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www.spadeindex.com / defense

SPADE Defense Index Statistics

9/30/19 Close	7886.85
12/31/18 Close	5754.86

All-time Intraday High:
 19 September 2019 8079.25

All-time Closing High:
 18 September 2019 8053.81

	SPADE Defense	S&P500
3Q19	4.52%	1.19%
2Q19	11.92%	3.79%
1Q19	17.15%	13.07%
2019 YTD	37.05%	18.74%

Commentary

What's on our mind

- (1) The incredible run for the performance of investing in defense stocks
- (2) Our unstable world
- (3) Is a recession on the horizon?

* * *

An Incredible 8-Year Performance

In case you've missed it, the SPADE Defense Index is up 37.05% YTD in 2019 and has outperformed the market over the past 8 years (since 2012), in this most recent multi-year run, by 144.17%.

Additionally, a real strength of this index and products that track is its diversification. Since the March 737Max incident in Ethiopia, the added sector diversification provided investors with an added 560 bps vs. an ETF using a differing methodology that excludes non-industrial players in the sector. On 9/30, Boeing's weight in the SPADE Defense Index (which caps the size of individual holdings at rebalancing) was 6.82% vs. an outstanding 22.38% found in the competitor.

Our Unstable World

As we've long maintained, investing in the defense sector is as much a proxy on world stability as it is an investment in an economic sector that correlates less with the growth/recession cycles.

After watching the British miniseries "Years and Years", I am reminded how much happens in the world that is a top of the news alert one day and largely forgotten by the West (US, Canada, Europe) as new stories hit the news cycle even as the prior events continue to impact those immediately involved.

Part I: Middle East Tensions

In early September, Iranian-based Yemen forces (as reported) used drones to disrupt Saudi Arabia oil facilities sending prices up 20%, the most ever on a daily basis. Within days, prices were back to normal. A few weeks later, as this newsletter goes to press, Iran announced two missiles hit one of its tankers, though news on this has been limited and little impact seen in the energy markets.

Elsewhere, Turkey got permission to invade Syria (let's call it what it is) to battle the Kurdish people, random missiles have been fired into Israel by fighters sympathetic to the Palestine cause, and there are daily protests in Hong Kong over what its citizens see as an encroachment of its sovereignty agreement with China. While these and dozens of actions take place around the planet, the U.S. media focuses its out-sized attention on tweets, conspiracy theories, and political intrigue--all of which is very important from a US perspective and can lead to significant

SPADE Defense Index September 2019 Rebalance

All current companies met the rules governing the index. No companies needed to be added to or removed.

Corporate Actions Affecting the Index During the Quarter

L3 and Harris merged to become L3 Harris.

Licensed Products

Exchange Traded Fund (ETF)

The SPADE Defense Index has been licensed to Invesco and serves as the underlying index for the Invesco Aerospace & Defense ETF (NYSE Arca: PPA).

3Q19 Leaders

1	Teledyne Tech	17.57%
2	Intelsat	17.22%
3	Northrop Grumman	15.99%
4	Comtech	15.62%
5	Mercury Computer	15.38%
6	CACI	13.04%
7	Raytheon	12.83%
8	Aerojet Rocketdyne	12.82%
9	AAR Corp	12.01%
10	Perspecta	11.58%

3Q19 Laggards

1	Kratos	-18.79%
2	MOOG	-13.34%
3	AXON Int'l	-11.57%
4	Parsons	-10.53%
5	FireEye	-9.93%
6	OSI Systems	-9.83%
7	Oshkosh Truck	-9.21%
8	Textron	-7.69%
9	Viasat	-6.81%
10	Heico	-6.67%

YTD Results

1	Triumph Group	98.96%
2	Vectrus	88.37%
3	Mercury Computer	71.64%
4	Leidos	62.90%
5	KBR	61.66%
6	Heico	61.18%
7	CACI	60.56%
8	Ball Corp	58.35%
9	Booz Allen	57.58%
10	Jacobs Engineering	56.52%
11	Teledyne Tech	55.50%
12	L3 Harris	54.95%
13	Transdigm	53.11%
14	Northrop Grumman	53.04%
15	Perspecta	51.68%
16	BWX Technologies	49.65%
17	Lockheed Martin	48.97%
18	Woodward	45.15%
19	Elbit Systems	44.51%
20	Aerojet Rocketdyne	43.37%
21	Hexcel	43.23%
22	OSI Systems	38.55%
23	SAIC	37.13%
24	Mantech Intl	36.57%
25	Comtech	33.53%
26	Kratos Defense	31.94%
27	Cubic Corp	31.06%
28	AXON Int'l	29.78%
29	United Technologies	28.21%
30	Honeywell Intl	28.07%
31	Raytheon	27.94%
32	Viasat	27.77%
33	Curtiss Wright	26.68%
34	Oshkosh Truck	23.63%
35	FLIR Systems	20.79%
36	Boeing Co	17.98%
37	Ducommun	16.74%
38	General Dynamics	16.23%
39	Huntington Ingalls	11.29%
40	AAR Corp	10.36%
41	Parsons	7.60%
42	Intelsat	6.59%
43	Textron	6.46%
44	Kaman	6.01%
45	Moog	4.70%
46	FireEye	-17.71%
47	AeroVironment	-21.16%
48	Maxar Technologies	-36.45%

**ETF Statistics (NYSE Arca: PPA)
Invesco Aerospace & Defense**

Exchange / Ticker Symbol:	NYSE / PPA
Assets (9/30/19)	\$ 1.15B
Closing Price (9/30/19)	\$67.70
Yield (TTM)*	0.96%
3Q19 Volume**	5,062,100
Turnover*	15%

source: * Morningstar & ** Yahoo Finance 10/1/19

Portfolio Price / Earnings*	19.05
Portfolio Price / Book*	4.51
Portfolio Price / Sales*	1.84
Portfolio Price / Cash Flow*	19.03
Beta (3-year) *	1.15
Alpha (3-year)*	10.02
R-squared (3 years)*	60.60

source: * Morningstar, FactSet 10/1/19

Capture Ratio	3-Yr	5-Yr	10-Yr
Upside	149	133	118
Downside	87	66	72

PPA Dividend History

YTD	\$0.5120
2018	\$0.4441
2017	\$0.3635
2016	\$0.7082
2015	\$0.5019
2014	\$0.2153
2013	\$0.383
2012	\$0.444
2011	\$0.199
2010	\$0.155
2009	\$0.202
2008	\$0.145
2007	\$0.055
2006	\$0.051
2005	\$0.022

Commentary (continued from page 1)

changes in the political spectrum here and abroad; however it is at a cost of ignoring significant events from around the world. We have always maintained investing in defense is a form of insurance against world instability--current and perceived. Can anyone question whether the current period is less than stable?

Part II: Impact of Brexit

While holding out hope that a last minute solution will appear, unfortunately the likelihood is, regardless of Deal or No Deal Brexit, United Kingdom policies over the news two-plus years will see a bit of turmoil as the government acclimates to whatever changes occur. While this could have major repercussions for the economy of the UK and the world, the A&D sector will likely be spared and the direct impact limited. The US and UK have a number of longstanding treaties and agreements in place, independent of their involvement with the European Union, to support each other militarily. We don't see existing or new contracts with UK-based entities or partners chang-

ing due to Brexit.

Part III: Economic Uncertainty

What happens to the defense sector when the US goes into recession? From a business and new contracts perspective, little as contracts from the defense department tend to be multi-year and dependent on the future year budgets authorized by Congress. In practice, when there is a market sell-off due to market conditions, defense stocks tend to roll-over a bit as investors initially sell their winning holdings to lock in gains. As time has proven, defense stocks have consistently been winners so there is a bit of a short-term hangover. That said, we've run the numbers and since 1980, and investors would have recovered their principal after reinvesting dividends within three years, regardless of any declines. There has been no "lost decade" like there was with the S&P500.

Part IV: Tariffs-The Double Edged Sword

Much of the media attention of the White House implementation of tariffs has been focused on products coming from China,

continued on page 4

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



Commentary (continued from page 3)

threats to post tariffs on automobiles from Europe, as well as products from Canada and Mexico as part of their negotiation for a new North American trade agreement. Each of these was covered by the media because of the profound impact they have on U.S. trade and the global economy. The impact of these tariffs on the defense sector, however, is relatively minimal since little military business done with China and defense products and services have been excluded from any discussion with Europe, Mexico, China, etc.

Why bring this up? After a 15-years in litigation, the World Trade Organization (WTO) ruled that the cheap loans provided by Europe to support Airbus and its development of aerospace vehicles was an illegal subsidy. In a decision favoring Boeing and the US, the WTO approved the US imposing countermeasures of \$7.5B in tariffs with a 10% rate on aircraft.

Presently, Airbus has a \$47B backlog to US airlines while Boeing has a \$17B backlog to western Europe firms. Considering 40% of Airbus' aircraft related procurement comes from US aerospace suppliers, this could increase the cost of their plans by \$15-\$20M (based on the original list price of an A380 of \$446M).

More importantly, this could enable a trade war with Europe. A politically agreed to solution/settlement is being discussed and this is critical because if a protracted battle ensues, then the long established process of how R&D is funded by US government agencies could be disrupted. While Europe has had a more overt, direct funding relationships with its manufacturing base, agencies such as the US Department of Defense and NASA have long relied on contracts that fund the development of new technology and systems. Where the line will now be drawn between overt subsidies and basic funding of science and technology development is one I imagine is debated heartily by economic professors and policy analysts. The question of what form of retribution takes place and whether the contracting system has to evolve is something that we are watching as a longer term issue for the sector.

What Else We Are Watching***The Boeing 737 Max***

The situation with Boeing getting the 737-Max back in service has proven to be more challenging than initially

anticipated. Although the firm continues to maintain it has a software fix, it's clients--the airlines--continue to postpone first flights and have pushed back the plane reentering operations until 1Q20...that is assuming they get approval from the FAA. Regulatory agencies around the world will be making their decisions independently so while it is possible that approval may come sooner in some parts of the world, the likelihood is that most airlines will wait until the US FAA gives its blessings. Moving forward, the 737-Max situation will have profound impact on the inclusion of new technology in future aircraft and in the profitability of airplane manufacturers. Boeing got caught trying to squeeze out additional profits by offering as an option an item now seen as mandatory for safety. Airlines will undoubtedly want to see greater testing before accepting aircraft with any new technology.

The world currently has only two commercial manufacturers of these large body planes that the airlines rely on. One has to wonder how long before China and Russia devote enough resources to mount a viable competitor. A 10-20 year time horizon is beyond what investors consider, but it can come much faster than people anticipate.

New Weapons Trend

A number of years back we discussed the cyclical nature of defense technology. Every time a new weapon or technology is developed to gain an edge over an adversary, resources are allocated to counter it and level the playing field. The advent of the armored tank led to the development of anti-tank projectiles. The expanded use of attack aircraft led to the development of radar, which in turned spurred the development of stealth technology. The utility of intercontinental ballistic missiles necessitated the invention of satellite monitoring. For each new advantage, there is a counter, and then a counter to the counter.

The latest of these game changing technologies has begun to enter the military planner lexicon--hypersonic weapons. Missiles that can travel faster than the speed of sound and reach their targets quicker and stealthier than those that currently exist offer a huge strategic advantage. Both Russia and China have publicized tests and evolving capabilities in these areas and Pentagon officials in the US are ramping up R&D spending in this area. Recently, the US Missile Defense Agency chose Boeing, Lockheed Martin, and Raytheon to further their efforts in this area by providing contracts under the Hypersonic Defense Weapon System Program.

By the Numbers

\$63 B - \$85 B - Program value of the USAF's GBSB program to replace the Minuteman ICBM (amount depends on the source). Boeing recently announced it is declining to submit a bid citing Northrop Grumman's purchase of rocket motor manufacturer Orbital ATK and other reasons that put it as a disadvantage. Aerojet Rocketdyne, the only other US manufacturer of large solid rocket motors, has joined the Northrop Grumman team. A 2020 decision is anticipated.

\$50.4 B - Japan's annual defense budget, the 8th year in a row it has grown.

\$47 B - Cost of Poland's military modernization program. As part of this, it is seeking approval to buy 32 F-35 fighter jets manufactured by Lockheed Martin and to expand its role in the global F-35 supply chain.

\$22.75 B - The proposed budget for NASA cleared the Senate Appropriations.

\$22 B - The Air Force and Lockheed Martin have started an upgrade program for the F-35.

\$10.6 B - Amount the new Space Development Agency plans to invest in satellite constellations over the next 5 years.

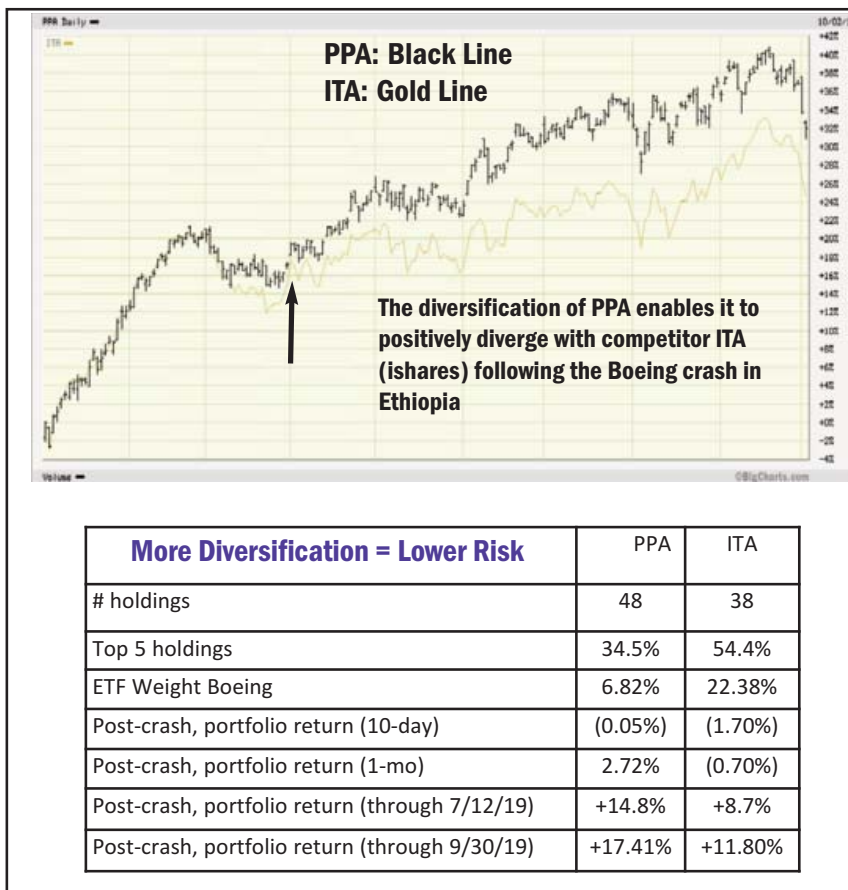
\$7.6 B - CSRA, a General Dynamics subsidiary is lead contractor for the Defense Enterprise Office Solutions cloud computing program.

\$6.3 B - Boeing contract from Korean Air for twenty 787 Dreamliners.

\$2.4 B - Lockheed for F-35 spare parts.

\$2.26 B - General Dynamics - From Canada for 360 military vehicles.

\$1.5 B - Collins Aerospace (a division of United Technologies) signed multiyear deals to support the Airbus A320 and Boeing 787.



\$1.1 B - General Dynamics - Received a Navy contract to supply expeditionary sea base ships

\$999 M - Boeing received a contract to continue building replacement wings for the 100 A-10 Warthog attack planes. They delivered 173 wing sets from 2011 to 2018. This will extend the A-10 until the early 2030s.

\$687 M - Huntington Ingalls for work on the USS Gerald R. Ford aircraft carrier

\$623 M - The Czech Republic plans to buy 8 Textron Bell UH-1Y Venom and 4 AH-1Z Viper helicopters.

\$534 M - Raytheon for Army Tank infrared thermal viewers

TBD - The Office of Naval Research awarded contacts to General Dynamics and SAIC to design a full scale prototype demonstration vehicle to replace the light armored vehicles (LAV) used by the Marine Corps since the early 1980s.

Other News Items That Could Affect Earnings

Boeing is planning to increase production of the 777 freighter in response to strong market demand.

Lockheed Martin Sikorsky received permission to go into production for its new combat rescue

helicopter HH-60W, a derivative of the Black Hawk that has better defensive systems than the HH-60G Pave Hawk which is currently used.

Total Price Return

(w/o dividends)

	SPADE Defense Index
3-Yr	62.29%
5-Yr	97.60%
10-Yr	305.99%
20-Yr	700.11%

Data through 9/30/19
* 2019 is YTD,
prior reflects calendar

Index Performance (ex div)

	SPADE Defense Index	S&P500	Alpha (bps)
YTD	37.05%	18.74%	1831
2018	[8.15%]	[6.24%]	191
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]

	SPADE Defense Index	S&P500	Alpha (bps)
2008	[38.03%]	[38.49%]	46
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]

Since the market selloff in 2008, the SPADE Defense Index is up **394.14%**, outgaining the **229.51%** return for the S&P500--an alpha of more than **164%**

Without reinvesting dividends...\$10,000 invested when the index began calculating in 1998 would be \$98,337.22 at the end of 3Q19.

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 and its homeland security, and space components.

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. Each firm is considered to be systematically important to the defense of the United States and defense is systematically important to the business, revenues, and health of the firm.

Full details are available on our website.

* Market Cap: Minimum \$100M

* Share Price: Minimum \$5.00

* Sufficient Liquidity

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End of 2Q19		99.999%					Market	Forward	Price/	Price/	PEG	
							Cap	P/E	Sales	Book	5 yr	Div Yld
		Percent	28-Jun-19	30-Sep-19	YTD	QTD	intraday	(ttm)	ttm	mrq	expected	forward %
Company	Ticker	9/30/19	Price	Price	% Ch	% Ch						
Kratos Defense & Security	KTOS	0.43%	22.89	18.59	31.94%	-18.79%	1.97	38.74	2.94	3.52	4.31	
Moog Inc.	MOGA	0.63%	93.61	81.12	4.70%	-13.34%	2.85	14.41	1	2.09	1.64	1.19%
AXON International Inc.	AAXN	0.75%	64.21	56.78	29.78%	-11.57%	3.37	44.02	7.51	6.88	1.94	
Parsons	PSN	0.71%	36.86	32.98	7.60%	-10.53%	3.28	26.81	0.86	-2.38		
FireEye	FEYE	0.60%	14.81	13.34	-17.71%	-9.93%	2.87	78.47	3.34	3.87	9.43	
OSI Systems	OSIS	0.41%	112.63	101.56	38.55%	-9.83%	1.85	19.64	1.57	3.34	1.27	
Oshkosh Truck	OSK	1.23%	83.49	75.8	23.63%	-9.21%	5.18	9.78	0.63	2.01	1.29	1.44%
Textron	TXT	2.58%	53.04	48.96	6.46%	-7.69%	11.27	12.24	0.85	2.11	1.39	0.16%
Viasat Inc	VSAT	1.02%	80.82	75.32	27.77%	-6.81%	4.62	129.86	2.13	2.35	-11.73	
Heico	HEI	3.72%	133.81	124.88	61.18%	-6.67%	14.56	48.22	7.31	10.37	3.05	0.11%
Kaman	KAMN	0.37%	63.69	59.46	6.01%	-6.64%	1.66	27.66	0.90	2.53	3.91	1.35%
Ducommun	DCO	0.11%	45.07	42.4	16.74%	-5.92%	0.49	14.83	0.72	1.8	0.74	
Huntington Ingalls	HII	1.99%	224.74	211.79	11.29%	-5.76%	8.75	12.52	1.02	5.39	-5.88	1.61%
AeroVironment	AVAV	0.29%	56.77	53.56	-21.18%	-5.65%	1.28	29.59	3.97	2.64	1.10	
Woodward	WWD	1.49%	113.16	107.83	45.15%	-4.71%	6.63	19.57	2.30	3.90	1.37	0.60%
Honeywell Intl	HON	7.27%	174.59	169.2	28.07%	-3.09%	121.74	19.10	3.15	6.81	3.07	2.14%
Maxar Technologies	MAXR	0.10%	7.82	7.6	-36.45%	-2.81%	0.45	1.52	0.23	0.62	1.25	0.51%
Flir Systems	FLIR	1.60%	54.1	52.59	20.79%	-2.79%	7.32	20.15	3.94	3.73	1.04	1.29%
KBR	KBR	0.77%	24.94	24.54	61.66%	-1.60%	3.47	12.46	0.65	1.96	1.22	1.31%
Triumph Group	TGI	0.26%	22.9	22.88	98.96%	-0.09%	1.15	7.31	0.35	---	0.85	0.69%
Vecrus	VEC	0.10%	40.56	40.65	88.37%	0.22%	0.47	10.48	0.36	1.95		
General Dynamics	GD	5.10%	181.82	182.73	16.23%	0.50%	52.78	13.97	1.38	4.09	1.78	2.23%
SAIC	SAIC	1.17%	86.56	87.35	37.13%	0.91%	5.04	13.91	0.90	3.78	3.13	1.73%
Hexcel	HXL	1.56%	80.88	82.13	43.23%	1.55%	6.99	20.95	3.01	4.84	2.03	0.84%
Curtiss Wright	CW	1.24%	127.13	129.37	26.68%	1.76%	5.53	16.98	2.25	3.34	2.19	0.49%
United Technologies	UTX	7.18%	132.2	136.52	28.21%	3.27%	117.79	15.51	1.62	2.86	1.96	2.16%
Ball Corp	BLL	3.91%	69.99	72.81	58.35%	4.03%	21.17	23.95	2.09	6.98	1.87	0.82%
Boeing Co	BA	7.10%	364.01	380.47	17.98%	4.52%	214.09	16.95	2.32		9.91	2.15%
Booz Allen	BAH	2.23%	66.21	71.02	57.58%	7.26%	9.96	20.29	1.45	13.30	1.92	1.30%
Lockheed Martin	LMT	7.14%	363.54	390.06	48.97%	7.29%	110.15	15.38	1.92	38.65	1.28	2.48%
Leidos	LDOS	2.81%	79.85	85.88	62.90%	7.55%	12.05	16.39	1.14	3.68	1.77	1.60%
Transdigm	TDG	3.97%	483.8	520.67	53.11%	7.62%	27.79	23.68	5.68	---	1.79	
Jacobs Engineering	JEC	2.91%	84.39	91.5	56.52%	8.43%	12.40	16.43	0.74	2.05	1.20	0.75%
Mantech International'a'	MANT	0.64%	65.85	71.41	36.57%	8.44%	3.83	28.00	1.88	1.99	3.10	1.52%
Cubic Corp	CUB	0.43%	64.48	70.43	31.06%	9.23%	2.20	17.74	1.56	2.32		0.38%
BWX Technologies	BWXT	1.22%	52.1	57.21	49.65%	9.81%	5.45	20.65	3.04	18.51	2.67	1.18%
Elbit Systems	ESLT	1.58%	149.51	164.77	44.51%	10.21%	7.34	24.85	1.81	3.44		1.08%
L3HARRIS TECHNOLOGIES INC.	LHX	3.95%	189.13	208.64	54.95%	10.32%	46.44	18.86	6.83	7.36	1.25	1.44%
Perspecta	PRSP	0.95%	23.41	26.12	51.68%	11.58%	4.24	12.09	0.98	1.97	2.50	0.93%
AAR Corp	AIR	0.32%	36.79	41.21	10.36%	12.01%	1.44	13.97	0.68	1.56	0.96	0.72%
Aerojet Rocketdyne	AJRD	0.86%	44.77	50.51	43.37%	12.82%	3.97	25.90	2.08	7.48	1.37	
Raytheon Co	RTN	5.35%	173.88	196.19	27.94%	12.83%	54.64	15.16	1.95	4.48	1.37	1.93%
Caci Intl	CACI	1.29%	204.59	231.26	60.56%	13.04%	5.75	16.83	1.15	2.43	3.96	
Mercury Computer Sys	MRCY	0.99%	70.35	81.17	71.64%	15.38%	4.50	34.54	6.88	3.43	1.91	
Comtech	CMTL	0.18%	28.11	32.5	33.53%	15.62%	0.79	17.66	1.17	1.47	1.49	1.20%
Northrop Grumman	NOC	6.19%	323.11	374.79	53.04%	15.99%	63.41	16.63	1.93	6.89	2.45	1.42%
Intelsat	I	0.70%	19.45	22.8	6.59%	17.22%	3.21	-7.35	1.51	-0.68	-0.05	
Teledyne Technologies	TDY	2.60%	273.87	321.99	55.50%	17.57%	11.71	29.65	3.9	4.74	1.11	

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