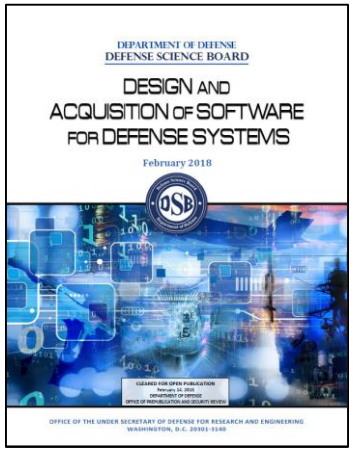
Driving Revolutionary Change in DoD Software Design and Acquisition

Joe Elm (L-3 Communications, NDIA SE Division vice-chair)
Geoff Draper (Harris)



https://www.acq.osd.mil/dsb/reports/2010s/DSB_SWA_Report_FINALdelivered2-21-2018.pdf

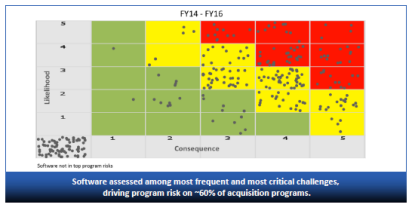


Figure 2. Software Risk Assessed by DoD Program Office

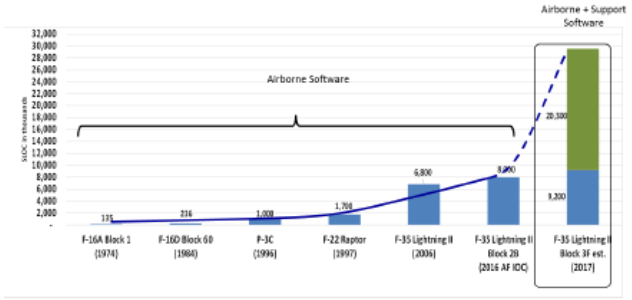


Figure 1. DoD Software Complexity and Growth: Explosive Growth of Source Lines of Code (SLOC) in Avionics Software[3]

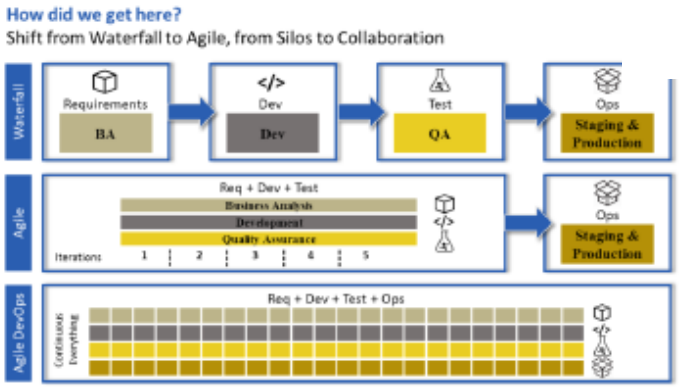


Figure 3. Theories of Software Development[4]

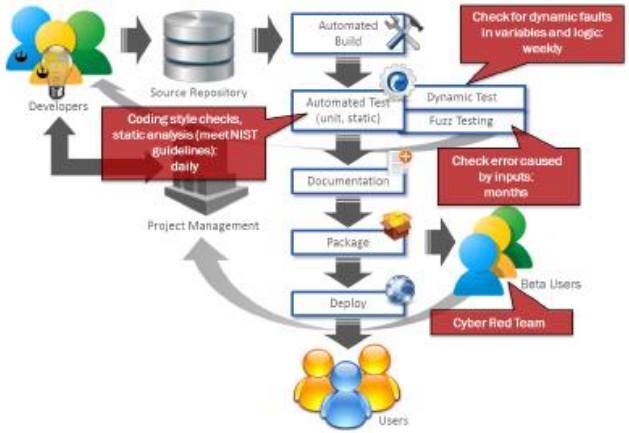


Figure 7. Addressing Cyber in the Software Factory

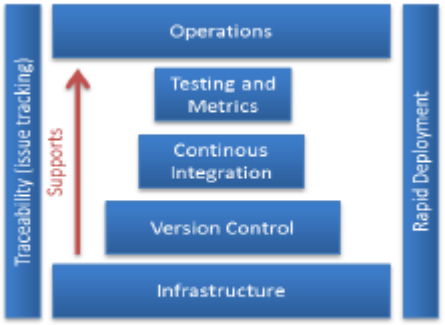


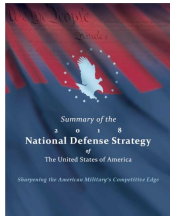
Figure E-1. Software Factory in Source Selection

Introduction

- **Software trends on DoD programs**
- **Is the defense industry capable of meeting future needs?**
  - Defense Science Report (DSB) task report, "Design and Acquisition of Software for Defense Systems"
  - Defense Innovation Board
- **DoD interest in commercial practices**
  - Iterative methods, DevOps, software factories, …
- **NDIA SE Division action (June 2018)**
  - Establish division level working group to provide action plan and industry recommendations for DoD consideration
  - Collaboration with INCOSE and other industry partners

DoD and Congress are Mandating Rapid Iterative Software Development for Defense Acquisition

National Defense Strategy



https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

"…streamline rapid, iterative approaches from development to fielding."

Defense Science Board (DSB) Task Force on the Design and Acquisition of Software for Defense Systems

https://www.acq.osd.mil/dsb/reports/2010s/DSB_SWA_Report_FINALdelivered2-21-2018.pdf

Recommendations:
- Evaluation criteria: efficacy of offeror's SW factory
- Adopt continuous, iterative development
- Risk reduction and metrics for new programs
- Transition for current and legacy programs in development, production, and sustainment
- Build competency in DoD and contractor workforce
- Source selection preference for delivery of SW factory framework to USG

NDAA 2019 (Sec. 868)

H.R.5515 - John S. McCain National Defense Authorization Act for Fiscal Year 2019
115th Congress (2017-2018) | Get alerts

SEC. 868. IMPLEMENTATION OF RECOMMENDATIONS OF THE FINAL REPORT OF THE DEFENSE SCIENCE BOARD TASK FORCE ON THE DESIGN AND ACQUISITION OF SOFTWARE FOR DEFENSE SYSTEMS.
(a) IMPLEMENTATION REQUIRED.—Not later than 18 months after the date of the enactment of this Act, the Secretary of Defense shall, except as provided under subsection (b), commence implementation of each recommendation submitted as part of the final report of the Defense Science Board Task Force on the Design and Acquisition of Software for Defense Systems.

https://www.congress.gov/bill/115th-congress/house-bill/5515/text

"Not later than 18 months after the date of the enactment of this Act, the Secretary of Defense shall… commence implementation of each recommendation submitted as part of the final report of the Defense Science Board Task Force on the Design and Acquisition of Software for Defense Systems."

Joint Industry SW Development and Acquisition WG

Advise and inform DoD on implementation recommendations (policies, guidance, RFP language, source selection criteria, training, metrics)

Waterfall

Agile

DevOps

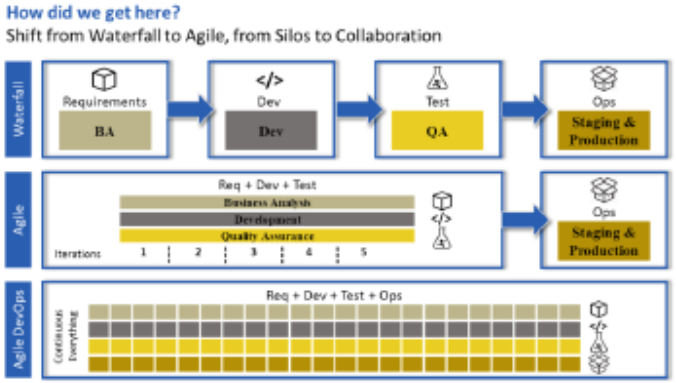
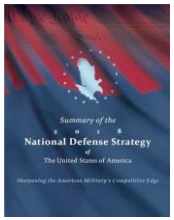


Figure 3. Theories of Software Development[4]

Streamlined acquisition, commercial practices, and iterative development are getting high emphasis in high places…

National Defense Strategy



https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

Software Productivity Trends and Issues (IDA)

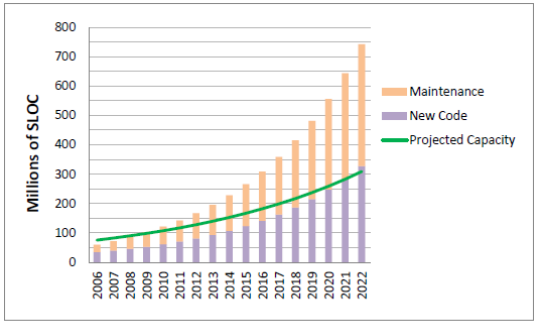


Figure 4. Forecast Supply vs. Unconstrained Demand

https://www.ida.org/idamedia/Corporate/Files/Publications/IDA_Documents/CARD/2017/D-8367.pdf

NDAA 2019

H.R.5515 - John S. McCain National Defense Authorization Act for Fiscal Year 2019

115th Congress (2017-2018) | Get alerts

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James N. Mattis
Secretary of Defense

Patrick M. Shanahan
Deputy Secretary of Defense

Ellen M. Lord
USD (A&S)

Dr. Michael D. Griffin
USD (R&E), CTO

Jeff Boleng
SEI, CTO
Special Ass't for Software Acquisition

Kristen Baldwin
Mission Engineering and Integration

Defense Innovation Board

DEFENSE INNOVATION BOARD

https://innovation.defense.gov/

Recommendations

Defense Innovation Board Ten Commandments of Software Fo

Defense Digital Service (DDS)

https://www.dds.mil/

Defense Innovation Unit Experimental (DIUx)

DEFENSE INNOVATION UNIT EXPERIMENTAL

https://www.diux.mil/

Defense Science Board (DSB) Task Force on the Design and Acquisition of Software for Defense Systems

https://www.acq.osd.mil/dsb/reports/2010s/DSB_SWA_Report_FINALdelivered2-21-2018.pdf

DSB Software Task Force

Defense Science Board (DSB) Task Force on the Design and Acquisition of Software for Defense Systems (Feb 2018):

"The task force concluded that the Department needs to change its internal practices to encourage and incentivize new practices in its contractor base. The assessment of the Task Force is that the Department can leverage best practices of iterative development even in its mission critical software systems."

https://www.acq.osd.mil/dsb/reports/2010s/DSB_SWA_Report_FINALdelivered2-21-2018.pdf

OFFICE OF THE SECRETARY OF DEFENSE
3140 DEFENSE PENTAGON
WASHINGTON DC 20301-3140

DEFENSE SCIENCE BOARD

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

SUBJECT: Final Report of the Defense Science Board (DSB) Task Force on the Design and Acquisition of Software for Defense Systems

I am pleased to forward the final report of the DSB Task Force on the Design and Acquisition of Software for Defense Systems, chaired by Dr. William LaPlante and Dr. Robert Wisnieff.

The Task Force has made seven recommendations on how to improve software acquisition in defense systems. A base recommendation underlying all others is to emphasize the importance of the software factory and to incorporate the software factory as a key evaluation criterion in the source selection process. Next, the Department of Defense (DoD) and its defense industrial base partners need to adopt continuous iterative development best practices. The study recommends DoD adopt best practices on risk reduction and metrics in formal program acquisition strategies. Software strategies must be better incorporated in current and legacy programs from development, production, and sustainment. The Task Force recommends ways to improve the software and acquisition workforce, in both software development expertise and the broader functional acquisition work force. Next, software is immortal and contracts must be framed to allow for software sustainment. Finally, the Task Force recommends further research into machine learning and the implementation of an independent verification and validation process for machine learning and autonomy in software systems.

Software is a crucial and growing part of weapons systems and the Department needs to be able to sustain immortal software indefinitely. The Task Force concluded that the Department of Defense would benefit from the implementation of continuous iterative development best practices as software becomes an increasingly important part of defense systems.

I concur with the Task Force's conclusions and recommend you forward the report to the Secretary of Defense.

Dr. Craig Fields
Chairman, DSB

DSB Software Acquisition Task Force

DEPARTMENT OF DEFENSE | DEFENSE SCIENCE BOARD

Appendix B: Task Force Membership

Chairs

Dr. William LaPlante
MITRE

Dr. Robert Wisnieff
IBM

Members

Dr. Victoria Coleman
Wikimedia

Dr. Paul Nielsen
Carnegie Mellon University

Mr. Christopher Lynch
Defense Digital Services

Dr. Fred Schneider
Cornell University

Dr. Joe Markowitz
Unaffiliated

Mr. Lou Von Thaer
Batelle

Mr. Robert Nesbit
Unaffiliated

Mr. Alfonso Velosa
Gartner, Inc.

Government Advisors

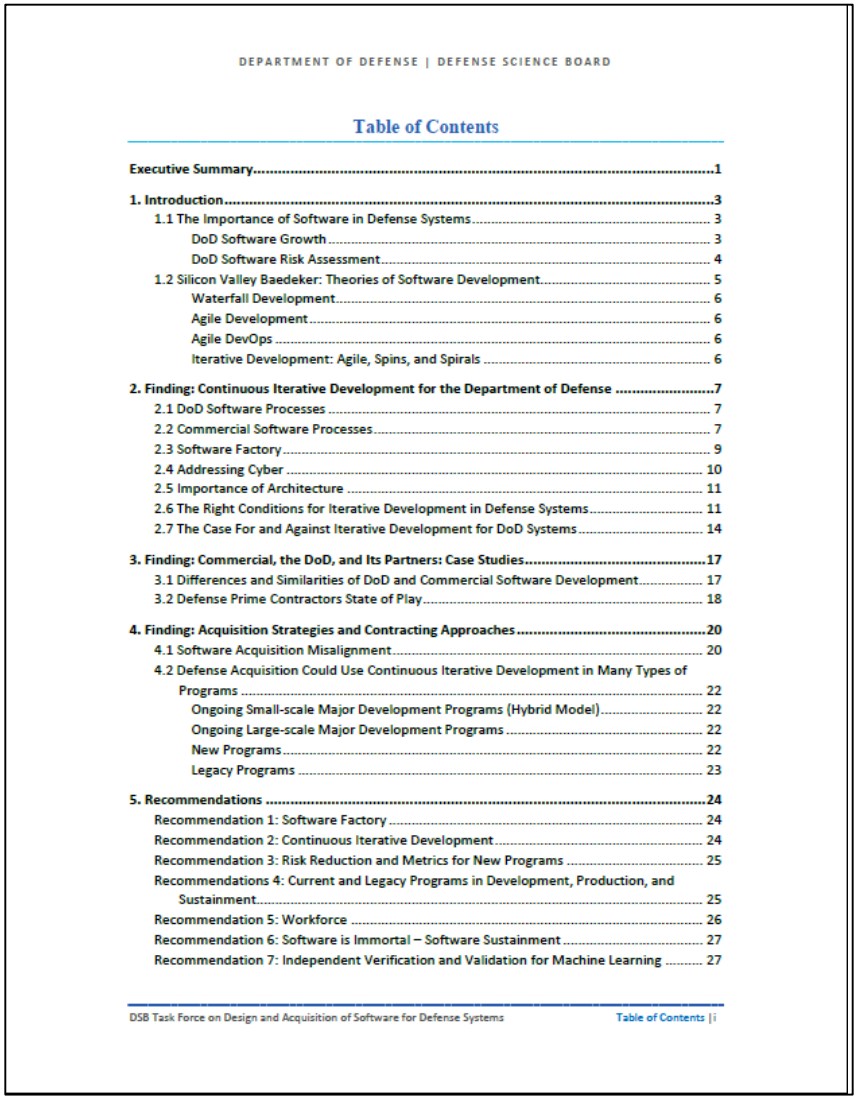
Ms. Cynthia Schurr
U.S. Air Force (SAF/AQ)

Mr. Joseph Heil
Naval Surface Warfare Center, Dahlgren Division

Executive Secretary

Mr. James Thompson
Office of the Deputy Assistant Secretary of Defense for Systems Engineering

Findings



DEPARTMENT OF DEFENSE | DEFENSE SCIENCE BOARD

Table of Contents

Continuous iterative development

SW practices in commercial industry vs. DoD and defense industry

Acquisition practices and contracting approaches

- DoD waterfall approach was largely abandoned by commercial industry years ago
- Rapid and continuous SW development is essential for quick response to adversaries
- DoD must incentivize contractor base to take advantage of modern software best practices

"The Task Force strongly believes greater adoption of continuous iterative development and its associated best practices will result in significantly improved acquisition performance.

The assessment of the Task Force is that an iterative approach to software development and sustainment is applicable to the DoD and should be adopted as quickly as possible."

Recommendations - 1

DSB Task Force on Design and Acquisition of Software Systems

NDIA

INCOSE

Summary of Recommendations

1. Software Factory – A key evaluation criteria in the source selection process should be efficacy of the offeror's software factory.

- Establish a common list of source selection criteria (draft App E; IDE, tools, SW, CM, issues, reqts, cloud)
- DoD has limited iterative development expertise – focus on acquisition

2. Continuous Iterative Development – DoD and defense industrial base partners should adopt continuous iterative development best practices for software, including through sustainment.

- Identify Minimally Viable Product (MVP) approaches, delegate acquisition authority to PM
- Engage Congress to change statutes for rapid iterative approach
- DAE and SAE/MDA should require for all programs entering MS-B (ACAT I,II,III)
- Incorporate in regular program reviews (e.g., DABs, IPRs, SRBs), with waivers only by exception

3. Risk Reduction and Metrics for New Programs – For all new programs, starting immediately, implement best practices in formal program acquisition strategies:

- MDA should allow multiple vendors to begin work, with down-select after ≥ 1 vendor is proven capable
- Modernize cost/schedule estimates and measures (SLOC > historical measures, adopt NRO approach for DIB WBS schedule, staff, cost, productivity)
- Require PMs to build status estimation framework (e.g., burndown measures for sprints, epics, releases, velocity, control chart, cumulative flow)

Recommendations - 2

DSB Task Force on Design and Acquisition of Software Systems

Summary of Recommendations	
4. <u>Current and Legacy Programs in Development, Production, and Sustainment</u> – for ongoing development programs, USD(A&S) should task PMs/PEOs to plan transition to a software factory and continuous iterative development.	
• Prime contractors should transition execution to a hybrid model, within contractual constraints. Incorporate continuous iterative development into a long-term sustainment plan.	• Business case for transition of legacy programs where development is complete. • Provide quarterly transition status update to USD(A&S)
5. <u>Workforce</u> – The U.S. Government does not have modern software development expertise in its program offices or the broader functional acquisition workforce. This requires Congressional engagement and significant investment immediately.	
• Services need to develop workforce competency (prioritize acquisition strategy, source selection) • DAU develop curricula to develop SW-informed PMs, sustainers, acquisition specialists	• Prime contractors must build internal competencies in modern SW methodologies. CEOs should brief progress to USD(A&S) annually, including proficiency in establishing effective software factories.

Recommendations - 3

DSB Task Force on Design and Acquisition of Software Systems

Summary of Recommendations	
6. <u>Software is Immortal: Software Sustainment</u> – RFPs for acquisition programs … should specify the basic elements of the software framework supporting the software factory… reflected in source selection criteria	
• Repositories; test infrastructure/tools; docs; etc. • Availability, cost, compatibility, licensing should be part of source selection criteria	• Delivered to USG at each production milestone • Selection preference based on ability of USG to reconstitute SW framework, binaries, tests, tools.
7. **<u>IV&V for Machine Learning</u>** – Machine learning is an increasingly important component of a broad range of defense systems, including autonomous systems, and will further complicate the challenges of software acquisition.	
• Invest to build a better posture in critical technology. • Establish research and experimentation programs, (focus of testing, IV&V, cybersecurity resiliency and hardening)	• Establish repository for machine learning and autonomy. • Promulgate methodology and best practices, including architecture and test harnesses.

Iterative SW Development in DoD is The Law

NDAA 2019 (Sec 868) requires implementing DSB SW Task Force recommendations

https://www.congress.gov/bill/115th-congress/house-bill/5515/text#toc-HAB10EC11F97741A7B921A97B8D48B16F

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Current Legislation | Examples: hr5, sres9, "health care" | MORE OPTIONS

Home > Legislation > 115th Congress > H.R.5515

H.R.5515 - John S. McCain National Defense Authorization Act for Fiscal Year 2019

115th Congress (2017-2018) | Get alerts

Subtitle G—Provisions Related To Software And Technical Data Matters

Sec. 865. Validation of proprietary and technical data.

Sec. 866. Continuation of technical data rights during challenges.

Sec. 867. Requirement for negotiation of technical data price before sustainment of major weapon systems.

Sec. 868. Implementation of recommendations of the final report of the Defense Science Board Task Force on the Design and Acquisition of Software for Defense Systems.

Sec. 869. Implementation of pilot program to use agile or iterative development methods required under section 873 of the National Defense Authorization Act for Fiscal Year 2018.

Sec. 870. Report on requiring access to digital technical data in future acquisitions of combat, combat service, and combat support systems.

SEC. 868. IMPLEMENTATION OF RECOMMENDATIONS OF THE FINAL REPORT OF THE DEFENSE SCIENCE BOARD TASK FORCE ON THE DESIGN AND ACQUISITION OF SOFTWARE FOR DEFENSE SYSTEMS.

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(b) EXCEPTIONS.—

(1) DELAYED IMPLEMENTATION.—The Secretary of Defense may commence implementation of a recommendation described under subsection (a) later than the date required under such subsection if the Secretary provides the congressional defense committees with a specific justification for the delay in implementation of such recommendation.

(2) NONIMPLEMENTATION.—The Secretary of Defense may opt not to implement a recommendation described under subsection (a) if the Secretary provides to the congressional defense committees—

(A) the reasons for the decision not to implement the recommendation; and

(B) a summary of the alternative actions the Secretary plans to take to address the purposes underlying the recommendation.

(c) IMPLEMENTATION PLANS.—For each recommendation that the Secretary is implementing, or that the Secretary plans to implement, the Secretary shall submit to the congressional defense committees—

(1) a summary of actions that have been taken to implement the recommendation; and

(2) a schedule, with specific milestones, for completing the implementation of the recommendation.

SEC. 869. IMPLEMENTATION OF PILOT PROGRAM TO USE
UNDER SECTION 873 OF THE NATIONAL DEFENSE AU

(a) IN GENERAL.—Not later than 30 days after the date of the
in the pilot program to use agile or iterative development methods pur
2018 (Public Law 115–91; 10 U.S.C. 2223a note):

(1) Defense Retired and Annuitant Pay System 2 (DRAS2),

(2) Army Integrated Air and Missile Defense (AIAMD), Army.

(3) Army Contract Writing System (ACWS), Army.

(4) Defense Enterprise Accounting and Management System (DEAMS) Inc2, Air Force.

(5) Item Master, Air Force.

National Defense Industrial Association
SYSTEMS ENGINEERING DIVISION

6 Dec 2017 R2

NDIA

COSE Council on Systems Engineering

Steering Committee
Div Chairs (Exec Com) plus:
Pete Larkin – GD, Electric Boat
Sam Valenti – Harris
Garry Roedler – Lockheed Martin
Mark Schaeffer – ManTech Int'l
Randall Lum – Northrop Grumman
Christi Gau Pagnanelli – Boeing
Frank Phillips – BAE Systems
David Schulte, SAIC
(open) – United Technologies
Tim White– Raytheon
Angela Wallace – Booz Allen Hamilton
Everett Lewis – Rolls Royce

CHAIR
Frank Serna
Draper

VICE-CHAIRS:
Joe Elm
L-3Com

Chair Emeritus
Bob Rassa
Raytheon

Sr Gov't Participation
Kristen Baldwin – DASD(SE)
Doug Wiltsie – US Army
Marty Irvine – US Navy
Jeffrey Stanley – USAF
Jack Zavin – ODASD C3/Cyber

New NDIA SED WG (proposed)
WG stakeholder members (draft)

Affiliate Groups
Gery Mras – AIA
Garry Roedler– INCOSE
Paul Croll – IEEE Computer Society
Bob Rassa – IEEE AESS
Les Orlidge – IEEE SCC20
George Rebovich – MITRE
Dr. Ken Nidiffer – SEI
(open) – Aerospace Corp

System-of Systems Cmte
Rick Poel, Boeing
Dr. Judith Dahmann, MITRE
Jennie Horne, Raytheon

Human Systems Int Cmte
Matthew Risser, Pacific S&E
Patrick Fly, Boeing

SW Dev & Acquisition WG
Joe Elm, L-3 Com
Geoff Draper, Harris
Jim Thompson, ODASD(SE)

Agile and SE WG
John Norton, Raytheon
Linda Maness, Northrop

Automatic Test Committee
Les Orlidge, Consultant
Pat Griffin, Astronics
Howard Savage, SCI

Development Test & Evaluation Committee
Joe Manas, Raytheon

ESOH Committee
David Schulte, SAIC
Sherman Forbes, USAF

Interoperability Committee
Jack Zavin – ODASD C3/Cyber
John Daly – Booz Allen Hamilton

Systems Engineering Effectiveness Committee
Joe Elm
L-3Com
Tim White
Raytheon

Education & Training Committee
Dr. John Snoderly
Defense Acquisition University
Dr. Don Gelosh
Worcester Polytechnic Institute
Dr. Ken Nidiffer
SEI

Software Committee
Paul Croll
IEEE
Dr. Ken Nidiffer
SEI

Modeling & Simulation Committee
David Allsop
Boeing
Chris Schreiber
Lockheed Martin

Enterprise Health Management Committee
Chris Reisig
Boeing (St Louis)

Systems Security Engineering Committee
Holly Dunlap
Raytheon
Melinda Reed
ODASD(SE)

Architecture Committee
Robert Scheurer
Boeing
Ed Moshinsky
Lockheed Martin

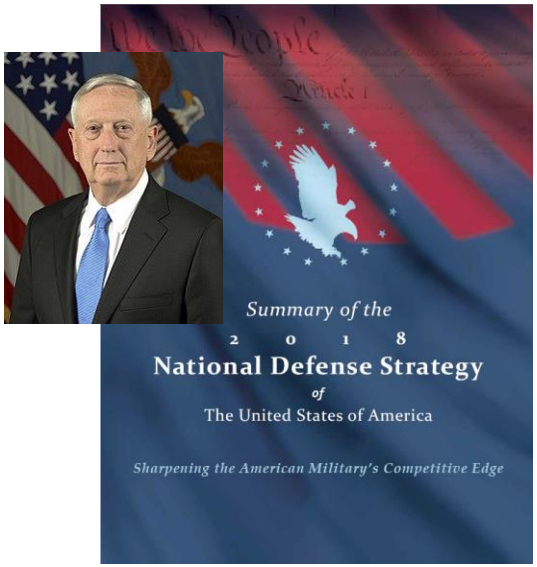
NDIA Division Executive: Tammy Kicker

Next Steps

- **Obtain participation commitments from NDIA SE Division committees**
- **Solicit participants**
- **Schedule working group kickoff**
- **Visible NDIA and DoD sponsorship at NDIA SE Conference to foster awareness and engagement**
  - Industry executive panel?

BACKUP

National Defense Strategy



https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

- **Build a More Lethal Force**
  - Modernize key capabilities
    …, space, cyberspace, C4ISR, …

> ➢ *Advanced autonomous systems.* The Department will invest broadly in military application of autonomy, artificial intelligence, and machine learning, including rapid application of commercial breakthroughs, to gain competitive military advantages.

- **Strengthen Alliances and Attract New Partners**
- **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."
  - "Streamline rapid, iterative approaches from development to fielding."
  - "A rapid, iterative approach to capability development will reduce costs, technological obsolescence, and acquisition risk."

USD (A&S)

Hon. Ellen M. Lord
Under Secretary of Defense for Acquisition, Technology, and Logistics

Software is the "thread that runs through all our programs. It's the functional area that I have focused on."

"both the department and industry are behind the curve in terms of modernization of software practices."

"I believe we are at an inflection point in terms of doing things differently. We are pivoting from the traditional waterfall software development methodology to agile and DevOps. So we are coding every day, testing every night."

Jeff Boleng
SEI, CTO
Special Assistant, Software Acquisition

Defense Digital Service (DDS)

https://www.dds.mil/

By the people. For the people.

The Department of Defense defends and protects our nation's military and civilians across the globe. Our projects range widely, from strengthening our national security, to taking care of our Veterans, or deploying next-generation GPS for billions of people. However, oftentimes our progress is hindered by outdated tools and practices that lag far behind private sector standards.

Our mission is to drive a giant leap forward in the way DoD builds and deploys technology and digital services. We work alongside our public servants and service members, empowering them to incorporate private sector best practices and talent to build a better ~~future~~ now.

Our work

We apply industry experience in shipping products to help deliver in-progress strategic or challenged projects. Explore some of the projects we've tackled:

Hack The Pentagon

Hack The Air Force 2.0

MIRS Form Transfer

Our team

Government is not an abstract institution or a concept. Our government is us. Meet some members of the Defense Digital Service who have signed on for nerd tours of duty:

Tim Van Name
Deputy Director
Previously: **White House Information Technology**

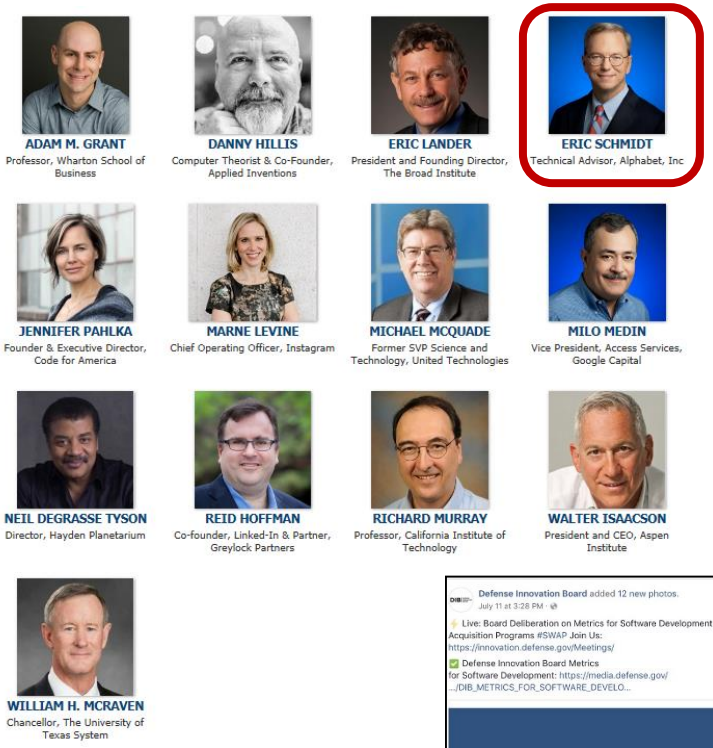
Chris Lynch
Fearless Leader
Previously: **Serial Entrepreneur**

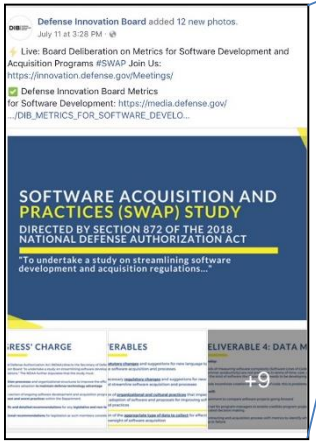
Hunter Price
Director, Air Force Digital Service
Previously: **Forsa Consulting**

Patrick Stoddart
Director, Army Digital Service
Previously: **Entrepreneur**

Defense Innovation Board (DIB)

https://innovation.defense.gov/





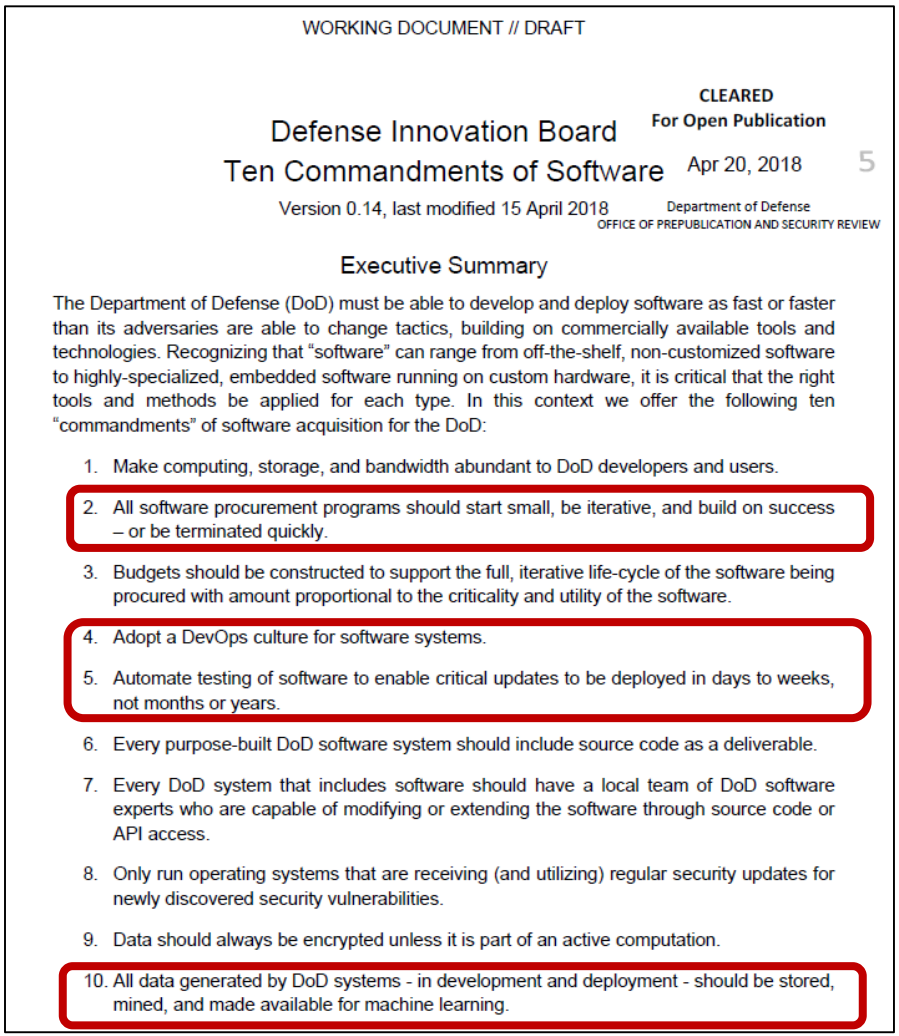
Defense Innovation Board unveils 'Ten Commandments of **Software**'
FedScoop - Apr 27, 2018
The **Defense Innovation Board** (DIB) unveiled an initial version of its "Ten Commandments of **Software**" at a public meeting Thursday in ...

Pentagon Announces Joint AI Center
GovernmentCIO Media - 17 hours ago
DIUx, the Defense Department's organization that helps the military benefit from ... and prepare a workforce of AI practitioners, **software** engineers and ... McCord said the DOD is also asking the **Defense Innovation Board** to ...
Defense Innovation Unit Experimental (DIUx) – Silicon Valley

The US Air Force learned to code—and saved the Pentagon millions
Fast Company - Jul 5, 2018
Standard DoD procedure requires systems like the AOC **software** to be ... The **Defense Innovation Board** (launched by Ashton Carter, then ...

Defense Innovation Board proposes new metrics for assessing DOD ..
FedScoop - Jul 12, 2018
The **Defense Innovation Board**, since it was established in April 2016, ... attention has turned to evolving the way the DOD acquires **software**.
DIB proposed metrics for DoD software acquisition

Defense Innovation Board – Ten Commandments of Software



WORKING DOCUMENT // DRAFT

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For Open Publication

Defense Innovation Board
Ten Commandments of Software

Apr 20, 2018

5

Version 0.14, last modified 15 April 2018

Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

Executive Summary

The Department of Defense (DoD) must be able to develop and deploy software as fast or faster than its adversaries are able to change tactics, building on commercially available tools and technologies. Recognizing that "software" can range from off-the-shelf, non-customized software to highly-specialized, embedded software running on custom hardware, it is critical that the right tools and methods be applied for each type. In this context we offer the following ten "commandments" of software acquisition for the DoD:

1. Make computing, storage, and bandwidth abundant to DoD developers and users.
2. All software procurement programs should start small, be iterative, and build on success – or be terminated quickly.
3. Budgets should be constructed to support the full, iterative life-cycle of the software being procured with amount proportional to the criticality and utility of the software.
4. Adopt a DevOps culture for software systems.
5. Automate testing of software to enable critical updates to be deployed in days to weeks, not months or years.
6. Every purpose-built DoD software system should include source code as a deliverable.
7. Every DoD system that includes software should have a local team of DoD software experts who are capable of modifying or extending the software through source code or API access.
8. Only run operating systems that are receiving (and utilizing) regular security updates for newly discovered security vulnerabilities.
9. Data should always be encrypted unless it is part of an active computation.
10. All data generated by DoD systems - in development and deployment - should be stored, mined, and made available for machine learning.

https://media.defense.gov/2018/Apr/22/2001906836/-1/-1/0/DEFENSEINNOVATIONBOARD_TEN_COMMANDMENTS_OF_SOFTWARE_2018.04.20.PDF

Statement of Dr. Eric Schmidt
House Armed Services Committee, April 17, 2018

https://docs.house.gov/meetings/AS/AS00/20180417/108132/HHRG-115-AS00-Wstate-SchmidtE-20180417.pdf

"DoD does not have an innovation problem; it has an innovation *adoption* problem."

The Need for Speed: "…service members must wait years before accessing current technology."

"Improved software engineering and a focus on artificial intelligence will accelerate DoD's speed…"

"The Defense Innovation Unit Experimental (DIUx)… streamlined procurement process that allows the Department to work at the speed of business."

Kessel Run, USAF Life Cycle Management Center: "…is DoD's version of a Software Factory."

Cloud, AI: "Any military that fails to pursue enterprise-wide cloud computing isn't serious about winning future conflicts."

AI: "…to create and sustain the asymmetric advantage required to outpace our adversaries."

People and Talent: "I have no doubt that top software engineers and data scientists will take a year or two out of their careers to work in DoD. …DDS's model is viable proof of concept."

"There are no shortcuts on this path. The Department must overcome significant obstacles…"

DIB Proposed Software Metrics for DoD

https://media.defense.gov/2018/Jul/10/2001940937/-1/-1/0/DIB_METRICS_FOR_SOFTWARE_DEVELOPMENT_V0.9_2018.07.10.PDF

WORKING DOCUMENT // DRAFT

Defense Innovation Board Metrics for Software Development

Version 0.9, last modified 9 Jul 2018

Software is increasingly critical to the mission of the Department of Defense (DoD), but DoD software is plagued by poor quality and slow delivery. The current state of practice within DoD is that software complexity is often estimated based on number of source lines of code (SLOC), and rate of progress is measured in terms of programmer productivity. While both of these quantities are easily measured, they are not necessarily predictive of cost, schedule, or performance. They are especially suspect as measurements of program success, defined broadly as delivering needed functionality and value to users. Measuring the health of software development activities within DoD programs using these obsolete metrics is irrelevant at best and, at worst, can be misleading. As an alternative, we believe the following measures are useful for DoD to track performance for software programs and drive improvement in cost, schedule, and performance.

	#	Metric	Target value (by software type)[i]				Typical DoD values for SW
			COTS[ii] apps	Custom -ized SW[iii]	COTS HW/OS[iv]	Real-time HW/SW[v]	
Deployment Rate Metrics	1	Time from program launch to deployment of simplest useful functionality	<1 mo	<3 mo	<6 mo	<1 yr	3-5 yrs
	2	Time to field high priority fcn (spec → ops) or fix newly found security hole (find → ops)[vi]	N/A <1 wk	<1 mo <1 wk	<3 mo <1 wk	<3 mo <1 wk	1-5 yrs 1-18 m
	3	Time from code committed to code in use	<1 wk	<1 hr	<1 da	<1 mo	1-18 m
Response Rate Metrics	4	Time req'd for full regression test (automat'd) and cybersecurity audit/penetration testing[vii]	N/A <1 mo	<1 da <1 mo	<1 da <1 mo	<1 wk <3 mo	2 yrs 2 yrs
	5	Time required to restore service after outage	<1 hr	<6 hr	<1 day	N/A	?
Code Quality Metrics	6	Automated test coverage of specs / code	N/A	>90%	>90%	100%	?
	7	Number of bugs caught in testing vs field use	N/A	>75%	>75%	>90%	?
	8	Change failure rate (rollback deployed code)	<1%	<5%	<10%	<1%	?
	9	% code available to DoD for inspection/rebuild	N/A	100%	100%	100%	0%
Program Management, Assessment and Estimation Metrics	10	Complexity metrics	#/type of specs structure of code #/type of platforms		# programmers #/skill level of teams #/type deployments		Partial/ manual tracking
	11	Development plan/environment metrics					
	12	"Nunn-McCurdy" threshold (for any metric)	1.1X	1.25X	1.5X	1.5X each effort	1.25X Total $

Defense Innovation Unit Experimental (DIUx)

https://www.diux.mil/

DEFENSE INNOVATION UNIT EXPERIMENTAL

WHITE PAPERS

In addition to accelerating commercial innovation for our men and women in uniform, we're aiming to bring about a cultural shift in DoD so other DoD entities can do the same. To that end, we've shared an overview of our Commercial Solutions Opening (CSO), our contract mechanism not bound by the Federal Acquisition Regulations (FAR), as well as a guide for DoD entities to set up their own similar contract mechanisms. This space will also feature other DIUx publications pertaining to issues of technology and national defense.

- DIUx Study on China's Technology Transfer Strategy
- DIUx Commercial Solutions Opening White Paper
- DIUx Commercial Solutions Opening: How-to Guide

1.2 CSO Procedure

This CSO is seeking proposals for innovative, commercial technologies that accelerate attainment of asymmetric defense capabilities. In this context, innovative means any new technology, process, or business practice, or any new application of an existing technology, process, or business practice that contributes to the sustainment of global peace and U.S. national security.

HOW WE'RE STRUCTURED

We're a small team of about 50 military and civilian personnel. Prior to joining DIUx, we've launched and sold companies backed by tier-1 VCs; led teams at the Joint Staff, the Office of the Secretary of Defense, and the White House; served with our military around the world; and helped build some of Silicon Valley's most iconic companies.

FIVE FOCUS AREAS

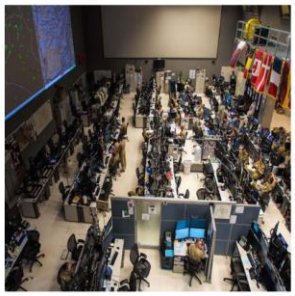
Artificial Intelligence
Leveraging artificial intelligence and machine learning for operational impact

Autonomy
Adopting and countering autonomous systems, with a focus on human-machine interaction and scalable teaming

Human Systems
Countering emerging biological threats while enhancing survivability, training, biomedical protection, and performance.

Information Technology
Making combat information open and accessible for operational forces

Space
Developing on-demand access to space, persistent satellite capabilities, and broadband space data transfer



The U.S. Air Force Learned to Code — and Saved the Pentagon Millions

Fast Company

July 05, 2018

In partnership with Pivotal Labs, a DIUx pilot program is out to remake how the Pentagon acquires weapons systems.

Read More

Army Leverages Machine Learning to Predict Component Failure

Defense Systems

July 02, 2018

Through an award facilitated by DIUx, the Army will be working with Uptake, a company that provides artificial intelligence solutions for industrial sector clients, to predict component failures, decrease the frequency of unscheduled maintenance and improve the productivity of repair operations.

NDIA / INCOSE Software Development and Acquisition WG

Charter:

- Provide industry recommendations and resources to advance the use of continuous iterative software methods and DevOps in DoD programs and acquisition
- Address recommendations of DSB Software Design and Acquisition Task Group and Defense Innovation Board

Participation:

- NDIA Systems Engineering Division
- INCOSE
- TBD - Software Engineering Institute (SEI), AIA, other NDIA divisions (PM, etc.)

Task Duration: est. Aug 2018 through Dec 2019. Kickoff by end of Aug.

Organization:

- Task leads: Joe Elm (L-3 Communications), Geoff Draper (Harris)
- Other representatives: Boeing, Raytheon, WPI, Lockheed Martin, …
- DoD R&E Mission Engineering & Integration
- Seek participation from NDIA SE Division committees

Deliverables:

- Industry recommendations (e.g., policies, acquisition, guidance, RFP language, source selection guidelines, transition)

Potential Outcomes (Industry Recommendations)
** DRAFT **

RFP language	• Requirements for software factory capability, iterative SW development processes • Documentation, reviews, and CDRLs consistent with iterative development • Source selection guidance and evaluation criteria
Guidance	• Guidance for iterative SW development (planning, architecture, design, continuous I&T, etc.) • Supplier reporting and monitoring of iterative SW development • Cost estimation techniques • Measures for iterative SW development and status monitoring • Strategies for program transition to SW iterative development methods (development and sustainment)
Education & Training	• Recommendations for developing acquisition workforce skills for software iterative methods
Other	• TBD