AIR FORCE CYBERWORX REPORT 16-001: A 21st CENTURY TRAINING MODEL FOR FLEXIBLE, QUICK, AND LIFE-LONG WORKFORCE DEVELOPMENT

MICHAEL V. CHIARAMONTE, Lt Col, USAF
Senior Designer & Facilitator

DOUGLAS R. HOWE, Lt Col, USAFR
Project Lead

JEFFREY A. COLLINS, Col, USAF
Director, AF CyberWorx

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Air Force CyberWorx™
2354 Fairchild Dr, Ste 2N300
USAF Academy, CO 80840
AFCyberWorx@usafa.edu - @AFCyberWorx - (719) 333–4278

Introduction

CyberWorx is a dynamic organization partnering Airmen, industry, and academia to reimagine how technology might enrich and protect our nation, businesses, and lives. As a human-centric design center, we seek out unique ways to connect Air Force warfighters with current and future technology in meaningful ways. We look to transfer, license, and share promising prototypes, solutions, and knowledge with our partners to create value for both the warfighter and the economy as this is the best way toward operational advantage.

Design Thinking

Design thinking is a common sense, human-centric problem solving method embraced by industry leaders such as Apple and Google but often overlooked in the government sector. The CyberWorx design thinking process is a transdisciplinary method that breaks down silos of standard organizational structures. Organizations naturally form structures based on specializations to facilitate deep expertise, but these structures often impede creativity, collaboration, and knowledge sharing vital to innovation. CyberWorx deliberately reaches across specialties to bring diverse perspectives to a problem in a non-threatening environment. This evokes ideas that would otherwise be missed or stifled. The transdisciplinary design approach teases out meaningful solutions that are intuitive and desirable to Airmen.

Air Force CyberWorx offers facilitated design thinking sessions that bring stakeholders, industry and academic experts together to develop solutions to hard problems. These sessions are tailored to best meet AF needs with differing lengths based on time sensitivity and CyberWorx capacity. One of the quickest and most successful approaches is to assemble teams for a concentrated design sprint of, typically, five days or less. The goal of a design sprint is to develop low fidelity prototypes that clearly convey the desired Airman experience and the technical and policy developments needed to bring that experience to fruition. These sprints help refine the requirement by seeking the right problem to solve and find meaningful solutions by exploring a wide range of possible answers to the problem.

For the 21st Century Training Model for Cyber Design Sprint, CyberWorx brought together 34 participants from numerous Air Force units, academia, and industry partners to rethink how the Air Force does initial cyber skills training. The goal was to develop a concept for improved training and present it the following week at Keesler AFB, MS.

Participants

The design sprint was attended by "outsiders" from both academia and industry whose differing perspectives provided unique value distinct from the military members and government civilians attending the sprint. The CyberWorx design thinking approach deliberately breaks through the military's hierarchical and mission silos to find hard-hitting answers. This design sprint included Cyber and Intelligence professionals from the Secretary of the Air Force's Staff, Headquarters Air Force Staff, Air Force Space Command, Air Education and Training Command, Air Combat Command, Air Force Reserve Command, National Guard Bureau, and The United States Air Force Academy.

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Experts in both face-to-face and online distance learning attended from Arizona State University and the University of Maryland's Center for Advanced Study of Language. Completing the design sprint team were the industry partners from Rim Technologies (Information Solutions), Peak Social Insights (Social Media), nestCare (Healthcare), Spark Mindset (Custom Training), and Fourth Axis Gaming (Virtual Reality Gaming). The collection of unique backgrounds and perspectives opened the aperture of the possible as CyberWorx tackled the 21st Century Training Model for Cyber challenge.

Design Problem

Streamline current Initial Skills Training: The challenge of identifying a 21st Century Training Model for Cyber Warriors was endorsed by the Commanders of Air Force Space Command and Air Education and Training Command as a critical need for the Air Force. The challenge was initially conceived as an opportunity to streamline Initial Skills Training (IST) held at Keesler Air Force Base, Mississippi. Concerns with the current training process included training duration, rigidity of the curriculum, and not leveraging industry and/or academia practices. The desired output was a modular, flexible, and responsive training program that can meet rapid operational changes.

Theme Discovery

The early stages of a design sprint and the design thinking methodology call for analyses of the users' work environment, their desires, and their dislikes to inform and revise the initial problem statement. As part of the design process, the participants spent time looking into the various facets of the challenge to ensure they understood the challenge and were working on solving the right problem. This included interviews with commanders, functional managers, operators, and recent training graduates.

This phase also included interviews with industry and academic partners as well as guest speakers from a variety of non-cyber backgrounds to tease out interesting ideas and possibilities. These experiences and views from science and technology, humanities, and business acumens provided an unparalleled view of the problem that could not be achieved with a homogeneous group.

> The diversity of the team led to a broadening of the design question and discovery of five interconnected, overarching themes for exploration.

Leveraging this unique group, we discovered a much broader problem set that not only captured the challenges currently associated with the IST pipeline, but also identified five overarching themes:

- ***Talent Management***,
- ***Asynchronous Training***,
- ***Modularity*** (coaching/inverted learning),
- ***Career Field Participation*** (Marketplace, online delivery, crowd-sourced instruction/assistance), and
- ***Recruiting***

These themes formed the foundation of an ecosphere capable of providing a cradle-to-grave approach facilitating a highly flexible and adaptive training environment and capitalizing on the experience and aptitude of new and established Cyber professionals.

Design Themes and Personas

Progressing through the design process requires teams to analyze and organize information in a manner that communicates efficiently with stakeholders. This communication is aided by the development of Personas; archetypal descriptions of user behavior patterns into representative profiles, to humanize the design focus and test scenarios.

To convey the linkage between the five themes, a persona was developed. This persona (a Cyber Airmen (3D0XX) is representative of the individuals the Air Force is looking to develop into Cyber Warriors. To garner an understanding of the proposed 21st Century training model, we will follow this Airman through her career. It is important to understand that this persona is used to tell the story of how Airmen will generally interact with the proposed training concept. The persona is not intended to detail all the specific differences between AFSCs.

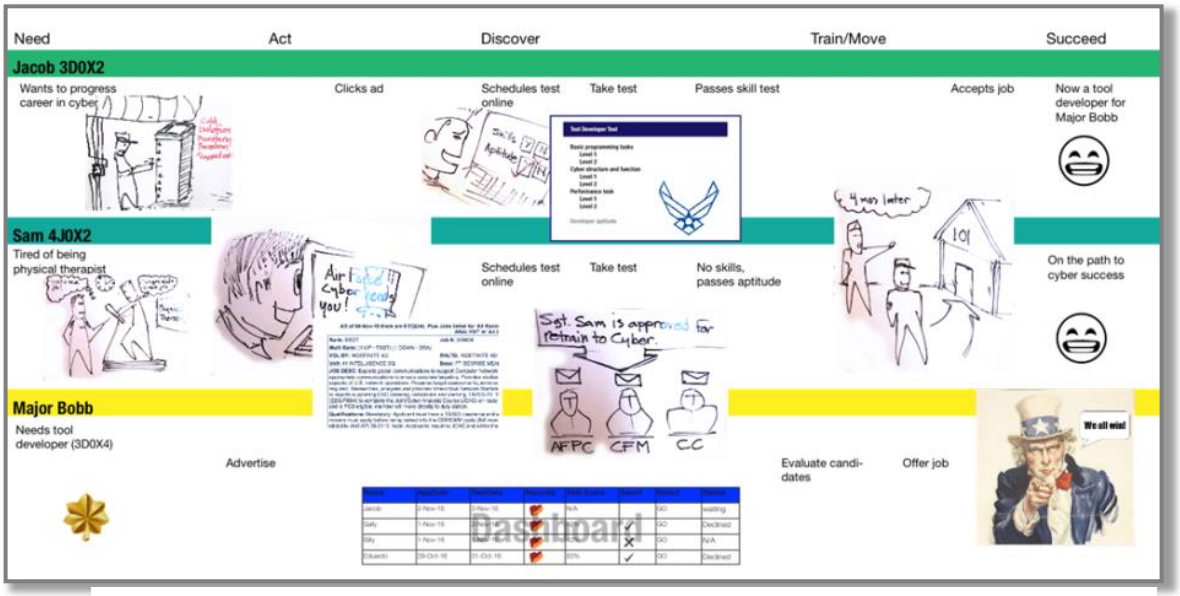


Figure 1: The combination of modern recruitment, talent management, and modular training both in the school house and online speed workforce development from day one through retirement.

Recruiting (Assessments)

Meet Joslin Rok. Joslin grew up in Ohio and was always fascinated by technology. Growing up, she was the family's "go to gal" for ensuring the home network was working and, while she didn't always have the latest gadgets due to her family's financial situation, she still kept up on technology. As she approached graduation, she wasn't sure what she wanted to do, but knew she wasn't really interested in going to college right away and, besides, her parents couldn't really afford it anyway.

Joslin's interest in the Air Force was piqued during a high school career fair when the recruiter mentioned the travel, ability to pay for college down the road and the promise of getting to work with the latest and greatest technology. Unlike past recruitment experiences, Joslin visited an Air Force recruiter that was equipped with virtual reality (VR) and augmented reality

(AR) technology. This technology provided an immersive view into the missions and expectations of the AF cyber workforce. This technology was delivered in person as well as on-line so Joslin could access and research at her convenience. The use of VR/AR technology speaks to the generation of cyber natives the Air Force is looking to recruit and ensures that recruits entering the cyber workforce clearly understand what life will be like. This deeper understanding minimizes turnover from job dissatisfaction.

> Aptitude assessments look at the key indicators that an individual has as natural ability. The knowledge assessment can be a test or a review of educational or professional transcripts.

While Joslin has some interest in Cyber from her day to day life, she didn't grasp the full scale possibilities within the Cyber Domain. Through the recruiting efforts described above, Joslin was exposed to cyber challenges, robotics and remotely piloted technologies. This initial exposure left Joslin with the desire for two jobs, to build and operate C2 centers and the related technology, and the desire to hack into adversarial systems.

During the recruiting process, Joslin was assessed on Cyber knowledge and aptitude through a test (similar to the language proficiency test, DLAP) and she scored well above average in both areas. This aptitude test augmented the Airman Skills Vocational Aptitude Battery (ASVAB) and provided specific insight into Joslin's motivators and abilities as it applied to Cyber.

The second part of assessment involved an evaluation of educational and professional transcripts. Through these assessments the Air Force trainers were able to determine the proper starting point for Joslin and all other candidates brought into the cyber career field.

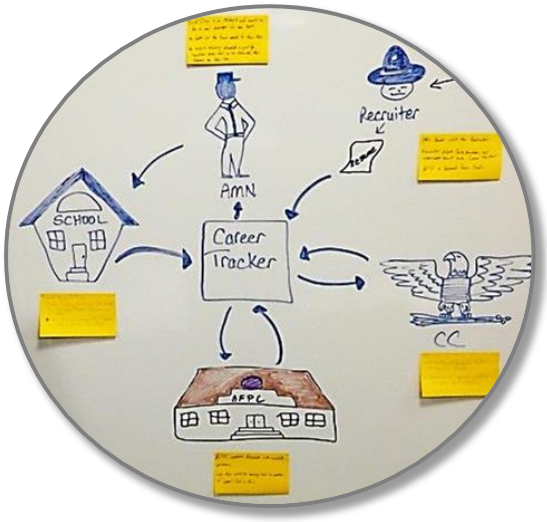


Figure 2: A talent management system to track qualifications, experience and training ensures that modern recruiting and training methods results in maximum value.

Talent Management

Not only did these assessments provide the starting point for Joslin, it also provided the foundational input for Joslin's entry in the

21st Century Career Tracker, a Talent Management System used by the Air Force. Through talent management Joslin will have the ability to view and log accomplished training. It's not just a repository of training, but is also a database of career field opportunities and the training required in order to be competitive for future opportunities.

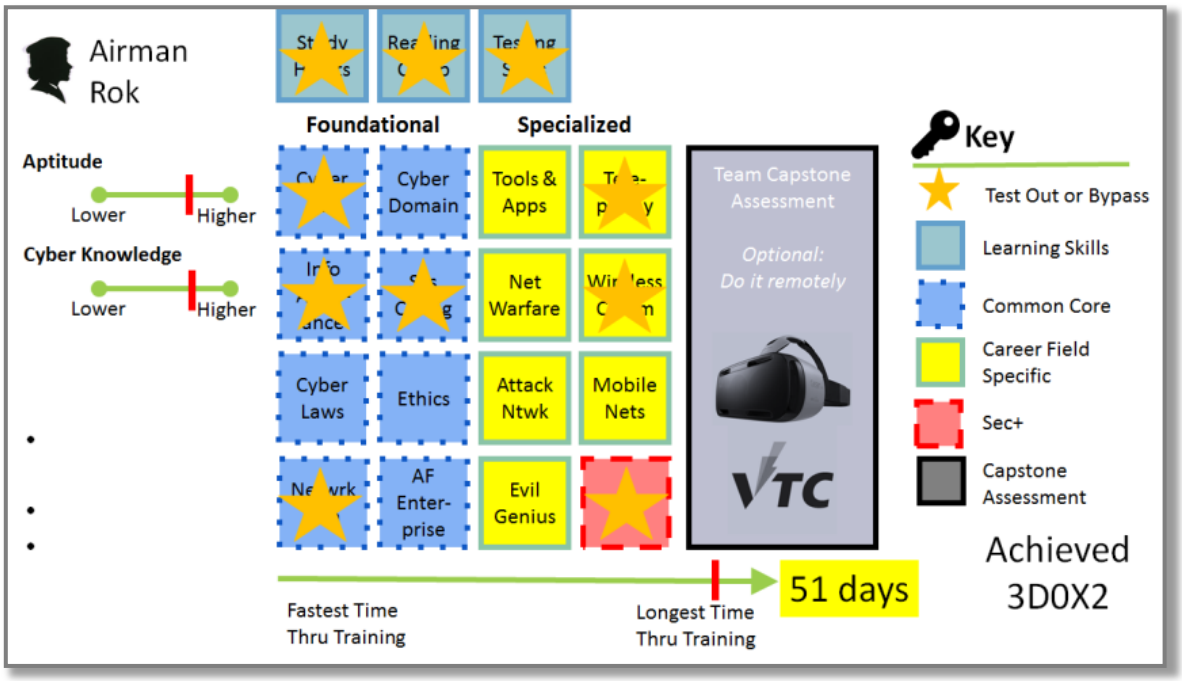


Figure 3: The Talent Management System details Joslin's assessment rating, common core and career field specific training requirements for the 3D0X2 Air Force specialty code.

From a leadership perspective the Talent Management System allows Joslin's supervisor to identify the critical skills she possesses in order to meet mission needs. At the same time leaders throughout the AF are able to search for highly skilled talent capable of supporting urgent operational needs or to fill high demand positions.

> Differentiation and tailored training are made possible through modern talent management.

The Air Force Personnel Center (AFPC) directly benefits from having a "real time view" of Joslin's skills and knowledge during the assignment process and Developmental Team boards. While Joslin has the ability to prepare herself for future opportunities, AFPC still retains the final say in filling positions to ensure mission requirements are met.

When Joslin entered Initial Skills Training the information in the talent management system, based on the data gathered during recruitment determined her path through the school house. Following basic training, Joslin (now Airman Rok) was allowed to test out of those areas marked with a star in Figure 3 based on the assessment she completed as a recruit. The remaining areas highlighted in blue and yellow identify the training areas that needed to be accomplished to be eligible for the 3D0X2 AFSC. This differentiation and tailored training was made possible through modern talent management and the new modular cyber training program.

Asynchronous Training and Modularity

Airman Rok's training days were long, but productive due to the newly established cyber training at Keesler AFB in Mississippi. The modularized training enabled Joslin and her peers to bypass areas they were assessed as having mastered, to test out of some other areas after a quick overview, and to really focus on areas where they have little to no knowledge. For the most part, it also allowed Joslin to select the course work at a pace conducive to her learning style and in an order that made sense to her.

The "inverted classroom" approach adopted by Keesler AFB made Joslin's time as productive as possible. The course material is available online in Keesler's closed network so Joslin can study and get the concepts from the comfort of her dorm room and in the lab. The lab is available daily from 0900-2300 for hands on practice with experienced cyber instructors available to assist and answer questions whenever Joslin needs help.

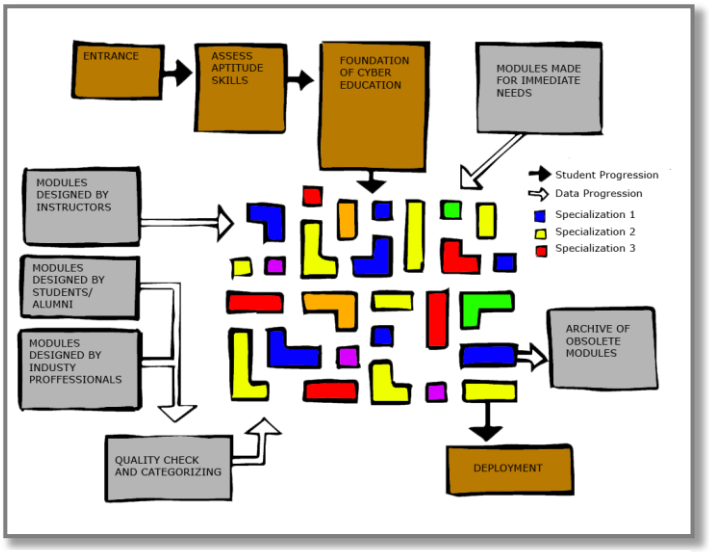


Figure 4: Modular training allows student to teach themselves with mentoring from experience coaches. The modularity allows high and low aptitude students to move through topics at a rate that ensures proper learning. This increases pipeline throughput and reduces student washout rates.

One of the key aspects of this new concept is the change from a "sage on the stage" to a "coach on the bench" approach. The instructors in this environment are there to mentor students and guide them as they immerse themselves in self-discovery. Joslin appreciates the fact that, unlike her predecessors, no longer are students subject to

endless hours of classroom lectures, but are instead given the opportunity to work through challenging areas under the guidance of an on-site instructor at their own pace (subject to meeting established minimum milestones). Luckily for Joslin there's always an instructor (or sometimes a peer) who is willing to help if more instruction or practice is needed in a particular area to ensure progress is being made. Her aptitude for the topics has enabled her to complete multiple modules at a faster-than-average pace, accelerating her path toward becoming an operational Airman. The instructors even seem to like this approach better as they've told Joslin it gives them more freedom to adjust their schedules and tailor their teaching styles to meet student needs while better balancing their home lives.

> The marketplace provides an online virtual environment for training that improves workforce capability by incentivizing airmen to continuously learn and

As Joslin progresses through her training she becomes enamored with Net Warfare tactics and becomes a local expert amongst her peers and coaches. So much so, that Joslin takes it upon herself to develop a visual training session detailing the intricate details (at the unclassified level and classified level) of Net Warfare. Joslin has solicited guidance and feedback from her coaches to ensure the training is relevant and augments the current training material. Her training is added to the cyber 'marketplace' and is available to students at AETC and inquiring minds throughout the Air Force.

Although not a direct motivator, Joslin knows her submission is eligible for a monetary reward based on crowd-sourced rating attained in the marketplace. These ratings also contribute to Joslin's credibility across the cyber community as a sound source of information regarding Net Warfare. After several months and thousands of positive ratings, the AF awards Joslin a $1,000 award for her contributions and cost avoidance due to her excellent training session. Joslin's success is then documented in the talent management system, which flags her as a "go to" Airman in cyber.

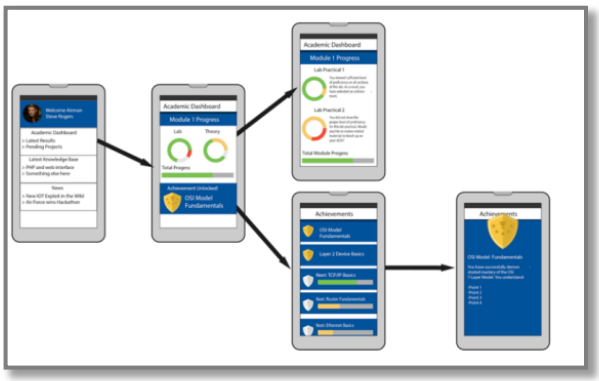


Figure 5: Gamified marketplace tracks participation (content development and question answering) and completed course work via scoring and achievements. Reaching certain thresholds can be rewarded with awards, both monetary and recognition based.

Career Field Participation

Fast forward a few years and A1C Rok is looking to move to a new opportunity. Enticed by the network warfare topics she was exposed to as a trainee. Joslin engages in a gamified online marketplace looking to qualify for the 1B4X AFSC. The marketplace provides an online virtual environment for training that improves workforce capability by incentivizing airmen to continuously learn and share expertise. The marketplace serves three functions: it allows units to share and create job specific training from general templates, allows airmen to take cyber training courses via online asynchronous courses, incents participation via gaming constructs and by providing a degree of self-determination where airmen can self-train for the jobs they want, even qualify for other cyber AFSCs. In many ways this becomes an evaluator system that allows airmen to compete for future opportunities.

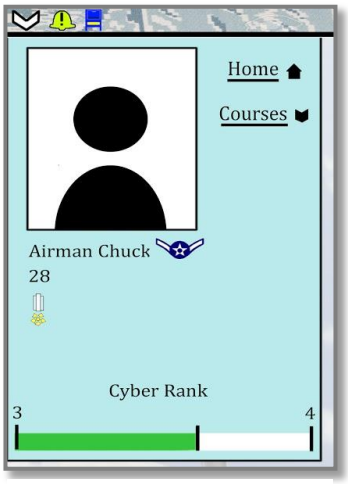


Figure 6: The Marketplace tracks an Airman's gamified rank and offers available courses.

When A1C Rok logs into the marketplace she can interact with the talent management system, which is linked to the training 'marketplace to view the available training courses and to visualize what jobs she is qualified for and what steps she would need to take to become eligible for jobs she desires. The idea behind the marketplace is to move cyber training beyond the classroom as talent evolves quicker than educational processes.

Figure 7 represents how a Crowd Sourced 'Marketplace' could provide training and take advantage of educational rigors, on the fly mission execution, and industry/ academia advancements. The beauty of this training marketplace is that it is open to cyber and cyber-related career fields, thus increasing opportunities for Airmen to explore, train and educate themselves.

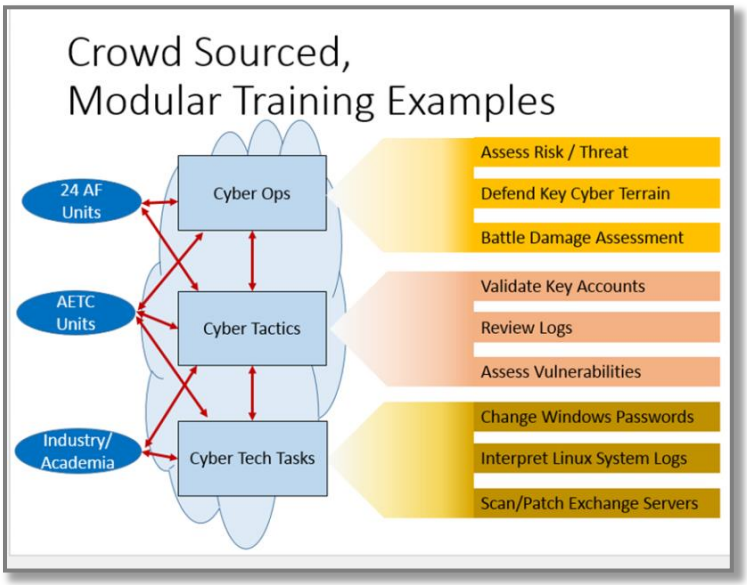


Figure 7: An online marketplace that blends a cyber range, learning management system, talent management system, social network and wiki provides a nexus for meaniful workforce sharing, development, and management.

After completing the required training to become eligible for the 1B4X AFSC, Joslin is awarded the AFSC at minimal cost to the AF and with zero time lost for training requirements.

In Joslin's case, accessing the training marketplace is not just about training. For years she has participated in the marketplace as an expert contributor, providing input on best practices and answering questions to help other Airmen trouble shooting mission problems. In today's cyber world it is common for cyber operators to use social media to identify crowd-sourced solutions. The marketplace provides an organized and controlled location where Joslin can exploit the knowledge of her fellow cyber warriors. This crowd sourced information sharing takes place in a reviewed wiki environment and a forum where good ideas and advice are up-voted and poor ideas are down-voted, similar to a stack exchange.

Figure 8: A career timeline tied to the talent management system, training system, and gamified profile provides push button access to the capabilities and experience of each and every Airman.

Retirement

Joslin is surprised how fast her time in the Air Force has flown by as she reaches the point in her career where she considers retirement. At this point she needs to take acount of all the training and qualifications she has accumulated over her 22 years of service. Fortunately the online marketplace's talent management system has been tracking all her experience and training since her recruitment. The career timeline provided in the system not only allows leadership to selectively place the right airman in the right job, it serves as a cyber resume that can be provided to separating airmen as a transcript and official certifacation of experience for use in job hunting.

Summary of Benefits

The proposal presented in this report corrects many underlying issues the AF faces in developing a cyber workforce. These isssues were raised by participants in the design sprint and by key stakeholders. It is important to note many of these reccomendations are extensible to other AFSCs (outside of cyber) and may represent a desired solution for much of our workforce.

The modernized recruitment is necessary to minimize dissatisfaction of Airmen who are recruited into the cyber workforce with misaligned expectations. Furthermore, the ability to accurately assess the cyber expertise and aptitude of new recruits facilitates validation of parts of the Initial Skills Training, accelerating recruits to operational units.

Allowing for modularity of courses at Keesler and self-paced learning facilitates two things: First students with high aptitudes can move through material faster than average students and complete their IST quicker. Furthermore, students who are struggling on some topics can spend a little more time and get tailored coaching from a cyber instructor to increase their likelihood of succeeding. This approach answers the concerns of both a top-level student who felt bored and slower students who desired alternative teaching styles and more soak time.

> The team's recommendations aim for life-long participation by Airmen to motivate self-learning and self-improvement of cyber talents.

The online marketplace facilitates life-long participation for Airmen. They have a place to enroll in and complete training courses to further their skill sets and be awared additional cyber AFSCs. This movitvates self-learning and avoids the need for the AF to lose man-hours for training courses. Furthermore, Airmen will have the ability to share knowledge by asking questions to the cyber force and answering questions to technical and procedural problems.

Tying all of these improvements together is the talent management system that facilitates job placement by AFPC and commanders. This allows Airmen to quickly see what jobs they are qualified for, which courses to take to become qualified for those desired jobs, and details how their qualifications stack up against their peers. This system informs the Airman from recruitment through retirement or separation.

Recommendations – Where to Start Small for Big Impacts

Air Force CyberWorx recommends a phased approach toward implementing all aspects of this proposal as described below.

Coaching Talent

1. Begin moving the Keesler school house toward an inverted classroom experience with a learning management system and curated content.

Recruiting Talent

1. Hire a gaming or TV/movie studio to create realistic virtual cyber recruiting materials
2. Work with the Army Cyber Institute to create a cyber aptitude game (not a skills test)
3. Generate a basic cyber skills test
4. Create a process to review and classify relevant pre-existing cyber experience, and aptitude to place new recruits into the right location in the cyber pipeline.

Modular and Asynchronous Courses

1. Begin modularizing Keesler's classroom content in a virtual environment and learning management system
2. Create a web-based entry portal to the virtual learning environment
3. Scale technological capacity to allow remote access to virtualized content

Managing Talent

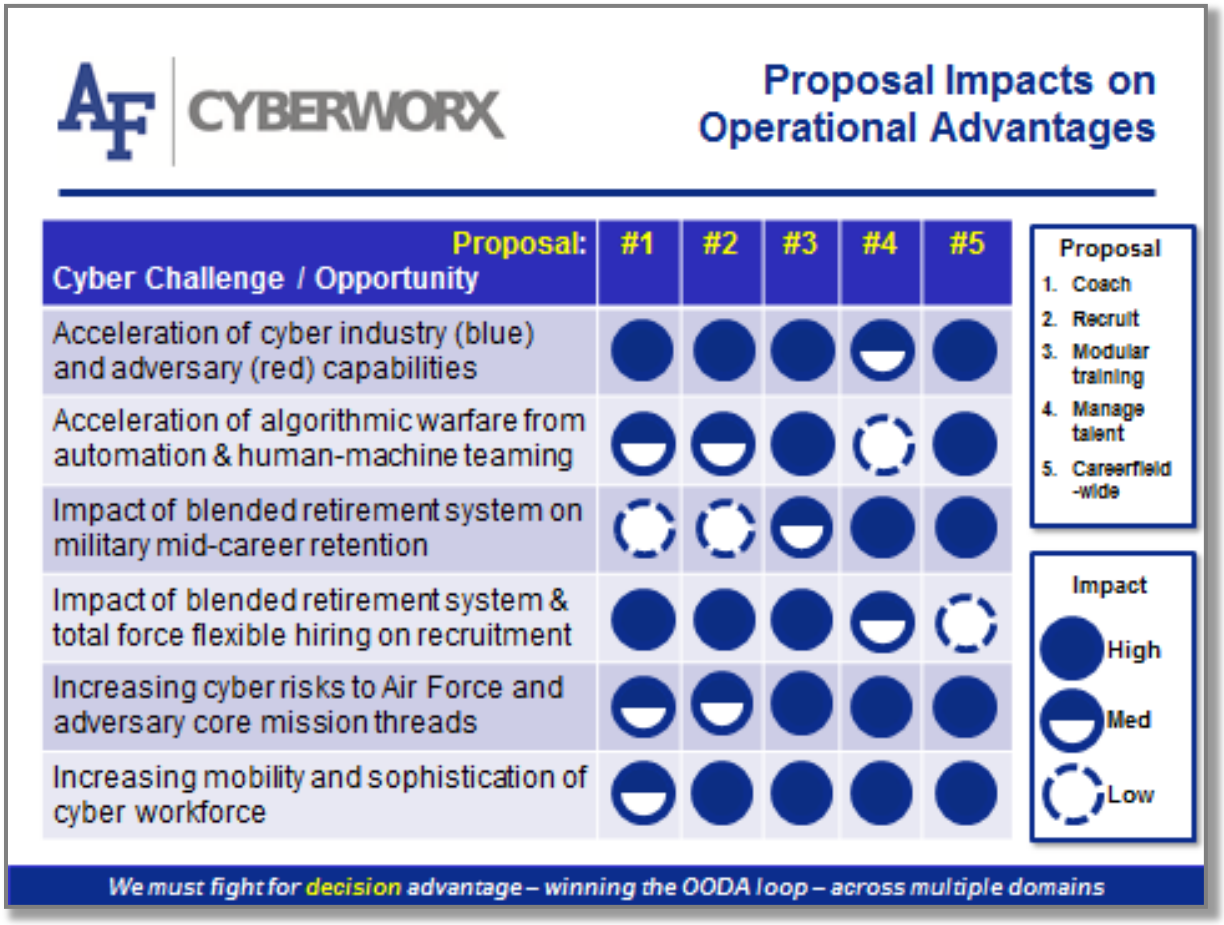
1. Begin searching for a commercial cloud based talent management system that will integrate AFPC and subsume the Cyber SURF
2. Directly field appropriate system or release an RFP for application of existing systems.
3. Link the system with virtual training system to track courses completed/validated.

Careerfield-wide Participation (Online Marketplace)

1. Link a Cyber Portal to the AF Portal.
2. Search for and field an open source Q&A forum to the Cyber Portal
3. Link the talent management system to the Cyber Portal
4. Link the training environment to the Cyber Portal
5. Create a Cyber Wiki that includes moderated content, initially populated with course materials from Keesler.
6. Gamify the user experience with rankings, avatars and rewards.

Two Slide Summary: Ops Advantages + The Fast Track

The CyberWorx "two slide" summary section is designed to help you in consideration of the recommendations in this report by weighing the operational improvements proposed against the current cyber challenges and opportunities we face as an Air Force.



In deciding what to do, the decision to do nothing is a decision and brings its own risks. Thus, the "fast track" slide spells out an easy set of actions to take at minimum to start trying to improve and to put the Air Force on a path of discovery in overcoming the challenges that drove this design project.

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Fast Track Ahead

- Start with a sprint to <u>modularize</u> (#3) one or two course training objectives
  - Team to use several methods to deliver the learning

  - Use several settings/environments (for Airmen's convenience!)
  - Assess impact & scale best methods to a few more objectives
- Make the modules (objectives and training) available to the <u>career field</u> (#5) for comment & improvement
- Encourage instructors to participate in discussions, coach students (#1) on modules & curate more content
- Offer select modules to mil/civ recruits (#2), link to local AF recruiters' contact & to nat'l STEM outreach groups

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