



Applying Principles of Agile to Strengthen the Federal Cyber Workforce

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Overview

- Introduction
- The Cyber Workforce Problem
- Background on Agile
- Agile Concepts for Building a Stronger Cyber Workforce
 - Minimum Viable Product (MVP)
 - Iterative and Incremental Improvement
 - Self-Organizing Teams (Decentralized Work)
 - Removing Blockers
 - Prioritized Effort
 - Highly Collaborative Environment
- Application to the Problem

About Me



Josh Hammerstein
Technical Manager
Cyber Workforce Development



Josh leads a diverse team of researchers and engineers on projects that focus on improving the readiness and capability of cybersecurity professionals in the federal government. His team has been working with the U.S. Department of Homeland Security on the President's Cup Cybersecurity Competition since its inception in 2019.



The Software Engineering Institute (SEI) at Carnegie Mellon University

DoD Federally Funded Research and Development Center

R&D in software engineering, artificial intelligence & cybersecurity

~730 employees

Founded in 1984

HQ in Pittsburgh; Offices near strategic partners in DC, CA, and MA

Cyber Workforce Development Directorate



Mission

- Grow the Nation's cybersecurity workforce
- Enhance operational readiness
- Address problems of time, scale, and cost

CISA President's Cup

- Presidential Executive Order 13870
- Cyber competition among DoD and federal executive workforce solving challenges
- 1,000s of individual and team participants
- Integrate immersive (gamified) experiences
- Platform and challenges released as open-source



<https://presidentcup.cisa.gov/>

The Problem

Not enough qualified cyber professionals to meet demand

- 600,000 unfilled openings across private and public sectors *
- 39,000 openings vs. 75,000 filled positions in public sector *
- No easy fix to not enough problem
- Motivation in training → this is an example of iterative improvement
- No way to dramatically scale that under current pipeline

* Bate, L., & Montgomery, M. (2022). *Workforce Development Agenda for the National Cyber Director*. Cyberspace Solarium Commission 2.0. <https://cybersolarium.org/csc-2-0-reports/workforce-development-agenda-for-the-national-cyber-director/>

The Problem: Pipeline

Need to increase entrance into the cyber field

- Diversity – bolster underrepresented demographics; continue to attract current demographic
- Motivation / Interest (need to move beyond the prototypical IT crowd)
- Capacity Building

Degree Awarded by Gender - Female

Degree	Computer Science	Computer Engineering	Information	Total
PhD	23.3%	19.8%	40.7%	24.7%
Masters	27.8%	25.7%	51.6%	31.7%
Bachelors	22.3%	17.0%	29.1%	22.7%

Computer Research Association. (2022). *2021 Taulbee Survey*. <https://cra.org/wp-content/uploads/2022/05/2021-Taulbee-Survey.pdf>

Degree Awarded by Ethnicity

Degree	Nonresident Alien		White		Non-White	
	Total	Percentage	Total	Percentage	Total	Percentage
PhD	1,177	67.4%	339	19.4%	230	13.3%
Master's	10,987	62.2%	3,468	19.6%	3211	18%
Bachelor's	5,362	15.6%	13,711	39.8%	15,397	44.7%

Computer Research Association. (2022). *2021 Taulbee Survey*. <https://cra.org/wp-content/uploads/2022/05/2021-Taulbee-Survey.pdf>

The Problem: Capacity Building

Increase the ability to train and teach

- K-12: lack of resources and knowledge for teachers
 - Cisco academy program in high schools
 - WiCyS story
- College has capacity but could increase (SFS)
- Community college, trade school route?
- Workforce: development & reskilling
 - Air Force Mission Defense Teams (IT → cyber mission)
- Cisco academy program in high schools

The Problem: Recruit & Retain

Attract more people to the federal workforce and keep them longer

Taulbee Survey - PhDs: 1 in gov't, 39 industry, 72 total in North America

Scholarships

- NSF CyberCorps: Scholarship for Services \$63M in FY22 (CSC 2.0, 2022)
 - 85 participating universities and community colleges
 - ~275 students per year (307 in 2019, 324 in 2018, 290 in 2017, 245 in 2016) *
- DoD Cyber Scholarship Program

* Cyberspace Solarium Commission. (2020). *Growing A Stronger Federal Cyber Workforce*. <https://drive.google.com/file/d/1WGNHpVmf4X12zv6DWuq9V4GtKF3jz92e/view>

Current Efforts

CETAP

SFS

President's Cup

NCD

- Strategy
- Recently announcement apprenticeship program

NICE

Agile Software Development Definition

An **iterative and incremental** (evolutionary) approach to software development which is performed in a **highly collaborative** and evolving manner by **self-organizing teams** within an effective governance **framework** with "just enough" ceremony that produces high quality solutions in a cost effective and timely manner which **meets the changing needs of its stakeholders**.

* Ambler, S. (2013). *Disciplined Agile Software Development: Definition*. <http://agilemodeling.com/essays/agileSoftwareDevelopment.htm>

Why Agile?

- Problem is large and complex
 - Reduce complexity by breaking down into simpler problems
- Cyber domain is continuously evolving
- No definitive solution
 - What looks good on paper, may be horrible in practice
- Provides an implementation process and workflow that is adaptable

Developing an effective cyber workforce requires a large and integrated multisector effort...

The total effort also requires flexibility as circumstances change in a dynamic environment. The federal government does not generally operate in a manner consistent with these operational considerations due to its size, complexity, and antiquated human resource processes.

Minimum Viable Product

Minimal feature set product that can be used by a customer

- Enables iteration and improvement
- Learn through customer feedback
- Deliver a product that has value

Example: Tesla Model 3

Application to Cyber Workforce Development

- Identify minimum components need for a program; accept good enough
- Standing up programs quickly; accept change will be needed
- Gather feedback, adapt, and improve
- Principle can be applied for developing a national strategy

Iterative and Incremental Improvement

Add to and improve on MVP

Learning and improving through feedback

- Is the software working as intended?
- Are goals being met?

Retrospectives

- Team self reflection for improvement

Application to Cyber Workforce Development

- Embrace user feedback
- Metrics and data collection to measure success
- Willingness to adapt and change

Self-Organizing Teams (Empowered Teams)

Sprint defines work; engineers decide on what they will work on

- Teams must be fully contained
- Teams can make decisions for themselves, not so regimented that it inhibits innovation, and have the authority

Application to Cyber Workforce Development

- Empower those closest to the problem
- Provide high-level goals; encourage decentralized execution
- Allow duplication of effort

Remove Blockers

Increase effectiveness by removing barriers for the team

- Pay / retention issues
- Military has direct commissioning programs (e.g., doctors)
- Strategic capacity problem?
- Job requirements (per conversation with Harry)

Application to CWD

- NCD provides strategic guidance and coordination
- Use authorities to cut through bureaucratic red tape
- Advocate for changes outside of current authorities

Prioritized Effort

Time, effort, and resources are finite

Certain efforts provide more value than others

Accepts and accounts for change

Application to Cyber Workforce Development

- Focus on efforts within locus of control
- Prioritize high-impact initiatives
- Periodically re-evaluate priorities; willingness to accept change

Highly Collaborative Environment

The daily stand-up meeting

Cross-functional teams

Application to Cyber Workforce
Development

- Facilitate productive collaboration
- Collaboration across federal government; state, local, tribal, and territorial governments; private sector; and academia

Application to the Cyber Workforce Shortage

MVP:

- Sustain existing efforts
- Focus on new efforts that can be implemented quickly through existing authorities
- Metrics, metrics, metrics!

Iteration:

- Improve implemented efforts
- Work towards longer-term efforts and those that require Congressional action

Self-Organizing Teams

- Empower organizations closest to the problem to devise solutions
- Provide strategic guidance; accept duplication of effort

Application to the Cyber Workforce Shortage

Remove Blockers

- Cut through bureaucratic red tape through existing and new authorities

Prioritize Effort

- Willingness to change priorities; defund efforts that are not effect