders ('21)	Net Orders ('20)
<u>Boeing</u>	5,136	479	-471