

## Lewis Shepherd

#### AFCEA Intelligence Committee Adjunct Professor, GMU Graduate School of Engineering

Senior Director, National Technology Strategy VMware Research Group "The drive to develop new technologies is relentless, expanding to more actors with lower barriers of entry, and moving at accelerating speed."



"Maintaining the Department's technological advantage will require changes to industry culture, investment sources, and protection across the National Security Innovation Base."

## "Reform the Department for Greater Performance and Affordability"



"The current bureaucratic approach, centered on exacting thoroughness and minimizing risk above all else, is proving to be increasingly unresponsive."

"Deliver performance at the speed of relevance... Our response will be to prioritize speed of delivery, continuous adaptation, and frequent modular upgrades."

## "Reform the Department for Greater Performance and Affordability"



"We must not accept cumbersome approval chains...or overly risk-averse thinking that impedes change."

"The Department's leadership is committed to changes in authorities, granting of waivers, and securing external support for streamlining processes and organizations."

#### DEFENSETECH

A > News > Defense Tech

#### New Air Force Acquisitions Chief Aims to Rid F-35 of Software Glitches



"To me, it's a software program at this point," Roper said of the Lockheed Martin aircraft, the largest procurement program in Pentagon history with costs projected at upwards of \$400 billion.



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"The rest of acquisition can be improved, but it's the software -- we've got to up our game," he said. "A lot of the sustainment problems could be solved if we could do the software."

"Underpinning the F-35's unrivaled capabilities is more than eight million lines of software code -- more than four times the amount of the world's first 5th-generation fighter, the F-22 Raptor," Lockheed said in a press release.



NITASHA TIKU BUSINESS 05.21.18 07:00 AM

#### THE LINE BETWEEN BIG TECH AND DEFENSE WORK

FOR MONTHS, A growing faction of Google employees has tried to force the company to drop out

said one former Google employee, who recently resigned in part because of Project Maven. "We've just sort of taken it for granted, 'Oh yeah, the US is the good guys.'"

interview job candidates in order to slow the project's progress.	
Other tech giants have recently secured high-profile contracts to build technology for defense, military,	

# Pop Quiz

We all know "**The Garage**" origin, a world-famous computer company born when two brilliant young innovators formed a startup in a Palo Alto garage....

# What decade was that?



#### 1970s Cupertino

#### Palo Alto 1930s





Data/chart from Steve Blank, "The Secret History of Silicon Valley"



First electronics company in Silicon Valley: Federal Telegraph, a vacuum tube company started in 1909 in Palo Alto

Chief scientist Lee Deforest made the first ship-to-shore radiotelephone call and in 1912 invented the Triode, a tube amplifier that became the foundation for pre-transistor electronics; AT&T purchased the patents and commercialized; essential in WWII and Cold War



*"The Father of Radio"* 

*Historic landmark at corner of Channing & Emerson, Palo Alto* 







Farnsworth vacuum-tube "image diffusors"

Invention of electronic television by **Philo T. Farnsworth**, "the Father of Television," **1927** 

Farnsworth Television and Radio Corp. acquired by defensecontractor ITT where Philo works on USG-funded research



**1937, Russell & Sigurd Varian** invent the **klystron** microwave tube in a lab at Stanford University –

backbone for development of radar, satellite communications, guidance systems for WWII/Cold War airplanes & missiles; used as the trigger in A-bomb fuses; Doppler radar for SAC bomber defense; used today in modern particle accelerators



1939 Palo Alto Times



*Today: Varian Physics Library, Stanford University, Palo Alto*  "Vacuum-Tube Valley" - **Bill Hewlett & Dave Packard** began in their "Garage" in **1938**; their electronics equipment became ubiquitous in USG labs during & after WWII



#### "The True Father of Silicon Valley":

Fred Terman, longtime Dean of Stanford Engineering Dept.

**1926-1940** Terman funded Deforest and Varian; introduced Hewlett to Packard, steered them to their first customers.

**1941-45** Terman ran the secret **Radar Research Laboratory**, directing all wartime U.S. electronics R&D; pioneered radar, ECM, SIGINT, early computers; directed \$Billions and >850 scientists

**1945-1965** As Dean and then Stanford Provost, Terman purposefully created a Silicon Valley ecosystem of basic R&D and advanced development; attracted Lockheed and IBM to the Valley; matchmaker for \$Billions in classified funding for new Valley startups (Litton, Fairchild, Intel, ESL etc) on contracts for DoD, SAC, NSA, CIA, NRO... **Cold War:** While at Stanford, and serving on several USG boards & panels, Terman also served on the board of Varian Associates and several other Valley startups



#### **1951** Varian Associates annual report:

Fortunately for the nation but unfortunately for our private plans, Varian Associates' basic technical abilities are of great value to the national defense effort and critically needed. Although we would have much preferred to continue on a moderate expansion program, reaching a modest size with interesting and profitable commercial business, I can state that the officers and directors of Varian Associates recognize fully their obligation to contribute to the maximum extent to the defense effort. Extreme pressure has been put upon us to expand at as rapid a rate as our management ability will permit. We are trying to comply with this urgent need for increased facilities by pushing our expansion program just as rapidly as we possibly can.<sup>49</sup>

## Historical trends in U.S. federal R&D funding



## USG R&D funding vs. Corporate R&D funding

Percent of GDP



#### The slow decline of Government IT:

#### USG missed 3 recent paradigm shifts... badly.



1980 1990 2000 2010

# Pace of Technology Development

"Moore's Law" Computing, 18 months

"Fiber Law" Communication, 9 months

"Storage Law" Storage, 12 months

## "WATLY's Law"

Lag time of government adopting any new COTS innovation doubles every two years



GLOBAL

#### China heads for top of world in R&D spending – OECD

Wachira Kigotho 14 November 2014 Issue No:343

China poised to outpace the US in R&D spending around 2019 GERD, millions of 2005 USD PPP, 2000-12 and projections to 2024



🛨 Share < 28

to overtake the European Union and the United th and development, or R&D, spending by the end ccording to an OECD report on the global state of ogy and industry published last Wednesday.

ch and development budgets in Europe and oded the weight of advanced economies in nology research, patent citations and scientific ving China on track to be the world's top R&D

biennial report, OECD Science, Technology and 2014, China's intensity in research and triven by economic dynamism and its long-term science and technology innovation.



#### 2017 Top 10 Supercomputers

Fastest performance, Teraflops per second

Rank	Site	System	Cores	(TFlop/s)
1	National Supercomputing Center in Wuxi China	Sunway TaihuLight - Sunway MPP, Sunway SW26010 260C 1.45GHz, Sunway NRCPC	10,649,6 <mark>00</mark>	93,014.6
2	National Super Computer Center in Guangzhou China	Tianhe-2 (MilkyWay-2) - TH-IVB-FEP Cluster, Intel Xeon E5-2692 12C 2.200GHz, TH Express-2, Intel Xeon Phi 31S1P NUDT	3,120,00 <mark>0</mark>	33,862.7
3	Swiss National Supercomputing Centre (CSCS) Switzerland	Piz Daint - Cray XC50, Xeon E5-2690v3 12C 2.6GHz, Aries interconnect , NVIDIA Tesla P100 Cray Inc.	361,760	19,590.0
4	Japan Agency for Marine-Earth Science and Technology Japan	<b>Gyoukou</b> - ZettaScaler-2.2 HPC system, Xeon D-1571 16C 1.3GHz, Infiniband EDR, PEZY-SC2 700Mhz <b>ExaScaler</b>	19,860,000	19,135.8
5	DOE/SC/Oak Ridge National Laboratory United States	Titan - Cray XK7, Opteron 6274 16C 2.200GHz, Cray Gemini interconnect, NVIDIA K20x Cray Inc.	560,640	17,590.0
6	DOE/NNSA/LLNL United States	<b>Sequoia</b> - BlueGene/Q, Power BQC 16C 1.60 GHz, Custom IBM	1,572,864	17,173.2
7	DOE/NNSA/LANL/SNL United States	<b>Trinity</b> - Cray XC40, Intel Xeon Phi 7250 68C 1.4GHz, Aries interconnect <b>Cray Inc.</b>	979,968	14,137.3
8	DOE/SC/LBNL/NERSC United States	<b>Cori</b> - Cray XC40, Intel Xeon Phi 7250 68C 1.4GHz, Aries interconnect <b>Cray Inc.</b>	622,336	14,014.7
9	Joint Center for Advanced High Performance Computing Japan	<b>Oakforest-PACS</b> - PRIMERGY CX1640 M1, Intel Xeon Phi 7250 68C 1.4GHz, Intel Omni-Path <b>Fujitsu</b>	556,104	13,554.6
10	RIKEN Advanced Institute for Computational Science (AICS) Japan	K computer, SPARC64 VIIIfx 2.0GHz, Tofu interconnect Fujitsu	705,024	10,510.0

# Where are "the big tech companies"?

Rank	Company	Region	Current Market Value (\$B)
1	Apple	USA	\$801
2	Google - Alphabet	USA	680
3	Amazon	USA	476
4	Facebook	USA	441
5	Tencent	China	335
6	Alibaba	China	314
7	Priceline	USA	92
8	Uber	USA	70
9	Netflix	USA	70
10	<b>Baidu</b>	China	66
11	Salesforce	USA	65
12	Paypal	USA	61
13	Ant Financial	China	60
14	JD.com	China	58
15	Didi Kuaidi	China	50
16	Yahoo!	USA	49
17	Xiaomi	China	46
18	eBay	USA	38
19	Airbnb	USA	31
20	Yahoo! Japan	Japan	26
Total			\$3,827



Source: CapIQ, CB Insights, Wall Street Journal, media reports. Market value data as of 5/26/17.

Note: For public companies, colors denote current market value relative to Y/Y market value. Green = higher. Red = lower. Yellow = private companies, where market value represents latest publicly announced valuation. Ant Financial and Didi Kuaidi valuation per latest media reports as of 6/16 and 4/17 respectively. Xiaomi valuation per latest media reports as of 4/17. Ant Financial treated separately from Alibaba as Alibaba retains no control of Ant and will receive a capped lump sum payment in the event of an Ant liquidity event. Cash includes cash and equivalents and short-term marketable securities plus long-term marketable securities media reports.

## What is a "U.S. tech company"?

#### South China Morning Post

China to replace US as world's top consumer tech market, says CES chief

PUBLISHED : Monday, 25 May, 2015, 12:33pm

Shapiro, citing industry data and estimates, said the size of the consumer technology market in China, the world's second largest economy, will grow by around 5 per cent to US\$281 billion this year, most likely overtaking the US as a the primary market for consumer technology goods by 2016.

# 第八届中美互联网论坛

The 8<sup>th</sup> US-China Internet Industry Forum / Seattle, September 23, 2015



Mark Zuckerberg, the chief executive of Facebook (a company essentially blocked from doing business in China by Internet regulators) spent about a minute speaking to Xi in Mandarin. Executives down the line delivered scripted-sounding, formal thanks to the leader of the world's most populous country.



# Tech leaders looked miserable in their meeting with Trump





Congratulate, they did. According to the official People's Daily, Mr. Cook expressed his admiration for Mr. Xi's leadership in global governance. Mr. Zuckerberg borrowed a phrase from Mr. Xi's speech to the congress, "Never forget where you started,"



#### Apple's Tim Cook and Google's Sundar Pichai attend Chinese state-run internet conference

of heavy censorship

PUBLISHED : Sunday, 03 December, 2017, 12:13pm UPDATED : Sunday, 03 December, 2017, 5:19pm

Tim Cook touts privacy, security at Chinese con promoting internet censorship

BY DAN PYE . MONDAY, DECEMBER 4, 2017



#### Tech chiefs make first appearance at event used to pus **China reboots internet conference with** keynote from Cook

Apple CEO lends credibility, kills VPN apps

By Kieren McCarthy in San Francisco 4 Dec 2017 at 21:22



China's efforts to reboot an annual internet conference have received a big boost with a keynote from Apple CEO Tim Cook and the attendance

NOVEMBER 21, 2017

Wuzhen, just outside Apple removes Skype from Chinese app store a to exert greater influence after request from Ministry of Public Security

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#### THEVERGE TECH - SCIENCE - MORE =

#### Apple is opening two more R&D centers in China

By Chaim Gartenberg | @cgartenberg | Mar 17, 2017, 2:15pm EDT

# Google is opening a China-based research lab focused on artificial intelligence

Posted Dec 12, 2017 by Jon Russell (@jonrussell)

Google has officially announced that it is opening an AI center in Beijing, China.

The confirmation comes after months of speculation fueled by a major push to hire AI talent inside the

#### THE WALL STREET JOURNAL.

#### Intel Warned Chinese Companies of Chip Flaws Before U.S. Government

Decision to disclose issue to select few customers, including Lenovo and Alibaba, has ripple effects through security and tech industries

*By Robert McMillan in San Francisco and Liza Lin in Shanghai* Jan. 28, 2018 11:37 a.m. ET Il has hundreds of staff in China which Alphabet chairman Eric Schmidt has pogle wouldn't want to ignore China's rts that include former Google China **Cold War:** While at Stanford, and serving on several USG boards & panels, Terman also served on the board of Varian Associates and several other Valley startups



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# **4 Recommendations** for USG – and its partners

Unleash Termans across DoD; Efforts at rapid non-traditional acquisition on the SCO model, using OTA and the like



Gap behind commercial US investment = >\$125B / year



Creative thinking on the Globalization issue

e.g. Basic R&D using recruited non-U.S.-located scientists?



Most R&D money will be spent OUTSIDE "Silicon Valley"

 on agile, fast-start efforts but within traditional USG Industry partners

# Enjoy the Symposium!

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