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www.spadeindex.com / defense

SPADE Defense Index Statistics

9/28/18 Close	7148.28
12/29/17 Close	6265.24

All-time Intraday High:
19 September 2018 7183.32

All-time Closing High:
18 September 2018 7155.36

	SPADE Defense	S&P500
3Q18	11.94%	7.20%
2Q18	[3.11%]	2.93%
1Q18	5.20%	[1.22%]
2018	1.93%	1.67%

Commentary

It is still a few weeks away but it is never too early to speculate on what we expect to happen in the upcoming Congressional elections. Perhaps the single greatest impact on companies operating in the defense sector are the budgets allocated by the US Congress to the Pentagon and related agencies.

In the past we've covered this very subject and highlighted the fact that defense budgets relate less to political party and more toward the current state of world stability. In times of "perceived" stability, budgets decline. In times of stress and when the country is at war, budgets remain strong or rise.

\$1.7 Trillion
World Military Spending in 2017, up 1.1% from 2016
2018 SIPRI Yearbook

How Big is the Classified Budget?
Military Intelligence Budget*
FY18: \$22.1 Billion
FY15: \$16.6 Billion
FY10: \$27.0 Billion
National Intelligence Program **
(FY18): \$57.7 Billion

*in support of tactical and operational priorities including to SOCOM
** defense & non-defense intel programs

2018 expects to be a bit different. While the world is by no means stable, without any immediate impetus, defense budgets have soared in the past two years as President Trump has made increases in defense spending a core part of his administration.

Regardless of who controls Congress, the White House has already outlined plans to reduce spending in FY20 by \$33 billion.

The most likely scenario calls for a split Congress with the Democrats retaking the House and the Senate remaining in control of Republicans. If this occurs, the Democrats will take over leadership of the House Armed Services Committee and the House Appropriations Committee. While much could change, many Democrats have campaigned on prioritizing domestic spending. While this should have some impact, we don't believe that there will be a dramatic change in total spending in the FY-20 and FY-21 budgets however there will likely be some noticeable shifts within specific programs and

how resources are allocated. Research and development funds are anticipated to remain stable. Spending at the State Department is likely to rise as the diplomatic effort has been curtailed in recent years. A continued decline of military action in and around Afghanistan will likely lead to declines in Overseas Operations and the Military Intelligence Budget. Likewise

SPADE Defense Index September 2018 Rebalance

Corporate Actions Affecting the Index During the Quarter
United Tech's acquisition of Rockwell Collins remains pending.

Licensed Products
Exchange Traded Fund (ETF)
The SPADE Defense Index has been licensed to Invesco and serves as the underlying index for the ~\$1 Billion Invesco Aerospace & Defense ETF (NYSE Arca: PPA).

During 2Q18, Invesco renamed its InvescoPowershares Aerospace & Defense ETF, the Invesco Aerospace & Defense ETF.

3Q18 Leaders

1	Intelsat	80.07%
2	Aerovironment	57.03%
3	Mercury Systems	45.35%
4	Kratos Defense	28.41%
5	Heico	26.98%
6	Perspecta	25.16%
7	Teledyne	23.92%
8	Ball Corp	23.74%
9	Ducommon	23.42%
10	Esterline	23.24%

3Q18 Laggards

1	Maxar	-34.54%
2	VSE Corporation	-30.66%
3	Sparton	-24.01%
4	Kaman	-4.52%
5	ViaSat	-2.69%
6	OSI Systems	-1.32%
7	Key W Holdings	-0.92%
8	SAIC	-0.41%
9	BWX Technologies	0.35%
10	Hexcel	1.01%

YTD Results

1	Intelsat	784.96%	28	Aerojet Rocketdyne	8.94%
2	Axon International	158.23%	29	Huntington Ingalls	8.65%
3	AeroVironment	99.73%	30	Hexcel	8.41%
4	Comtech	63.97%	31	Lockheed Martin	7.76%
5	KeyW Holdings	47.53%	32	Mercury Computer	7.73%
6	Ducommon	43.55%	33	L-3 Communications	7.47%
7	Kratos Defense	39.57%	34	Leidos	7.11%
8	CACI	39.14%	35	KBR	6.05%
9	Teledyne Tech	36.17%	36	Woodward	5.64%
10	Transdigm	35.57%	37	SAIC	5.26%
11	FLIR Systems	31.85%	38	Honeywell	4.00%
12	Booz Allen	30.16%	39	Rockwell Collins	3.58%
13	Engility	26.86%	40	Perspecta	3.46%
14	Textron	26.29%	41	Northrop Grumman	3.41%
15	Mantech Intl	26.12%	42	BWX Technologies	3.39%
16	Boeing	25.53%	43	Vectrus	1.10%
17	Cubic	23.92%	44	General Dynamics	0.62%
18	AAR Corp	21.89%	45	Moog	-1.01%
19	Esterline Tech	21.75%	46	Heico	-1.84%
20	FireEye	19.72%	47	Elbit Systems	-5.83%
21	Harris Corp	19.46%	48	Triumph Group	-14.34%
22	OSI Systems	18.53%	49	Viasat	-14.56%
23	Ball Corp	16.22%	50	Oshkosh Truck	-21.62%
24	Kaman	13.09%	51	VSE Corporation	-31.59%
25	Curtiss Wright	12.78%	52	Sparton	-37.42%
26	Raytheon	10.01%	53	Maxar Technologies	-48.59%
27	United Technologies	9.59%			

ETF Statistics (NYSE Arca: PPA)

Invesco Aerospace & Defense

Exchange / Ticker Symbol:	NYSE / PPA
Assets (9/28/18)	\$1,051 M
Closing Price (9/28/18)	\$61.52
Yield (TTM)*	1.35%
3Q18 Volume**	3,121,700
Turnover**	11%

source: * Morningstar & ** Yahoo Finance 9/30/18

Portfolio Price / Earnings*	20.23
Portfolio Price / Book*	4.44
Portfolio Price / Sales*	1.85
Portfolio Price / Cash Flow*	16.39
Beta (3-year) **	0.89
Alpha (3-year)**	10.07
R-squared (3 years)**	50.03

source: * Morningstar & ** Yahoo Finance 9/30/18

**US Air Force
Top Contractors Forecast 2018-2023**

Lockheed Martin	\$63.43B
Boeing	\$38.19B
Northrop Grumman	\$24.76B
Raytheon	\$13.44B
United Technologies	\$9.31B
Other / Classified / Unknown	\$412.23B
Total	\$561.36B

source: Avascent Analytics
Defense News, 17Sept 18, 46.

**US Air Force
Top Programs Forecast 2018-2023**

F-35A Joint Strike Fighter	\$35B+
KC-46A Tanker	\$17B+
B-21 Long Range Strike Bomber	\$15B+
Ground Based Strategic Deterrent	\$10B
F-X Air Dominance Fighter Development	~\$7.5B
Evolved Expendable Launch Vehicle	~\$7B

source: Avascent Analytics
Defense News, 17Sept 18, 46.

**US Air Force -
How Many Squadrons?**

USAF Secretary Heather Wilson called for the service to grow from 312 operational squadrons to 386 by 2030 as it prepares for a major conflict with a nation such as China or Russia.

The 74 additional squadrons would be involved with C4ISR (+22), Tankers (+14), Special Operations (+7), Space (+7), Fighters (+7), Bombers (+5), and Combat Search and Rescue (+9), Strike (+2), and Airlift (+1).

Source: USAF, Defense News
24Sept18, 7

**US Air Force
Average Annual Contract Total, 2018-2023: \$93.6 Billion**

source: Avascent Analytics Defense News, 17 Sept 18, 46

**US Marine Corps
Average Annual Contract Total, 2018-2023: \$11.9 Billion**

source: Avascent Analytics Defense News, 24 Sept 18, 30

**Total Forecasted Global Spending
on Ship and Submarine Programs
2018-2023 -- \$442.78 Billion**

Huntington Ingalls	\$99.59B
General Dynamics	\$64.96B
BAE Systems	\$24.76B
Naval Group	\$20.14B
Lockheed Martin	\$15.22B
Thyssenkrupp AG	\$8.93B
Raytheon	\$4.53B
Unknown	\$11.17B
Not Selected Yet	\$67.02B
Others	\$126.45B

**DoD: Money Spent on "Major"
IT Investments**

source: ITDASHBOARD.GOV
C4ISRNet.com, Sept 18.

FY17	\$5.5B	
FY18	\$6.7B	up 21.8%
FY19	\$7.0B	up 4.5%

**US Marine Corps
Top Contractors Forecast 2018-2023**

Lockheed Martin	\$26.02B
Bell Boeing JV	\$8.90B
Contractor TBD	\$7.15B
United Technologies	\$3.92B
Oshkosh Corp	\$2.97B
Textron	\$2.56B
US Navy	\$1.31B
Other/Classified	\$18.32B
Total	\$71.15B

source: Avascent Analytics
Defense News, 24Sept 18, 30

**US Marine Corps
Top Programs Forecast 2018-2023**

F-35B Joint Strike Fighter	~\$17.50B
CH053K Heavy Lift Helicopter	~\$12B
MV-22 Osprey	~\$7.5B
Joint Light Tactical Vehicle (JLTV)	~\$2.5B
Radio Systems	~\$2B
Amphibious Combat Vehicle 1.2	~\$1.25B

source: Avascent Analytics
Defense News, 24 Sept 18, 30

**Global Prime Contractors
Ship/Submarine Forecast
2018-2023 (# ships)**

2014	774
2015	1077
2016	1002
2017	1219

source: Avascent Analytics
Defense News, 22 Oct 18, 30

Commentary (continued from page 1)

the National Intelligence Program has risen substantially since 9/11 and with many Democratic congresspeople focused on “openness” and “government accountability,” one could see classified intelligence budgets declining by a few billion.

Another area that might see increased attention is House oversight of international weapons sales, especially to countries not in political favor.

International Weapons Sales Surging

At a September 7th meeting, the Defense Security Cooperation Agency stated that the US has signed \$46.9 billion in weapons sales to foreign partners and allies. This compares to \$41.9 billion for all of fiscal 2017.

A Large Industry Merger

The proposed merger of Harris & L3 Communications will create a defense firm with net revenues of \$16 billion. The deal has been shaped by over two decades of acquisitions and spinoffs by

both firms. In May 2015, Harris bought Exelis which was spun off from ITT. The firm then shed CapRock, which provided bandwidth to commercial and government customers and its IT services business. Harris’ tactical radio business expanded into secure communications and ISR. L3 started as a divestment from Lockheed Martin and over the past two decades was involved in roughly 100 transactions. Today, it has dozens of locations and business lines mostly involving electronics and communications for all military domains.

DoD Contracting

On September 28, 2018, the Pentagon handed out \$7.54 billion in 114 end of year contracts.

- Army: 41, \$2.44B
- Navy: 39, \$1.85B
- Air Force: 17, \$1.76B
- DLA, 11, \$1.36B
- Other, 6, \$0.13B

ViaSat received approval for its BATS-D AN-PRC-161 device. It’s important given that it is a tablet approved by the National Security Agency for use with all Five Eyes nations: US, UK, Australia, New Zealand, and Canada-- it can provide communications between soldiers and aircraft that can perform close air support, engage enemy targets, and reduce fratricide incidents.

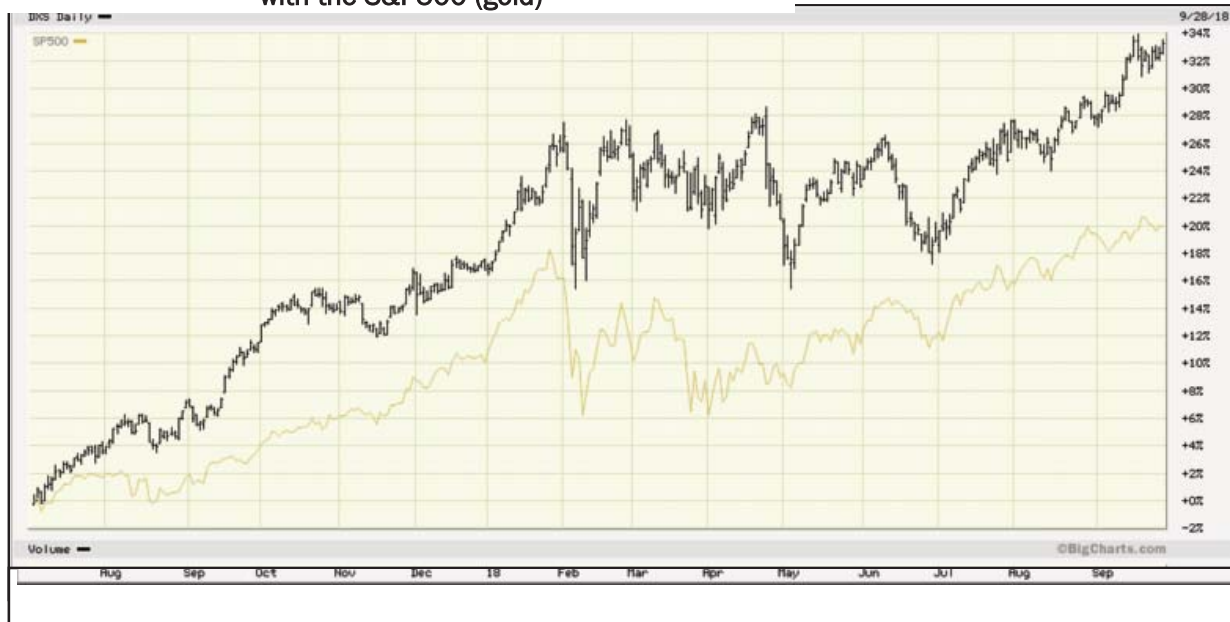
Lockheed Martin received a \$1.3 billion contract for 2 GPS III satellites. This covers the 11th and 12th satellites in the constellation.

Number of Failed, Foiled or Completed Terrorist Attacks 2014-2017

2014	226
2015	193
2016	142
2017	205

source: Europol
Defense News, 8Oct18, 46

Two-year chart comparing SPADE Defense Index (black) with the S&P500 (gold)



Performance (ex div)

	SPADE Defense Index	S&P500	Alpha (bps)
YTD	11.94%	7.20%	474
2017	28.92%	19.42%	950
2016	17.95%	9.53%	842
2015	3.23%	[0.73%]	396
2014	11.77%	11.39%	38
2013	48.27%	29.60%	1867
2012	16.30%	13.41%	289
2011	[2.75%]	[0.00%]	[275]
2010	9.62%	12.78%	[316]
2009	21.71%	23.45%	[174]
2008	[38.03%]	[38.49%]	46

	SPADE Defense Index	S&P500	Alpha (bps)
2007	22.17%	3.53%	1864
2006	19.33%	13.62%	571
2005	5.30%	3.00%	230
2004	20.47%	8.99%	1148
2003	37.27%	26.38%	1089
2002	[2.87%]	[23.37%]	2050
2001	0.94%	[13.04%]	1488
2000	4.98%	[10.14%]	1512
1999	15.31%	19.53%	[422]
1998	6.63%	26.67%	[2004]

About the SPADE Defense Index

The SPADE Defense Index (NYSE: DXS) provides an investment benchmark for the value that the market ascribes to companies involved with defense, homeland security, and space.

The Index is designed to reflect the broad diversity of activities that is representative of companies involved with the sector – including industrial firms that manufacture aircraft, tanks, ships, and missiles; and those involved with current and next generation systems related to network centric warfare and information technology; intelligence, surveillance, and reconnaissance; satellites; border security; and defense systems that protect the lives of our servicemen and servicewomen.

SPADE Indexes specializes in designing and managing equity benchmarks for ETF and other products.

Rules

The Index was designed to be RIC (registered investment company) compliant for the purpose of enabling financial products. Companies are required to meet a variety of eligibility criteria including market valuation, liquidity, and listing on a major U.S. exchange. Full details are available on our website.

- * Market Cap: Minimum \$100M
- * Share Price: Minimum \$5.00
- * Sufficient Liquidity

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End of 3Q18		100.000%				
		Percent	30-Jun-18	30-Sep-18	YTD	QTD
Company	Ticker	9/28/18	Price	Price	% Ch	% Ch
AXON International Inc.	AAXN	0.76%	63.18	68.43	158.23%	8.31%
AAR Corp	AIR	0.35%	46.49	47.89	21.89%	3.01%
Aerojet Rocketdyne	AJRD	0.50%	29.49	33.99	8.94%	15.26%
AeroVironment	AVAV	0.56%	71.43	112.17	99.73%	57.03%
Boeing Co	BA	7.05%	335.51	370.19	25.53%	10.34%
Booz Allen	BAH	1.50%	43.73	49.63	30.16%	13.49%
Ball Corp	BLL	3.24%	35.55	43.99	16.22%	23.74%
BWX Technologies	BWXT	1.31%	62.32	62.54	3.39%	0.35%
Caci Intl	CACI	0.96%	168.55	184.15	39.14%	9.26%
Comtech	CMTL	0.18%	31.88	36.27	63.97%	13.77%
Rockwell Collins	COL	3.95%	134.68	140.47	3.58%	4.30%
Cubic Corp	CUB	0.42%	64.20	73.05	23.92%	13.79%
Curtiss Wright	CW	1.28%	119.02	137.42	12.78%	15.46%
Ducommun	DCO	0.10%	33.09	40.84	43.55%	23.42%
Engility	EGL	0.28%	30.64	35.99	26.86%	17.46%
Esterline Technologies	ESL	0.57%	73.80	90.95	21.75%	23.24%
Elbit Systems	ESLT	1.13%	118.74	125.52	-5.83%	5.71%
FireEye	FEYE	0.67%	15.39	17.00	19.72%	10.46%
Flir Systems	FLIR	1.80%	51.97	61.47	31.85%	18.28%
General Dynamics	GD	5.85%	186.41	204.72	0.62%	9.82%
Heico	HEI	2.57%	72.93	92.61	-1.84%	26.98%
Huntington Ingalls	HII	2.43%	216.79	256.08	8.65%	18.12%
Honeywell Intl	HON	6.93%	144.05	159.49	4.00%	10.72%
Harris Corp	HRS	4.12%	144.54	169.21	19.46%	17.07%
Hexcel	HXL	1.26%	66.38	67.05	8.41%	1.01%
Intelsat	I	0.76%	16.66	30.00	784.96%	80.07%
Kaman	KAMN	0.39%	69.69	66.54	13.09%	-4.52%
KBR	KBR	0.62%	17.92	21.03	6.05%	17.35%
KEY W Holding	KEYW	0.09%	8.74	8.66	47.53%	-0.92%
Kratos Defense & Security	KTOS	0.32%	11.51	14.78	39.57%	28.41%
Leidos	LDOS	2.20%	59.00	69.16	7.11%	17.22%
L-3 Communications Hlds	LLL	3.49%	192.32	212.62	7.47%	10.56%
Lockheed Martin	LMT	7.15%	295.43	345.96	7.76%	17.10%
Mantech International'a'	MANT	0.52%	53.64	63.30	26.12%	18.01%
Maxar Technologies	MAXR	0.39%	50.52	33.07	-48.59%	-34.54%
Moog Inc.	MOGA	0.65%	77.96	85.97	-1.01%	10.27%
Mercury Computer Sys	MRCY	0.55%	38.06	55.32	7.73%	45.35%
Northrop Grumman	NOC	5.32%	307.70	317.37	3.41%	3.14%
OSI Systems	OSIS	0.30%	77.33	76.31	18.53%	-1.32%
Oshkosh Truck	OSK	1.13%	70.32	71.24	-21.62%	1.31%
Perspecta	PRSP	0.90%	20.55	25.72	3.46%	25.16%
Raytheon Co	RTN	5.73%	193.18	206.66	10.01%	6.98%
SAIC	SAIC	0.73%	80.93	80.60	5.26%	-0.41%
Sparton	SPA	0.03%	18.99	14.43	-37.42%	-24.01%
Transdigm	TDG	4.02%	345.14	372.30	35.57%	7.87%
Teledyne Technologies	TDY	1.85%	199.06	246.68	36.17%	23.92%
Triumph Group	TGI	0.24%	19.60	23.30	-14.34%	18.88%
Textron	TXT	3.93%	65.91	71.47	26.29%	8.44%
United Technologies	UTX	6.95%	125.03	139.81	9.59%	11.82%
Vectrus	VEC	0.07%	30.82	31.19	1.10%	1.20%
Viasat Inc	VSAT	0.79%	65.72	63.95	-14.56%	-2.69%
VSE Corporation	VSEC	0.08%	47.78	33.13	-31.59%	-30.66%
Woodward	WWD	1.04%	76.86	80.86	5.64%	5.20%

Data Provided by Yahoo Finance, Thomson Reuters (P/E, PEG), Morningstar (div)