



NDIA
AT THE HEART
OF THE MISSION

2021 HUMAN SYSTEMS DIGITAL EXPERIENCE

Maximizing Human Readiness

March 2, 9, 16, 23, & 30 | [NDIA.org/HSDE](https://www.ndia.org/HSDE)

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NDIA

WHO WE ARE

The National Defense Industrial Association is the trusted leader in defense and national security associations. As a 501(c)(3) corporate and individual membership association, NDIA engages thoughtful and innovative leaders to exchange ideas, information, and capabilities that lead to the development of the best policies, practices, products, and technologies to ensure the safety and security of our nation. NDIA's membership embodies the full spectrum of corporate, government, academic, and individual stakeholders who form a vigorous, responsive, and collaborative community in support of defense and national security. For more than 100 years, NDIA and its predecessor organizations have been at the heart of the mission by dedicating their time, expertise, and energy to ensuring our warfighters have the best training, equipment, and support. For more information, visit NDIA.org

GET INVOLVED

Learn more about NDIA's Divisions and how to join one at NDIA.org/Divisions



LEADERSHIP

Jim McCarthy
Division Chair

Kelly Hale
Deputy Chair

Peter Palmer
Vice Chair

Travis Klopfenstein
HSDE Industry Co-Chair

Jeffrey Thomas
HSDE Government Co-Chair

HUMAN SYSTEMS

WHO WE ARE

The NDIA Human Systems Division promotes the exchange of technical information and discussions between government, industry, and academia, and supports the expansion of research and development in areas related to the human as a system whose performance must be integrated into any military system of systems. To this end, the Division serves as an essential infrastructure by providing a variety of ways for government, industry, and academia to collaborate and advance human performance in air, land, sea, space, and cyberspace through research, education, and consultation.

WELCOME TO THE 2021 HUMAN SYSTEMS DIGITAL EXPERIENCE

On behalf of the NDIA Human Systems Division, we welcome you to our Human Systems Digital Experience!

When we met last March in Washington, DC, the seriousness of the pandemic was just beginning to emerge. We received last-minute instructions to avoid handshakes, but masks and social distancing were not yet part of the national discourse. How things have changed! As we began to plan for our 2021 annual meeting, we started with the tried-and-true: an in-person gathering that would allow colleagues to interact and benefit from those “hallway moments” that can be such an important part of professional gatherings. However, over time, it became apparent that a live gathering would not be possible; it simply would not be safe.

In reimagining our annual meeting, we applied the lessons learned from countless “Zooms” and “WebExs.” We knew how tiring they could be and how difficult it was to step away from normal day-to-day activities when you were still in your office (wherever that may be). Based on these insights, we decided to try something completely new. Rather than a one- or two-

day intensive gathering, we opted to design our meeting as five bite-sized chunks that would take place at the same time each week for a month. The thought was that the relatively small and predictable structure would enable you to more actively participate in the discussions that make these sorts of meetings so valuable. Each week will focus on a topic of particular interest to our community, such as the demand signals from the government; the latest advances in fields such as personalized assessment and training; supporting and protecting our warfighters; the design of system interfaces harmonized with the cognitive processing ability of our users; and measuring and advocating for the power of human systems design.

We are pleased that you are joining us for this ground-breaking event. We—the members of the NDIA Human Systems Division, our invited speakers, and community participants—hope you will both contribute to and learn from this month-long exploration of the many dimensions of the human systems challenge!

Jim McCarthy, PhD
 Vice President, Instructional Systems, Sonalysts, Inc.
 Chair, Human Systems Division, NDIA

Kelly Hale, PhD
 Principal Member, Technical Staff, Draper
 Deputy Chair, Human Systems Division, NDIA

SCHEDULE AT A GLANCE

DAY 1: TUESDAY, MARCH 2

Keynote Speakers & Col Panel

11:00 am – 2:00 pm EST

DAY 2: TUESDAY, MARCH 9

Focus: Personalized Assessment, Education, & Training

11:00 am – 2:00 pm EST

DAY 3: TUESDAY, MARCH 16

Focus: Protection, Sustainment, & Warfighter Performance

11:00 am – 2:00 pm EDT

DAY 4: TUESDAY, MARCH 23

Focus: Systems Interface & Cognitive Processing

11:00 am – 2:00 pm EDT

DAY 5: TUESDAY, MARCH 30

Focus: Advocacy & Metrics

11:00 am – 2:00 pm EDT

EVENT INFORMATION

EVENT WEBSITE

NDIA.org/HSDE

EVENT THEME

Maximizing Human Readiness

SURVEY AND PARTICIPANT LIST

You will receive via email a survey and list of participants (name and organization) after the event. Please complete the survey to make our event even more successful in the future.

EVENT CONTACTS

Jessica Lewton
Meeting Planner
(703) 247-2588
jlewton@NDIA.org

Jacqueline Dupre
Coordinator, Divisions
(703) 247-2575
jdupre@NDIA.org

SPEAKER GIFTS

In lieu of speaker gifts, a donation is being made to the Fisher House Foundation.

PLATFORMS

GoToWebinar: We will be utilizing GoToWebinar for the majority of this digital experience. You should have received a confirmation email from GoToWebinar after registering. These emails will be resent 24 hours and 1 hour before each webinar.

Zoom.Gov: The final session of Days 2 – 5 (the Roundtable Discussions) will be hosted on Zoom.Gov to allow maximum attendee participation. A calendar invitation will be sent 24 business hours prior to each of these sessions.

ON-DEMAND POSTER SESSIONS

Poster presentations will be available in an on-demand format on the event website: NDIA.org/HSDE.

HARASSMENT STATEMENT

NDIA is committed to providing a professional environment free from physical, psychological and verbal harassment. NDIA will not tolerate harassment of any kind, including but not limited to harassment based on ethnicity, religion, disability, physical appearance, gender, or sexual orientation. This policy applies to all participants and attendees at NDIA conferences, meetings and events. Harassment includes offensive gestures and verbal comments, deliberate intimidation, stalking, following, inappropriate photography and recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome attention. Participants requested to cease harassing behavior are expected to comply immediately, and failure will serve as grounds for revoking access to the NDIA event.

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AGENDA

The following program is in the Eastern Time Zone.

DAY 1: TUESDAY, MARCH 2

11:00 – 11:10 am

OPENING REMARKS

Jim McCarthy, PhD

Vice President, Instructional Systems, Sonalysts, Inc.

Chair, Human Systems Division, National Defense Industrial Association (NDIA)

NDIA REMARKS

Gen Herbert “Hawk” Carlisle, USAF (Ret)

President and Chief Executive Officer, NDIA

EXCLUSIVE WEBINAR SPONSOR REMARKS

Tony Kurta

Strategic Account Executive, Health & Human Performance, Leidos

11:10 – 11:55 am

KEYNOTE SPEAKER

Lernes Hebert

Deputy Assistant Secretary of Defense, Military Personnel Policy, Office of the Secretary of Defense, U.S. Department of Defense

Includes Q&A

11:55 am – 12:00 pm

BREAK

12:00 – 1:05 pm

COI PANEL

Michelle Zbylut, PhD

Director, Army Research Institute

Moderator

Mark Draper

Lead, Adaptive Warfighter Interfaces Core Technical Competency, Air Force Research Laboratory
SI&CP Government Co-Chair, Human Systems Division, NDIA

Michael LaFiandra

Deputy Chief Scientist, Army Research Laboratory

PS&WP Government Representative, Human Systems Division, NDIA

Kendy Vierling, PhD

Director, Naval Education Division, Office of the Assistant Secretary of the Navy (Manpower & Reserve Affairs)
PAE&T Government Co-Chair, Human Systems Division, NDIA

Includes Q&A

1:05 – 1:10 pm

BREAK

1:10 – 1:55 pm

KEYNOTE SPEAKER

VADM Richard Brown, USN (Ret)
President, Siren Consulting, LLC

Includes Q&A

1:55 – 2:00 pm

CLOSING REMARKS

Kelly Hale, PhD
Principal Member, Technical Staff, Draper
Deputy Chair, Human Systems Division, NDIA

Revolutionizing the health readiness of our forces

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[NDIA.org/LinkedIn](https://www.linkedin.com/company/NDIA.org/LinkedIn)



[@NDIAToday](https://www.instagram.com/NDIAToday)



[@NDIAToday](https://www.youtube.com/channel/UC...)

DAY 2: TUESDAY, MARCH 9 | PAE&T

11:00 – 11:15 am

OPENING REMARKS**Jim McCarthy, PhD**Vice President, Instructional Systems, Sonalysts, Inc.
Chair, Human Systems Division, NDIA**EXCLUSIVE WEBINAR SPONSOR REMARKS****Tony Kurta**

Strategic Account Executive, Health & Human Performance, Leidos

**PERSONALIZED ASSESSMENT, EDUCATION, & TRAINING RECAP
OF STRATEGY/GAPS****Kendy Vierling, PhD**Director, Naval Education Division, Office of the Assistant Secretary of the Navy (Manpower & Reserve Affairs)
PAE&T Government Co-Chair, Human Systems Division, NDIA

11:15 – 11:20 am

INTRO TO PERSONALIZED ASSESSMENT, EDUCATION, & TRAINING**Elizabeth Biddle, PhD**Senior Technical Fellow, Advanced Learning Capabilities, Mission Systems & Autonomy,
Boeing Research & Technology, The Boeing Company
PAE&T Industry Co-Chair, Human Systems Division, NDIA

11:20 – 11:40 am

**FIVE FACTORS THAT SHOULD BE CONSIDERED WHEN CHOOSING
TECHNOLOGY FOR TRAINING****Julian Abich, PhD**

Senior Engineer, Human Factors, Quantum Improvements Consulting

Eric Sikorski, PhD

Secondary Author

Includes Q&A

11:40 am – 12:00 pm

**MEASURING AND ASSESSING HUMAN READINESS: USING DATA
STANDARDS TO IMPROVE THE FIDELITY OF ASSESSMENT DATA
(XAPI, XAPI PROFILES, RCDS, AND P2881)****Ashley Howell**

Project Manager and Systems Engineer, Advanced Distributed Learning Initiative

Hunter Smith

Software Engineer, Advanced Distributed Learning Initiative

Includes Q&A

12:00 – 12:05 pm

BREAK

12:05 – 12:25 pm

FATIGUE DETECTION/PREDICTION USING MACHINE LEARNING AND WEARABLE TECHNOLOGY

Alex Kniffin

Biomedical Engineer, Dahlgren Division, Naval Surface Warfare Center

Includes Q&A

12:25 – 12:45 pm

THE TEAM-BASED ADVANCED RESILIENCE ACCELERATOR (TARA) SYSTEM: A TABLET-BASED OBSERVATIONAL PERFORMANCE ASSESSMENT TOOL FOR DEVELOPMENT OF RESILIENT TEAMS

Kristy Kay

Scientist, Aptima, Inc.

Lisa Lucia, PhD, and Jeff Beaubien, PhD

Secondary Authors

Includes Q&A

12:45 – 12:50 pm

CLOSING REMARKS

Kendy Vierling, PhD

Director, Naval Education Division, Office of the Assistant Secretary of the Navy (Manpower & Reserve Affairs)
PAE&T Government Co-Chair, Human Systems Division, NDIA

12:50 – 1:00 pm

BREAK/TRANSFER TO ZOOM.GOV

1:00 – 2:00 pm

Hosted on Zoom.Gov

ROUNDTABLE FOCUSED ON PERSONALIZED ASSESSMENT, EDUCATION, & TRAINING

Elizabeth Biddle, PhD

Senior Technical Fellow, Advanced Learning Capabilities, Mission Systems & Autonomy,
Boeing Research & Technology, The Boeing Company
PAE&T Industry Co-Chair, Human Systems Division, NDIA

Kendy Vierling, PhD

Director, Naval Education Division, Office of the Assistant Secretary of the Navy (Manpower & Reserve Affairs)
PAE&T Government Co-Chair, Human Systems Division, NDIA

Includes Q&A

DAY 3: TUESDAY, MARCH 16 | PS&WP

11:00 – 11:15 am

OPENING REMARKS

Jim McCarthy, PhD

Vice President, Instructional Systems, Sonalysts, Inc.
Chair, Human Systems Division, NDIA

EXCLUSIVE WEBINAR SPONSOR REMARKS

Tony Kurta

Strategic Account Executive, Health & Human Performance, Leidos

PROTECTION, SUSTAINMENT, & WARFIGHTER PERFORMANCE RECAP OF STRATEGY/GAPS

Travis Klopfenstein

Executive Director, Programs, University of Iowa Technology Institute
HSDE Industry Co-Chair, Human Systems Division, NDIA

11:15 – 11:20 am

INTRO TO PROTECTION, SUSTAINMENT, & WARFIGHTER PERFORMANCE

Brad Chedister

Chief Technology Officer, DEFENSEWERX
PS&WP Industry Co-Chair, Human Systems Division, NDIA

11:20 – 11:40 am

PEAKSLEEP: A WEARABLE NEUROTECHNOLOGY FOR SLEEP AND MEMORY ENHANCEMENT

Stephen Simons, PhD

Principal Scientist, Teledyne Scientific

Michael Weisend, PhD, Alexandra Yanoschak, and Calvin Schmidt

Secondary Authors

Includes Q&A

11:40 am – 12:00 pm

WARRIOR PERFORMANCE PLATFORM (WP2™) FOR THE UNITED STATES AIR FORCE: ENABLING REMOTE FITNESS COACHING AND WELLNESS TRACKING CAPABILITIES FOR GEOGRAPHICALLY DISTRIBUTED POPULATIONS

Jake Repanshek

Executive Director, Solutions & Technology, TIAG

Kevin Dawidowicz

Co-Founder and President, CoachMePlus

Includes Q&A

12:00 – 12:05 pm

BREAK

12:05 – 12:25 pm

ADDING STRESSORS TO TACTICAL COMBAT CASUALTY CARE AND CARE UNDER FIRE VIRTUAL REALITY PERFORMANCE ASSESSMENTS USING HAPTICS AND INTEGRATED IMMERSIVE TECHNOLOGIES

Conner Parsey

Manager, Science & Technology, Combat Capabilities Development Command Soldier Center (DEVCOM SC),
U.S. Army

Joanne Barnieu

Director, Instructional Science, Engineering & Computer Simulations

William Pike, PhD, Madison Quinn, and Justin Welzien

Secondary Authors

Includes Q&A



NDIA Connect

AN ONLINE COMMUNITY FOR DEFENSE PROFESSIONALS

The Human Systems Community is now available for you to join and use, all while enhancing your Division participation and growing your network.

As the National Defense Industrial Association's members-only online community, NDIA Connect offers 24/7 exclusive access to content, contacts, and collaboration capabilities. Each day, defense professionals from around the world post their thoughts, questions, and answers—even related to the human as a system, biometrics, human-centered research, human performance, manpower, occupational health, and all physical domains. Log in today to join these conversations and take advantage of all that NDIA Connect enables:

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- Collaborate on projects and documents of all kinds
- Plan meetings, seminars, webinars, conferences, or any NDIA-related event
- Foster discussion, promote innovation, and grow your network

Log in today at Connect.NDIA.org

12:25 – 12:45 pm

MEASURING AND PREDICTING SOLDIER PERFORMANCE AND LETHALITY THROUGH SOLDIER-SYSTEMS MODELING**Robb Wilcox, PhD**

Lead, Science & Technology, Human Systems Performance, DEVCOM SC, U.S. Army

Includes Q&A

12:45 – 12:50 pm

CLOSING REMARKS**Travis Klopfenstein**

Executive Director, Programs, University of Iowa Technology Institute

HSDE Industry Co-Chair, Human Systems Division, NDIA

12:50 – 1:00 pm

BREAK/TRANSFER TO ZOOM.GOV

1:00 – 2:00 pm

Hosted on Zoom.Gov

ROUNDTABLE FOCUSED ON PROTECTION, SUSTAINMENT, & WARFIGHTER PERFORMANCE**Brad Chedister**

Chief Technology Officer, DEFENSEWERX

PS&WP Industry Co-Chair, Human Systems Division, NDIA

Travis Klopfenstein

Executive Director, Programs, University of Iowa Technology Institute

HSDE Industry Co-Chair, Human Systems Division, NDIA

Includes Q&A**DAY 4: TUESDAY, MARCH 23 | SI&CP**

11:00 – 11:15 am

OPENING REMARKS**Lillian Asiala, PhD**

Cognitive Scientist, Sonalysts, Inc.

Incoming Deputy Chair, Human Systems Division, NDIA

EXCLUSIVE WEBINAR SPONSOR REMARKS**Tony Kurta**

Strategic Account Executive, Health & Human Performance, Leidos

SYSTEMS INTERFACE & COGNITIVE PROCESSING RECAP OF STRATEGY/GAPS**Mark Draper**

Lead, Adaptive Warfighter Interfaces Core Technical Competency, Air Force Research Laboratory

SI&CP Government Co-Chair, Human Systems Division, NDIA

11:15 – 11:20 am

INTRO TO SYSTEMS INTERFACE & COGNITIVE PROCESSING**Steve Dorton**

Director, Human-Autonomy Interaction Laboratory, Sonalysts, Inc.

Vice President, Research & Development, Sonalysts, Inc.

SI&CP Industry Co-Chair, Human Systems Division, NDIA

11:20 – 11:40 am

REVOLUTIONIZING PREVENTATIVE MAINTENANCE CHECKS AND SERVICES WITH AUGMENTED REALITY

Charis Horner

Product Engineer, Design Interactive, Inc.

Includes Q&A

11:40 am – 12:00 pm

CONTEXT-SENSITIVE ADAPTIVE FRAMEWORK FOR CROSS-PLATFORM INTERACTION

Pooja Bovard, PhD

Senior Engineer, Human Systems, Draper

Includes Q&A

12:00 – 12:05 pm

BREAK

12:05 – 12:25 pm

BATTLEFIELD CARE DECISION SUPPORT

Christopher Nemeth, PhD

Principal Scientist, Applied Research Associates, Inc.

Includes Q&A

12:25 – 12:45 pm

PERFORMANCE IN NOISE SPEECH TO TEXT COMMUNICATIONS AID

Tyler Ferro, PhD

Engineer, Operational Design & Performance, Dahlgren Division, Naval Surface Warfare Center

Includes Q&A

12:45 – 12:50 pm

CLOSING REMARKS

Mark Draper

Lead, Adaptive Warfighter Interfaces Core Technical Competency, Air Force Research Laboratory SI&CP Government Co-Chair, Human Systems Division, NDIA

12:50 – 1:00 pm

BREAK/TRANSFER TO ZOOM.GOV

1:00 – 2:00 pm

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ROUNDTABLE FOCUSED ON SYSTEMS INTERFACE & COGNITIVE PROCESSING

Steve Dorton

Director, Human-Autonomy Interaction Laboratory, Sonalysts, Inc.

Vice President, Research & Development, Sonalysts, Inc.

SI&CP Industry Co-Chair, Human Systems Division, NDIA

Moderator

Mark Draper

Lead, Adaptive Warfighter Interfaces Core Technical Competency, Air Force Research Laboratory SI&CP Government Co-Chair, Human Systems Division, NDIA

Includes Q&A

DAY 5: TUESDAY, MARCH 30 | A&M

11:00 – 11:15 am

OPENING REMARKS**Kara Orvis, PhD**Vice President, Research & Development, Aptima, Inc.
Incoming Division Chair, Human Systems Division, NDIA**EXCLUSIVE WEBINAR SPONSOR REMARKS****Tony Kurta**

Strategic Account Executive, Health & Human Performance, Leidos

ADVOCACY & METRICS RECAP OF STRATEGY/GAPS**George Salazar**Discipline Lead, Human Computer Interface Tech, Lyndon B. Johnson Space Center, NASA
A&M Government Co-Chair, Human Systems Division, NDIA

11:15 – 11:20 am

INTRO TO ADVOCACY & METRICS**Eric Jones**Engineer, Human Factors, Cooper Perkins | Part of PA Consulting
A&M Industry Co-Chair, Human Systems Division, NDIA

11:20 – 11:40 am

HUMAN PREVENTATIVE MAINTENANCE CHECKS AND SERVICES MANUAL**BG Peter Palmer, USA (Ret)**President, P2 Consulting Service, LLC
Vice Chair, Human Systems Division, NDIA**Includes Q&A**

11:40 am – 12:00 pm

USING DATA MANAGEMENT AND AI TO IMPROVE READINESS AND RETURN**Scott Keplinger**

Chief Executive Officer, Malum Terminus Technologies, Inc.

Kyle Peterson and David Batka

Secondary Authors

Includes Q&A

12:00 – 12:05 pm

BREAK

12:05 – 12:25 pm

READINESS IN REAL-TIME: USING COGNITIVE SCIENCE AND AI TO PREDICT HUMAN CAPABILITY**Iain Harlow, PhD**

Vice President, Science, Cerego, Inc.

Includes Q&A

12:25 – 12:45 pm

ADDRESSING THE GAP IN DATA MANAGEMENT: A HEALTH AND HUMAN PERFORMANCE DATA ARCHITECTURE

Adam Faurot

Chief Executive Officer, TITUS Human Performance Solutions

David Batka

Secondary Author

Includes Q&A

12:45 – 12:50 pm

CLOSING REMARKS

George Salazar

Discipline Lead, Human Computer Interface Tech, Lyndon B. Johnson Space Center, NASA
A&M Government Co-Chair, Human Systems Division, NDIA

12:50 – 1:00 pm

BREAK/TRANSFER TO ZOOM.GOV

1:00 – 2:00 pm

Hosted on Zoom.Gov

ROUNDTABLE FOCUSED ON ADVOCACY & METRICS

Eric Jones

Engineer, Human Factors, Cooper Perkins | Part of PA Consulting
A&M Industry Co-Chair, Human Systems Division, NDIA

George Salazar

Discipline Lead, Human Computer Interface Tech, Lyndon B. Johnson Space Center, NASA
A&M Government Co-Chair, Human Systems Division, NDIA

Includes Q&A

NDIA has a policy of strict compliance with federal and state antitrust laws. The antitrust laws prohibit competitors from engaging in actions that could result in an unreasonable restraint of trade. Consequently, NDIA members must avoid discussing certain topics when they are together at formal association membership, board, committee, and other meetings and in informal contacts with other industry members: prices, fees, rates, profit margins, or other terms or conditions of sale (including allowances, credit terms, and warranties); allocation of markets or customers or division of territories; or refusals to deal with or boycotts of suppliers, customers or other third parties, or topics that may lead participants not to deal with a particular supplier, customer or third party.



The banner features a central image of a soldier in full combat gear, including a helmet and a backpack, standing in a futuristic, digital environment. The background is filled with glowing blue and white data points, lines, and abstract shapes, suggesting a high-tech or artificial intelligence theme. In the top left corner, there is a blue shield-shaped logo with the text 'NDIA AT THE HEART OF THE MISSION'. On the right side, the main title 'NDIA NATIONAL SECURITY AI CONFERENCE & EXHIBITION' is written in large, bold, white capital letters. Below the title, the text 'Register Today' is written in a smaller, bold, white font. Further down, a paragraph of white text describes the event as a premier gathering on AI for national security, highlighting topics like competition, AI solutions, and real-world technology. The bottom of the banner features the dates 'March 23 – 25' and the website 'NDIA.org/NSAICE' in white text.

KEYNOTE BIOGRAPHIES



VADM RICHARD BROWN, USN (RET)

President

Siren Consulting, LLC

Vice Admiral

Richard Brown is a recognized expert in crisis management,

including the single most important issue of our time, COVID-19, having successfully kept the 92 Surface Ships of the Pacific Fleet and their crews operational during the height of the pandemic. As demonstrated during his 35-year career in the United States Navy, he is also a change leader who led the digital transformation and technical refresh of the Navy's Personnel System; completely revamped the Surface Warfare Officer career path; brought Surface Warfare training into the 21st century by transforming the curricula and devices to state-of-the-art virtual systems; and created programs and policies that professionalized the Surface Warfare community. He designed, initiated, tracked, oversaw, and successfully implemented the most comprehensive culture change the United States Navy has ever achieved.

Brown was appointed Commander, Naval Surface Forces/Commander, Naval Surface Force, U.S. Pacific Fleet, following the tragic destroyer collisions and loss of 17 sailors in 2017 in the Pacific. He was hand-selected

to fix a deteriorating institution. He revamped the career and training continuum of over 6,500 Surface Warfare Officers, revitalized training regimens of the 162 surface ships, and changed the culture of the Surface Force of over 55,000 sailors to a Culture of Excellence. He led a staff of 475 in the manning, training, and equipping of the United States Navy's Surface Ship Fleet, influencing a \$40-billion annual enterprise-wide budget and directly executing a \$3-billion annual Naval Surface Force U.S. Pacific Fleet budget. He directed detailed succession planning for Surface Warfare senior and flag officers, ensuring the right leader was available at the right time.

Brown was hand-selected twice to lead two high-visibility and critical investigations. In August 2017, he led the dual-purpose investigation into the collision of USS JOHN S MCCAIN (DDG 56) and Motor Vessel ALNIC MC in the Singapore Traffic Separation Scheme. Then, in May 2020, he led the USS THEODORE ROOSEVELT investigation into the command relationships, decisions, and climate following the COVID-19 breakout that took this capital asset off-line for two months. These

investigations resulted in concrete and measurable recommendations for Navy improvement in operational oversight, safety, crew training, and personnel.

Brown excels in key stakeholder engagement, including an extensive history of successfully engaging directly with and being held accountable through briefings and congressional testimony to the Senate and House Armed Services Committees.

Brown held seven command tours throughout his career. Prior commands include USS THE SULLIVANS (DDG 68), USS GETTYSBURG (CG 64), Surface Warfare Officers School Command, Naval Service Training Command, Carrier Strike Group Eleven/NIMITZ Carrier Strike Group, and Navy Personnel Command/Deputy Chief of Navy Personnel.

Brown holds a BS in Mathematics from the United States Naval Academy, an MS in Operations Research from the United States Naval Postgraduate School, and an MA in National Security and Strategic Studies from the United States Naval War College.



LERNES HEBERT

Deputy Assistant Secretary of Defense, Military Personnel Policy
Office of the Secretary of Defense, U.S. Department of Defense

Mr. Lernes Hebert oversees the full spectrum of human resource policies for

over two million military personnel serving in the Department of Defense. As the Deputy Assistant Secretary of Defense for Military Personnel Policy, a component of the Office of the Under Secretary of Defense for Personnel and Readiness, his responsibilities include accessions, compensation, development, separations, and recognition programs. He is directly responsible for policies to sustain the all-volunteer force.

Mr. Hebert has served in Military Personnel Policy since 2003. During his tenure, he led the Department through major initiatives to restructure career longevity provisions, joint officer management, and general and flag officer management. His achievements were recognized in 2017 with his receipt of the Presidential Rank Award of Meritorious Executive in 2017.

He previously served in the Air Force and, after a 24-year military career, retired as a colonel. He served at every level in the field of personnel management, including key

assignments in the Office of the Secretary of Defense, in the Air Staff, at the Air Force Personnel Center, and with the Air Combat Command.

Mr. Hebert earned an MS in National Security Strategy from the National War College at the National Defense University. He also holds an MA in Management and Computer Resource Management from Webster University. He attended the University of Louisiana, where he earned his BS in Management.

POSTERS

PERSONALIZED ASSESSMENT, EDUCATION, & TRAINING

Training Cognitive Overmatch through Esports

Allison Brager, PhD

Director, Human Performance, U.S. Army Recruiting Command

Contact: allison.brager@gmail.com

PROTECTION, SUSTAINMENT, & WARFIGHTER PERFORMANCE

Mission Task Analysis Tool (MTAT): Preparing to Fight a New Mission

Lisa Bolin

Program Manager, SimVentions

Contact: lisabolin@simventions.com

Matthew Wilson and Cory Cheek

Secondary Authors

SYSTEMS INTERFACE & COGNITIVE PROCESSING

Task-Centered Approaches to Human Interface Design

Michael Cowen, PhD

Technical Director, Monterey Technologies, Inc.

Contact: mcowen@montereytechnologies.com

Empowering Knowledge Transition through AR-Based Complex Troubleshooting

Lori Mullen

Senior Business Analyst, Design Interactive, Inc.

Contact: lori.mullen@designinteractive.net

Selecting Best-in-Breed HMI Components for MUM-T

Blake Piper

Research Scientist, Leidos

Contact: blake.piper@leidos.com

Assessing Interface Readiness Using Model-Based Systems Engineering

Michael Miller, PhD

Professor, Air Force Institute of Technology

Contact: michael.miller@afit.edu

The Science of Understanding

Leslie Blaha, PhD

Senior Research Psychologist, Warfighter Interactions & Readiness

Division, 711th Human Performance Wing, Air Force Research Laboratory

Contact: leslie.blaha@us.af.mil

Implementing Decision-Centric Warfare

Brian Clark

Senior Fellow, Hudson Institute

Contact: bclark@hudson.org

ADVOCACY & METRICS

Human Readiness Levels: Ensuring Systems Are “Ready” for Human Users

Benjamin Schwartz

Systems Engineer, Engineering For Humans

Contact: benjamin@engineeringforhumans.com

Holly Handley, PhD

Secondary Author



Human Systems Community of Interest

Dr. Michelle Zbylut – Col Chair

Dr. Kendy Vierling - Personalized Assessment, Education, and Training

Dr. Mark Draper – Systems Interfaces and Cognitive Processes

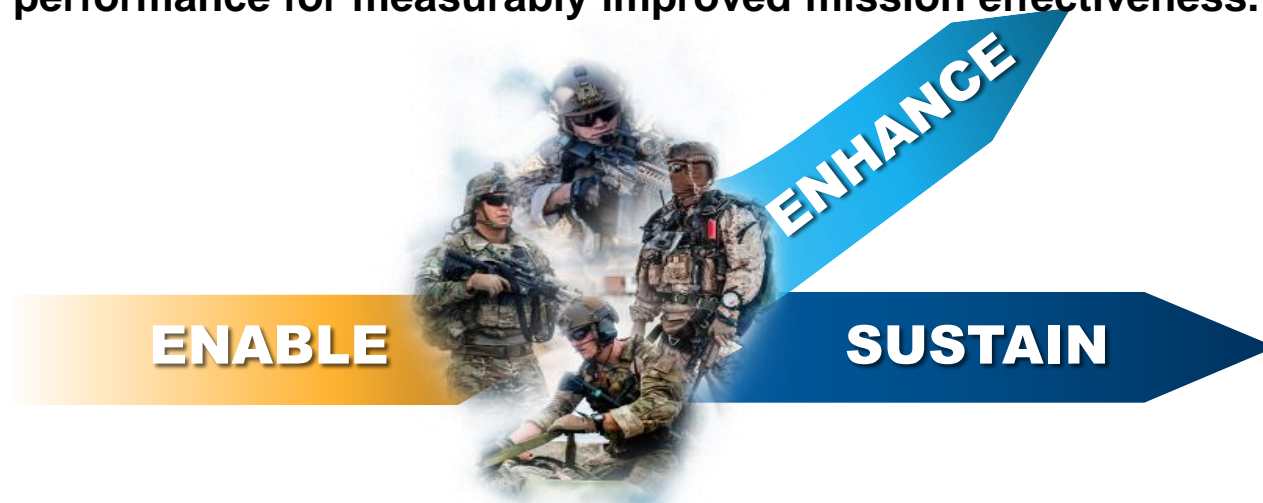
Dr. Mike LaFiandra – Protection, Sustainment and Warfighter Performance



Vision and Mission

VISION

Develop and deliver technologies to enable, sustain, enhance, and quantify human performance for measurably improved mission effectiveness.



MISSION

Enhance mission effectiveness through:

- Integrated simulations for mission training, experimentation
- Human-machine designs for mission effectiveness
- Assessment of operator effectiveness
- Protecting operators through battlespace stressors
- Mastering the political, military, economic, social, infrastructure, and information systems (PMESII) battle space



Human Systems Community of Interest Active Membership



STEERING GROUP

Dr. John Tangney (Navy)
Dr. Patrick Mason (Navy)

Dr. Rajesh Naik (AF Acting)
Ms. Lisa Sanders (SOCOM)
Dr. Ben Petro (OUSD)

Dr. Corde Lane (Army)
Dr. Thomas Davis (Army)
Dr. Michelle Zbylut (Army)
Dr. Robb Wilcox (Army)

WORKING GROUP

Dr. Kelly Ervin (Army)
Ms. Rachel Weatherless (Army)
Dr. Jessie Chen (Army)
Dr. Jill McQuade (AF)

Ms. Roxanne Constable (AF)
LCDR Jacob Norris (Navy)
Ms. Karen Gregorczyk (Army)

Dr. Paul Chatelier (Navy)
Dr. Kristy Hentchel (Navy)
LTCol Eric Midboe (OUSD)

SUB-AREAS

Personalized Assessment, Education, and Training

Dr. Kendy Vierling (USMC)

Dr. Ben Files (Army)
Mr. Rodney Long (Army)
Dr. Pete Khooshabehadeh (Army)
Dr. Greg Ruark (Army)
Dr. Sae Schatz (ADL)
Dr. Harold Hawkins (Navy)
LCDR Pete Walker (Navy)
Dr. Mark Livingston (Navy)
Dr. Jim Pharmer (Navy)
Dr. Ray Perez (Navy)
Dr. Melissa Walwanis (Navy)
Dr. Shannon Salyer (OPA)
Dr. Michael Nugent (DLNSEO)
Dr. Kimberly Pollard (Army)
Dr. Glenn Gunzelmann (AF)

Protection, Sustainment, and Warfighter Performance

Dr. Peter Squire (Navy)

Dr. Mike LaFiandra (Army)

Dr. John Ramsay (Army)
Ms. Betty Davis (Army)
LCDR Josh Swift (Navy)
Dr. Karl Van Orden (Navy)
Dr. Sandra Chapman (Navy)
Dr. Kristy Hentchel (Navy)
Mr. Keith King (Navy)
Dr. Curt Grigsby (AF)
Dr. John Schlager (AF)
Dr. Morgan Schmidt (AF)
Dr. Kendy Vierling (USMC)

Systems Interfaces and Cognitive Processes

Dr. Mark Draper (AF)

Dr. Laurie Fenstermacher (AF)
Dr. Jeff Palumbo (AF)
Dr. Tammy Chelette (AF/ Autonomy Col)
Mr. Ed Davis (AF)
Mr. Eric Hansen (AF)
Dr. Tom McKenna (Navy)
Dr. Jeff Morrison (Navy)
Dr. Rebecca Goolsby (Navy)
Dr. Katherine Cox (Army)
Dr. Caroline Mahoney (Army)
Dr. Jeff Hansberger (Army)
Dr. Edward Palazzolo (Army)
Dr. Lisa Troyer (Army)
Dr. Dale Russell (Navy)
Dr. Dan Zelick (AF)
Dr. Jennifer Serres (Army)



Service Demand Signals



<p><u>DoD</u></p> <p>2018 National Defense Strategy</p> <p>Close Combat Lethality Task Force</p>	<p>Military readiness = more lethal force</p> <p>Performance optimization; sustained mission readiness in extreme environments</p> <p>Optimize the physical preparedness of personnel</p> <p>Prepare squad through realistic training in immersive high-stress environment</p>
<p><u>Army</u></p> <p>The Army Vision</p> <p>The Army Strategy</p> <p>U.S Army Modernization Strategy</p> <p>The Army People Strategy</p>	<p>Smart, thoughtful, innovative leaders → new talent mgt-based personnel system</p> <p>Soldier lethality spanning shooting, moving, communicating, protecting, sustaining</p> <p>Next Generation Combat Vehicle: Human and non-human teams at new levels</p> <p>Rapid expansion of synthetic training environments, simulations capabilities</p>
<p><u>Navy</u></p> <p>A Design for Maintaining Maritime Superiority</p> <p>Naval R&D: A Framework for Accelerating to the Navy and Marine Corps After Next</p>	<p>Augmented Warfighter Priority: Enhance decision-making and Human-Machine teaming</p> <p>Science-based practices to support leader development, better decision making</p> <p>Scalable Lethality: Enable directed energy (low cost, high precision standoff strike)</p>
<p><u>Air Force</u></p> <p>Air Force Future Operating Concept</p> <p>The Science and Technology 2030 Initiative</p>	<p>Human-Machine Interface: Right information + right person + right time = right decision</p> <p>Agile innovative airmen in performance optimized teams for multi domain operations</p> <p>Rapid effective decision making</p>



Human Systems Col Taxonomy



Sub-Areas	Thrusts	
<p>Personalized Assessment, Education, and Training</p>	<p>Personnel Selection and Assignment</p>	
	<p>Training Design, Assessment, and Readiness Monitoring</p>	
	<p>Advanced Learning Technologies</p>	
<p>System Interfaces and Cognitive Processes</p>	<p>Understanding Human/Cognitive Processing</p>	
	<p>Human-Machine Interaction and Aiding</p>	
	<p>System Level Interfaces and Teaming</p>	
<p>Protection, Sustainment, and Warfighter Performance</p>	<p>Sensing, Monitoring, and Assessment</p>	
	<p>Enhancement Technologies and Techniques</p>	



Mutual Col-to-Col Research Interests



Biomedical Col

- Autonomous medical evacuation
- Biomedical modeling and simulation
- Predictors of mental health and medical attrition
- Modernization of biotechnology data and analytics infrastructure

Biotechnology Col

- Human Machine Teaming (HMT)

CWMD

- Dark web concerns
- Social network analysis
- Counter-terrorism research

Autonomy

- Human-Machine Teaming (HMT)
- Verification and Validation (V&V)
- Trust

C4I

- Human Decision Making

DE

- Bioeffects

Cyber

- Cyber selection and training
- Cyber situational awareness

Biomedical, Sensors, CWMD
Wearable physiological monitors



Industry Engagement



Independent Research & Development Technology Interchange Meetings IR&D TIMs Upcoming in June 2020

- Co-hosted by HS/Biomedical/Biotech Cols
- This engagement has broad goals to increase awareness, stimulate collaboration, and seek alignment between industry's IR&D innovation investments and DoD's high-priority science and technology needs and corresponding acquisition sustainment roadmaps.
- Participants: DTRA, DARPA, Army, Navy, Air Force, USMC, others
- <https://defenseinnovationmarketplace.dtic.mil/technology-interchange-meetings/>

ADL iFest - August 30, 2021 - September 1, 2021

I/ITSEC – December 2021

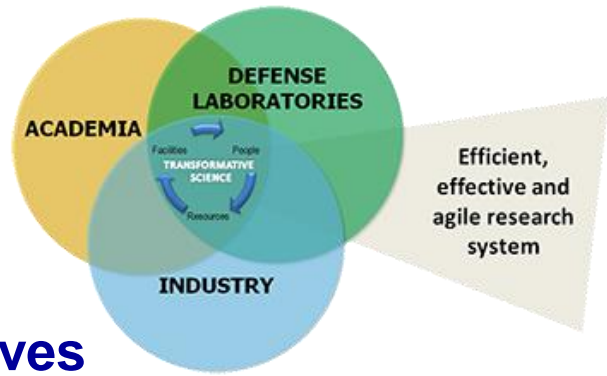


Academic Collaborations



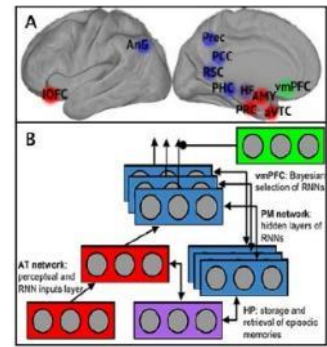
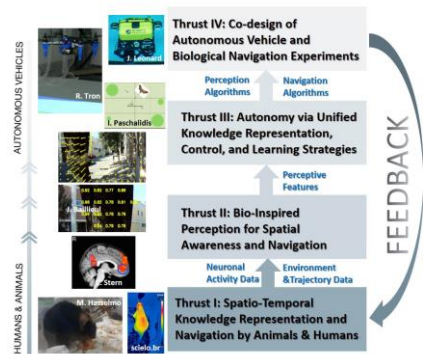
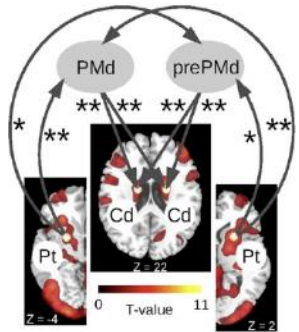
Centers of Excellence

- Human-Machine Teaming at Carnegie Mellon
- Biotechnology at Northwestern
- Directed Energy Bioeffects Institute (DEBI)
- TUFTS– Center for Applied Brain and Cognitive Sciences



Multidisciplinary University Research Initiatives

- Active Perception and Knowledge Exploitation in Navigation and Spatial Awareness
- Neural Circuits Underlying Symbolic Processing in Primate Cortex and Basal Ganglia
- A Computational Cognitive Neuroscience Approach to Understanding Event Representation and Episodic Memory



ARL Open Campus

ARL's Open Campus is a collaborative endeavor, with the goal of building a science and technology ecosystem that will encourage groundbreaking advances in basic and applied research areas of relevance to the Army. Through the Open Campus framework, ARL scientists and engineers (S&Es) will work collaboratively and side-by-side with visiting scientists in ARL's facilities, and as visiting researchers at collaborators' institutions.

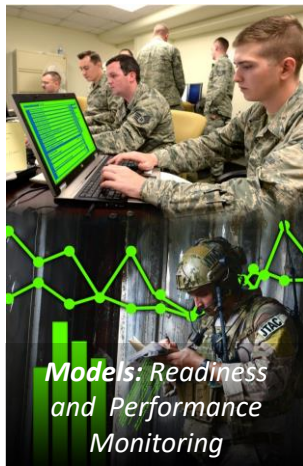
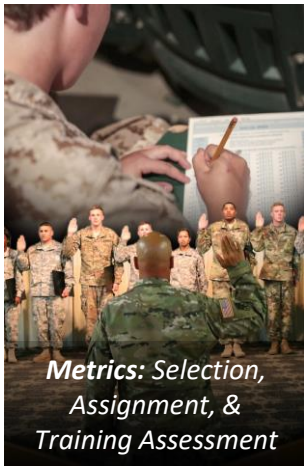
1.0

Personalized Assessment, Education, and Training

Right Person, Right Job, Right Skills

VISION

A readiness ecosystem that ensures the right person has the knowledge, skills, and experiences to be mission ready for the 21st century operating environment



OPERATIONAL OPPORTUNITIES:

- Train-as-we-fight opportunities with Live Virtual Constructive (LVC) environments for current and future systems
- Learning environments tailored to training objectives
- Advanced learning technologies that facilitate personalization and deliberate practice at the point-of-need
- Technological advances that enable new training paradigms
- Individualized, proficiency-based assessments of training effectiveness and operational performance
- Talent management functions personalized through big data

ENDURING CHALLENGES:

- Increased technological parity with adversaries
- Inadequate ranges for training advance weapon system capabilities (e.g., 5th gen aircraft, residential encroachment)
- Live training potentially reveals capabilities to adversaries
- Dynamic, evolving operational environments and adversaries
- Requirements outpace opportunities and resources to train
- Ineffectiveness of one-size-fits-all, Industrial Age training
- Sparse data for manpower, education, and training decisions
- Limited capacity to leverage personnel diversity



1.0

PAE&T Taxonomy



1.1 Personnel Selection and Assignment

1.1.1: Individualized Measures of Aptitude

1.1.2: Career-Long Outcome Measures (area to further explore)

1.1.3: Predictive Models for Performance and Retention

1.2 Training Design, Assessment, and Readiness Monitoring

1.2.1: Data and Learning Sciences

1.2.2: Cognitive and Performance Modeling

1.2.3: Innovative Training Design and Methodologies

1.3 Advanced Learning Technologies

1.3.1: VR/AR/MR and Integrated Simulations

1.3.2: Intelligent Tutoring Systems

TECH/CAPABILITY GAPS:

- Developing and integrating predictor measures that have individualized precision
- Developing or improving measures of operational performance and behavior that could inform decisions about career trajectory and future assignments
- Integrating currently stove-piped predictive models that are based on more than just group probabilities
- Warehousing and using (big) proficiency-based performance measures to inform training and operational decisions
- Adapting learning sciences to military contexts
- Conducting training and assessment in human-machine teams
- Developing and employing models, agents, and algorithms as synthetic training entities and for real-time readiness monitoring
- Securely integrating LVC environments
- Assessing virtual, augmented, and mixed reality technologies for training
- Creating software instructors for personalized training interventions





1.0 PAE&T Success Stories

Advancing the State-of-the-Art in Distributed Learning Through Public Outreach



Federal E-Learning Science & Technology

iFEST

innovation • instruction • implementation

Challenge: During pandemic restrictions, many DoD components needed a forum for interagency, industry, and academic sharing of distributed learning technologies, best practices, policies, and programs.

Accomplishments:

- Successful transition of annual iFEST conference from in-person to virtual format.
- Created an interactive conference portal and event agenda featuring senior executives, thought leaders, and project managers.
- Registration for the virtual 2020 event surpassed in-person participation in 2019 by 25%, and content also increased by 25%.
- Virtual event access remains open through end of 2020.



1.0

PAE&T Success Stories



Connected, Device-Assisted Learning, Anytime Anywhere



Challenge: Use emerging technologies to improve access to training, increase knowledge retention, and allow training data analytics: *Personalized eBooks for Learning (PeBL)*.

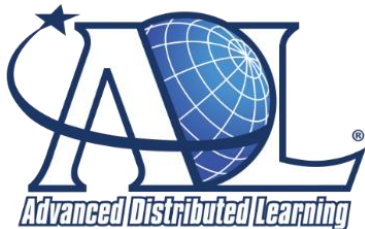
Accomplishments:

- Developed ePub3 standard and PeBL eBook reader which improves learner engagement through enhanced content personalization and new forms of interactivity.
- Instrumented with the Experience API (xAPI) to standardize learner data collection, sharing, and analytics.
- Upcoming deployment of PeBL enhanced version of Marine Corps Doctrinal Publication-7 *Learning*, to ~180K Marines. Expected in early FY21.



1.0 PAE&T Success Stories

DoD-Wide Interoperability for Education and Training Systems

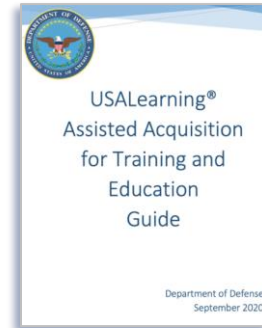


Challenge: Connect disparate, siloed education and training systems into an interoperable ecosystem that leverages enterprise data analytics to improve readiness and reduce costs.

Accomplishments:

- *Total Learning Architecture* “reference implementation” is now being demonstrated in collaborations with DHA, NAWCTSD, NETC, AETC, TRADOC, PEOSTRI, DAU, NPS, DCSA/CDSE, and others.
- Multiple commercial interoperability standards established for learner data collection and sharing.
- Prototype tools and technologies developed to facilitate the adoption and deployment of the next generation of education and training products.
- Streamlined DevSecOps pipeline to expedite integration and testing of learning technologies and products.

Education and Training Acquisition Reform



Challenge: Improve how DoD buys and maintains digital learning software and services.

Accomplishments:

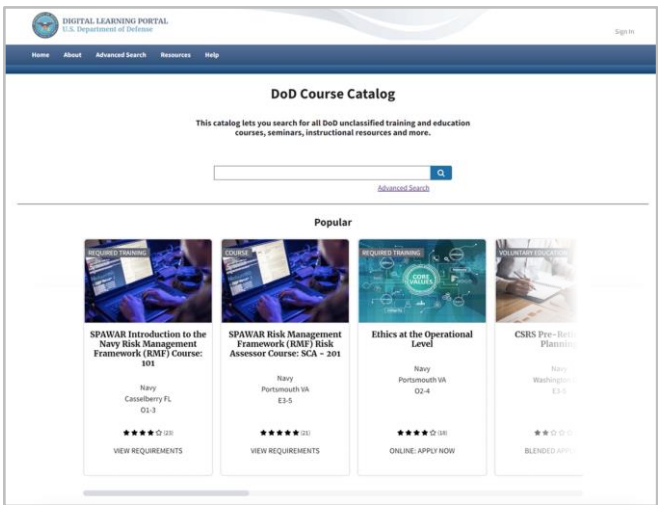
- Part of CMO-led *Enterprise Digital Learning Modernization* reform effort, approved in July 2018.
- Acquisition focus includes eliminating redundancies, maximizing shared services, and streamlining procurement of education/training products and services across the DoD.
- OPM’s USA Learning providing “Assisted Acquisition” portal to leverage DoD buying power through procurement services.
- USA Learning DoD Assisted Acquisition guide developed and targeted for September release/distribution.



1.0 PAE&T Upcoming Products



Enterprise Digital Learning Modernization (EDLM) Reform Effort

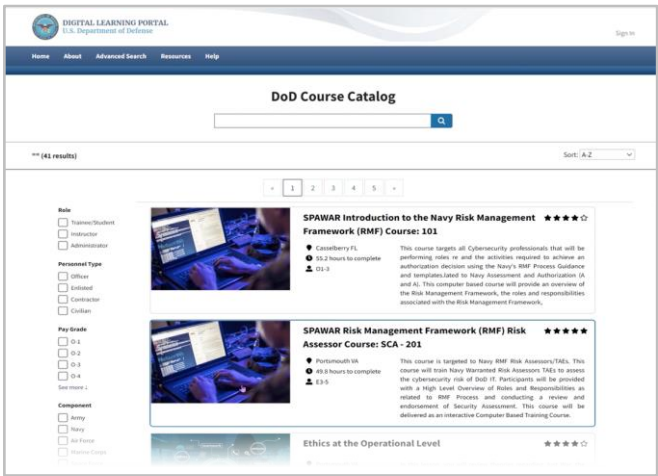


Enterprise Course Catalog

Portals federate local course catalog data from different DoD components into a single defense-wide directory with semantic search capabilities.

DoD users will be able to experience one seamless interface to discover all DoD course information instead of going to multiple locations.

- Aggregates tens-of-thousands of DoD course listings
- Uses commercial standards (IEEE P2881) to harmonize how courses are described (better support of big data, AI/ML, and analytics)
- Makes all DoD course catalogs interoperable & reduces duplications
- Anticipate developmental testing in FY21; anticipate Initial Operational Capability in FY22



Enterprise Learner Record Repository

A federated data fabric of learner data that relies on commercial standards and APIs to expose traditionally stove piped learner data across the DoD enterprise.

Maintains ownership and stewardship of the data with existing owners.

- Expose education/training outcome data in an interoperable, career-long system
- A federated solution to look at learner records from across the DoD
- Learning data pulled from existing, authoritative sources
- Currently working on R&D; anticipate early testing in FY21

2.0

Systems Interfaces & Cognitive Processes

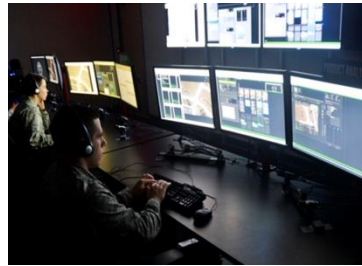
Effective, Natural Human-Machine Teaming

VISION

Warfighters teamed with agents and machines through intuitive, individualized, and adaptive interactions that enhance mission effectiveness.



Multi-Domain Operations



Manned-Unmanned Teaming



Team Performance Assessment



Quantified Warrior

OPERATIONAL OPPORTUNITIES:

- Enhance warfighter effectiveness by coupling humans & intelligent machines to maximize performance in the fog of war
- Real-time measurement, assessment and prediction of warfighter performance & functional state
- Adaptive human-machine interfaces for optimized weapon system and warfighter performance in contested environments
- Rapid, intuitive decision aiding & course of action analyses
- Manage perceptual abilities to exploit information throughput
- Field demonstrations in applied environments

ENDURING CHALLENGES/NEEDS:

- Mission effectiveness metrics & baselining
- Workflow models for teams
- Robust cognitive models & architectures for autonomous agents
- Multisensory adaptive interfaces that enhance, not interfere
- Robust, reliable natural language interfaces
- Dynamic calibration of system transparency to need
- Contextually aware dynamic decision support
- Tools for individual & team functional state assessment (Sensors & Algorithms)
- Identification of biomarkers for operator performance
- Coordination methods for teams of multi-adaptive systems.
- Interfaces that adapt to individual differences



2.0

SICP Taxonomy



2.1 Understanding Human/Cognitive Processing [WITHIN HUMAN]

- 2.1.1: Perception (Unitary and Multi-sensory)
- 2.1.2: Dynamic Operator Functional State Assessment
- 2.1.3: Cog Neuroscience/Performance Augmentation

2.2 Human-Machine Interaction and Aiding [HUMAN-MACHINE]

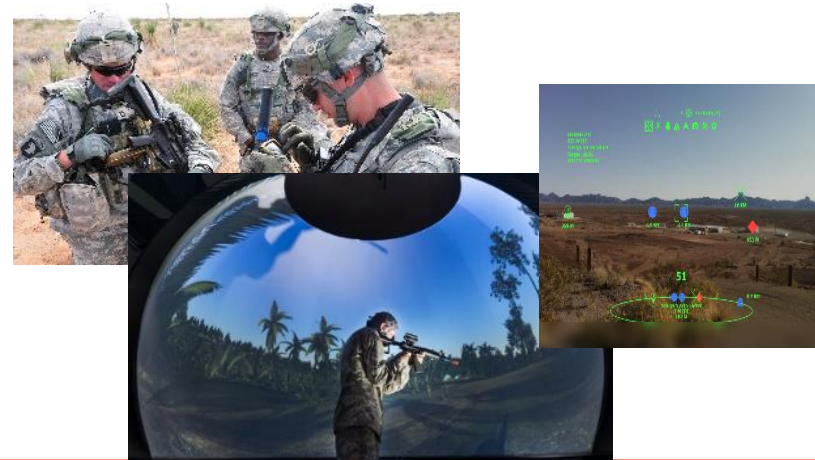
- 2.2.1: Advanced Interface Methods (Adaptive, Multi-modal)
- 2.2.2: Intelligent Decision Aiding/Support
- 2.2.3: Dynamic/Adaptive Task Allocation and Authority Transfer
- 2.2.4: Trust Calibration & Transparency

2.3 System Level Interfaces & Teaming [HUMAN-SYSTEM]

- 2.3.1: System Analyses and HSI (Organization)
- 2.3.2: Team Processes, Performance, & Metrics (Shared SA;Cohesion)
- 2.3.3: Data Analytics/ Socio-Cultural Analytics/ Exploitation Tools
- 2.3.4: System Interface Design and Application

TECH/CAPABILITY GAPS:

- Perception research– especially in areas of multi-sensory modeling/exploitation
- Design guidelines for reliable, real-time assessment of operator functional state
- Joint cognitive H-A decision making
- Baselining for envisioned capabilities
- Foundational research on distributed H-H-A teaming affordances
- Team performance metrics development



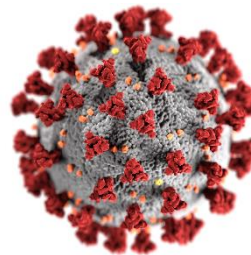


2.0

SICP Success Stories



MASTR-E Collaborating on COTS sensor-based study to advance COVID-19 early predictors and human performance research



Challenge: CCDC SC MASTR-E Program will lead a symptomology and physiology data collection in active duty military cohort to support model development and testing of susceptibility to illness predictive algorithms.

Technical Approach: This tri-service (CCDC SC, NHRC, AFRL) and academia team, will support U.S. Army Medical Research and Development Command's (MRDC's) Military Infectious Disease and Military Operational Medicine Research Program, by teaming with 4th Battalion, 31st Infantry Regiment, 2nd BCT, 10th Mountain Division (LI) to monitor up to 1000 Soldiers for a period of 1 year to understand how physiological, cognitive, and behavioral data can lead to understanding this susceptibility.

Impact:

- This approach will enable short term targeted testing of the most vulnerable, maintain unit readiness and support long term idea of a predictive algorithm evaluation that enable screening and triage for unit members while maintaining the end objective of optimizing the human weapon system.



Development and Evaluation of In-Cockpit Cursor Control for Display Interaction: *RHINO POINTING*



Challenge

- 5th/6th-Gen aircraft will have Large Area Display touch screen
 - Use violates HOTAS philosophy for fighter aircraft ops
 - Precision suffers in dynamic conditions (e.g., vibration)
- Eye tracking (ET) technology not currently suitable for cockpit use



Solution

- **Rhino Pointing (RP):** Team (AFRL, TPS, U of Iowa) developed in-cockpit prototype head-slaved cursor system

Approach

- In-house lab development/evaluation prior to in-flight testing
- AFRL/OPL integrated system
- 7 TPS pilots flew total of 14 sorties comparing RP, ET, and Touch



Results

- Each method judged to have military utility; complementary
- Operator-recommended future interface combining strengths of each
- Arango Memorial Award winner for Society of Experimental Test Pilots paper



2.0

SICP Success Stories



Operator focus on Space C2 Joint Emergent Operational Need (JEON)



Challenge:

Space operators need interfaces to integrate data related to space threats to promote SA/

Tech Approach:

Developed 2 apps aimed at situation analysis and “at-a-glance” overview centered on: Impact, likelihood, and urgency of emerging threats.

The 711th has transitioned multiple technologies related to space C2. Most recently, RH lead one of the lines-of-effort (LOE) for the AFRL/RV-lead Space C2 Joint Emergent Operational Need (JEON). This LOE entailed establishing an overarching human-system interface (HSI) for the collection of applications* used by the new National Space Defense Center (NSDC). This HSI was developed in 3 segments related to Awareness, Action and Overview

Accomplishment/Impact:

Transitioned to National Space Defense Center in July 2020



Innovations in Distributed Experimentation During COVID

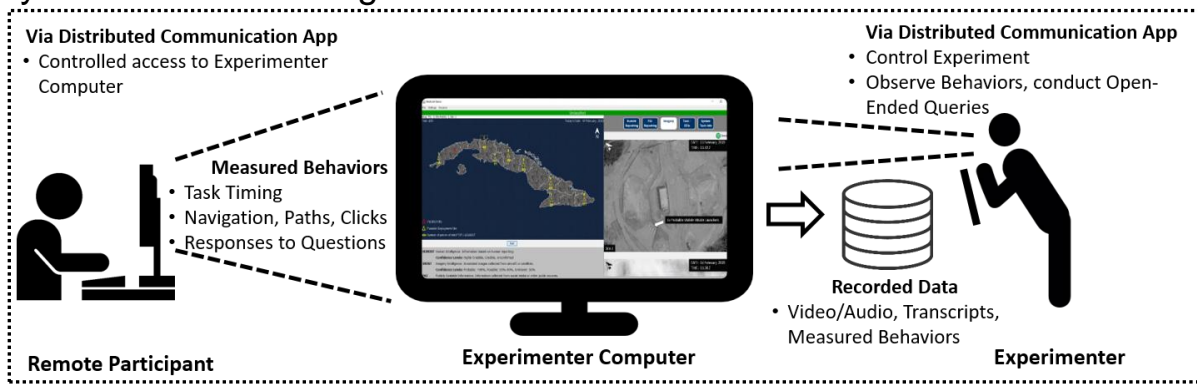


Challenge

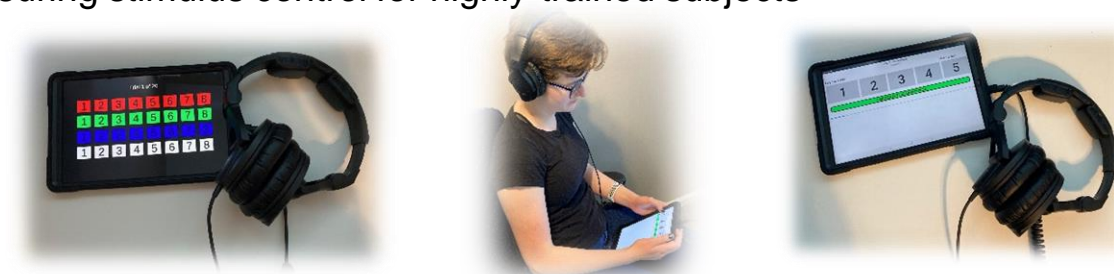
- COVID-19 stay-home order put abrupt halt on in-house research activities
 - Direct study oversight and use of specialized equipment/facilities no longer feasible
 - Requirement to conduct research that informs adaptive interface development remained
 - However, variable research constraints necessitated multiple remote testing capabilities

Approach

- 1) Utilize contemporary meeting/video collaboration apps (e.g., Zoom) to collect unclassified research data on analytics of sense-making



- 2) Develop new research kit on portable platform (Android tablet) for communication and perception research, ensuring stimulus control for highly-trained subjects





2.0 SICP Thrusts and Focus Areas

		Army	Navy	AF	Other							
<i>Understanding Human/Cognitive Processing [WITHIN HUMAN]</i>		FYDP										
		2019	2020	2021	2022	2023	2024	2025				
2.1.1 Perception (unitary and Multi-Sensory)												
Multisensory Perception and Multimodal Displays												
2.1.2 Dynamic operator functional state assessment												
Cognitive Performance Optimization												
Adaptive Soldier Architecture												
A&A Campaign Zero Sum Moves Human Analysis Methodology for CEMA												
Continuous Multi-faceted Soldier Characterization for Adaptive Technology (Human Variability)												
Multiscale Modeling												
2.1.3 Cog Neuroscience/Performance augmentation												
Applied Adaptive Aiding												
Monitoring, Predicting and Optimizing Battlespace Awareness												
Soldier Focused Neurotechnologies												



2.0 SICP Thrusts and Focus Areas

Army Navy AF Other

<i>Human-Machine Interaction and Aiding [HUMAN-MACHINE]</i>	FYDP						
	2019	2020	2021	2022	2023	2024	2025
2.2.1 Advanced Interface Methods							
Visual Interactive Exploratory Data Analysis (VIEDA)	AF						
Human Interaction with Adaptive Automation (HIAA)	AF						
Human-Robot Interaction	Army						
Brain-Computer Interaction	Army						
Autonomy, Artificial Intelligence, and Robotics	Navy						
Explainable Intelligence Underlying Efficient Integration of Cognitive-assist Agents	Army						
Enhanced Tactical Communications	AF						
Visualization of Fused Info	AF						
Human Language Technology	AF						
2.2.2 Intelligent Decision aiding/support							
Novel Human-Intelligent Agent Interactions	Army						
Understanding Sociocultural Behavior	Army						
Mine Counter Measures Task Force Planning	Navy						
Human-agent Interactions for Intelligent Squad Weapons	Army						
ISR Analyst Performance	AF						
2.2.3 Dynamic/adaptive task allocation and Authority Transfer							
Decision Authority Delegation (DAD)	Navy						
2.2.4 Trust calibration & transparency							
Human Insight and Trust (HIT)	AF						



2.0 SICP Thrusts and Focus Areas

		FYDP						
		2019	2020	2021	2022	2023	2024	2025
System Level Interfaces & Teaming [HUMAN-SYSTEM]								
2.3.1 System analyses and HSI								
Early Human Systems Integration		Army						
Human Factors and Organizational Design		Navy						
2.3.2 Team processes, performance, and metrics								
NGCV Human-intelligent Agent Performance Assessment Tools		Army						
Crew Capability Enhancement		Army						
Coordination-promoting agents for maximizing team performance		Other						
2.3.3 Data analytics/exploitation tools								
Information Environment Assessment Nexus		Navy						
2.3.4 System Interface Design and Application								
Vigilant Spirit - Multi Role Control Station (VS-MRCS)		AF						
Cross-Domain unmanned Systems (C-D UxS)		Navy						
Operational Planning Tool		Navy						
Manned and Unmanned Common Planning Picture		Navy						
Modernizing Terrain Generation for USMC M&S		Navy						
Soldier Performance in Sociotechnical Environments		Army						
Adaptive Teamwork with Layered Airman-Machine Interfaces and Systems (ATLAS)		AF						
Mission Planning & Debrief		AF						
BATMAN III		AF						

3.0

Protection, Sustainment, and Warfighter Performance

Ensuring Warfighter Safety and Survivability

VISION

Enable superiority of Warfighters by understanding and overcoming operational stressors, and providing protection from threats in their environment.



Nutrition and Sustainment



Exoskeletons for Physical Augmentation



Wearable sensor technology



Protection and performance optimization

OPERATIONAL OPPORTUNITIES:

- Ubiquitous and unobtrusive real-world, real-time performance assessment will provide information on warfighter readiness
- Optimizing Warfighter performance by understanding the impact of individual differences
- Enhanced technologies for optimization of warfighter load resulting in reduction in metabolic cost and increase in operational performance
- Optimized nutrition to modulate and enhance health and performance

ENDURING CHALLENGES:

- Real-world, real-time performance assessment relies on large amounts of data and advanced algorithms that have not yet been developed.
- Differences in the ways individuals respond to stress require individualized models that account for human variability in order to optimize performance.
- Warfighters are exposed to combinatorial stressors that complicate study outcomes related to stress-induced health and performance decrements
- Transitioning from correlative biological measures to causative performance outcomes



3.0 PSWP Taxonomy

3.1 Sensing, Monitoring, and Assessment

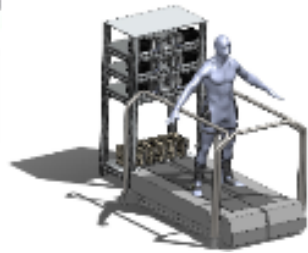
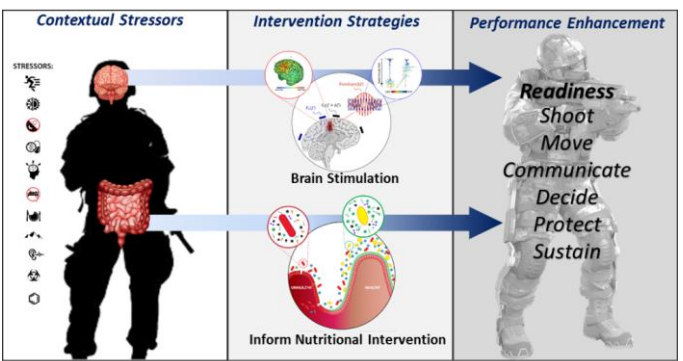
- 3.1.1: Sensing and Monitoring
- 3.1.2: Assessment

3.2 Enhancement Technologies and Techniques

- 3.2.1: Training Enhancements
- 3.2.2: Physical Augmentation
- 3.2.3: Molecular Interventions & Treatments

TECH/CAPABILITY GAPS:

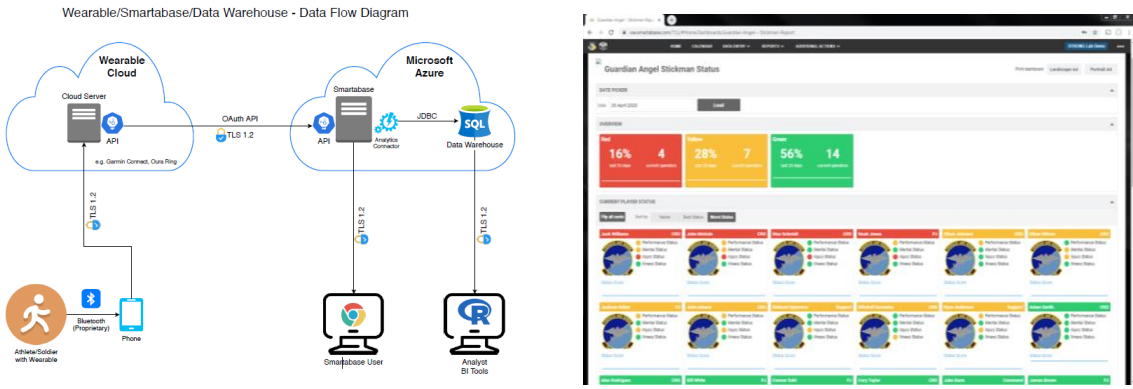
- Sensor technology and the data collection/analysis infrastructure that is needed in order to collection real-time real world performance data, and make that data useful, are lacking.
- Algorithms that account for the influence of human variability on warfighter performance need to be developed.
- Understanding the who, what, when, and how concerning the application of materiel and non-material enhancement interventions (e.g. neurostimulation)
- Understanding of how the gut microbiome responds to exposures (military stressors, nutrient intake), impacts of these responses on nutrition status and performance, and whether nutrition interventions could modulate this axis to optimize warfighter performance is lacking





3.0 PSWP Success Stories

Authority to Operate Certification for Human Performance Data Management System



Challenge: The challenge of this effort between ONR and the Air Force Research Laboratory was to investigate the development, implementation and utility of a Human Performance Management Platform (HPMP) for both data collection and analytics to support measurement, assessments, and tracking of human performance metrics at select military pilot sites. The next step was to then demonstrate enabling capability as a prevention based countermeasure, both of which were accomplished.

S&T Accomplishments:

- ONR and Air Force Research Labs project deployment of HPMP to Marine Corps, Naval Special Warfare, and Air Force sites.
- These activities informed USSOCOM’s decision to move forward with this HPMP solution across the SOF-Enterprise
- USSOCOM obtained Authority to Operate (ATO) certification Jun 20 for Smartabase HPMP to support the Preservation of the Force and Family (POTFF) program



3.0

PSWP Success Stories



DoD Sleep Meeting



ONR led a key DoD meeting on sleep research with the goals of

- 1) establishing awareness of ongoing DoD funded research focused on sleep and its role in Human Performance**
- 2) improving alignment amongst the services**
- 3) providing opportunities for collaboration.**

The two-day event brought together over 100 researchers, stakeholders, and operators with the common interest of optimizing the health, readiness, and performance of the Joint Force.

It also showcased outstanding basic, applied, and advanced technology development sleep research through 34 briefs from 20 groups which included DoD labs, academia, and industry where researchers presented their work.

Retired and active duty operators representing the Army, Navy, Air Force Special Forces also shared their operational experience and the effect sleep has played in their jobs and on their lives.

Results: Several prominent and emerging areas of focus were identified in DoD sleep research, such as scheduling & modeling, sleep assessment, and biomarkers of sleep debt/fatigue. This was coupled with existing roadblocks and challenges hindering interagency collaboration (e.g. overwhelming administrative burden). A path forward is currently under development and there will be an overview document on DoD sleep requirements, notable papers, and an overview slide deck of the DoD funded research efforts.



3.0 PSWP Success Stories

Integrated Cockpit Sensing (ICS)



This effort was established to allow real-time pilot alerting to physiological issues in flight while collecting and storing sensor data for root cause analysis. The program was also to address gaps in flight-compatible component sensor technologies and reduce false alarm rate through data fusion. The challenge was high-TRL sensor component integration with common data storage platform and standalone pilot alerting capabilities to enhance pilot decision making given any unexplained physiological events in flight.

S&T Accomplishments:

- Completed benchtop testing, static aircraft seat evaluations, dynamic physiological sensor evaluations, upper pressure garment evaluations, centrifuge evaluations and lastly, hanging harness evaluations.
- The Lockheed Martin, In-Cockpit Physiological Monitoring program utilized pilot mounted physiological sensors, feeding pilot health messages via their Open Mission Systems to enable cockpit integrated cautions and warnings. The close-out demonstration postponed due to travel restrictions during the COVID pandemic.
- Conducted 77th Fighter Squadron Flight Test over 8 weeks at Shaw and Nellis AFB, collecting 77 hours of in-flight data by outfitting F-16 pilots with sensors to monitor cabin pressure during training missions. Goal was to determine if depressurization was the cause of physiologic symptoms while also testing device efficacy. The sensors recorded the partial pressure of oxygen, percentage of oxygen delivered, ambient pressure, cabin pressure, and acceleration during flight. One pilot reported physiological symptoms of dizziness and air hunger; after following standard operating procedures he was able to complete his flight. The potential physiological episode did not align with abnormal data, enabling multiple causal factors to be ruled out while highlighting that additional research and development is needed in the exploration of the root cause of physiological episodes.



3.0 **PSWP** **Thrusts and Focus Areas**

Army
Navy
AF
Joint

3.1 Sensing, Monitoring, and Assessment

FYDP						
2019	2020	2021	2022	2023	2024	2025
3.1.1 Sense and Monitor						
MASTR – E Optimizing Human Weapon System						
Human Performance Monitoring and Augmentation						
Body-worn Wireless Neurophysiological Monitoring Network / OMNI						
Performance Evaluation of Newly Available Sleep Assessment Devices						
Hypoxia Alert and Mitigation System						
Physiological Beacon						
Fatigue Optimized Cognition Under Stress (FOCUS)						
On-Board Oxygen Generating Systems (OBOGS)						
Integrated Cockpit Sensing						
3.1.2 Assessment						
Measuring & Advancing Soldier Tactical Readiness & Effectiveness (MASTR-E) Pilot						
Fitness and Body Composition as Predictors of Musculoskeletal Injury Risk						
Human System Design Guidance for Head-Borne Systems						
Dynamic Marksmanship Characterization: Novice vs. Expert						
MASTR-E Program (SUPRA, TSMA, Field, Prediction)						
Human Digital Twin (HDT)						
Physical and Cognitive Overburden of Small Team Performance						
Human Performance in Dismounted Operations						
Incapacitation Prediction for Readiness in Expeditionary Domains						
Airman Data Analysis and Performance Tracking System						
Human Performance Assessment and Recommendations for Training and Operations						



3.0 PSWP Thrusts and Focus Areas

Army
Navy
AF
Joint

3.2 Enhancement Technologies and Techniques	FYDP						
	2019	2020	2021	2022	2023	2024	2025
3.2.1 Training Enhancements							
Adaptive Training Protocols (ATP)							
FitForce Planner (FFP)							
Strengthening Health & Improving Emotional Defenses (SHIELD)							
Just-in-Time Multi-Mission Airman							
3.2.2 Physical Augmentation							
Naval Noise Induced Hearing Loss							
Exoskeletons:							
Advancement of Exoskeletons for Movement & Maneuver and Sustainment							
Determination of Lower Extremity Joint Actuation Requirements							
Research for Advanced Soldier-PA System Interaction							
Technology for Human Interactions							
Lightweight Atmospheric Dive Suit (LADS)							
3.2.3 Molecular Interventions & Treatments							
MASTRE- Recovery Probiotic Field Experimentation							
➤ Leverage Biotechnology COI Optimizing Warfighter Health & Performance subgroup gut microbiome, performance nutrition, and nutritional factors supporting immune function, muscle recovery work							
PHITE: Precision High Intensity Training through Epigenetics							



Backup



Human Systems Col Taxonomy Evolution



Sub-Areas	Former	Current 2020 Thrusts
Personalized Assessment, Education, and Training	Personnel Selection and Assignment	Personnel Selection and Assignment
	First Principles for Training Design	Training Design, Assessment, and Readiness Monitoring
		Advanced Learning Technologies
System Interfaces and Cognitive Processes	Human Information Interpretation & Influence	Understanding Human/Cognitive Processing
	Intelligent, Adaptive Aiding	Human-Machine Interaction and Aiding
	Human-Machine Teaming	System Level Interfaces and Teaming
Protection, Sustainment, and Warfighter Performance	Critical Stressor Mitigation Strategies	Sensing, Monitoring, and Assessment
	Understanding and Quantifying the Effects of Critical Stressors	Enhancement Technologies and Techniques
		Bioeffects

Maximizing “Human Readiness” in the United States Navy Surface Force

Vice Admiral Richard A. Brown, USN (Retired)

Former

Commander, Naval Surface Forces / Naval Surface Force, U. S. Pacific Fleet

March 2, 2021

Distribution A/ Unclassified



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#GOBUCS

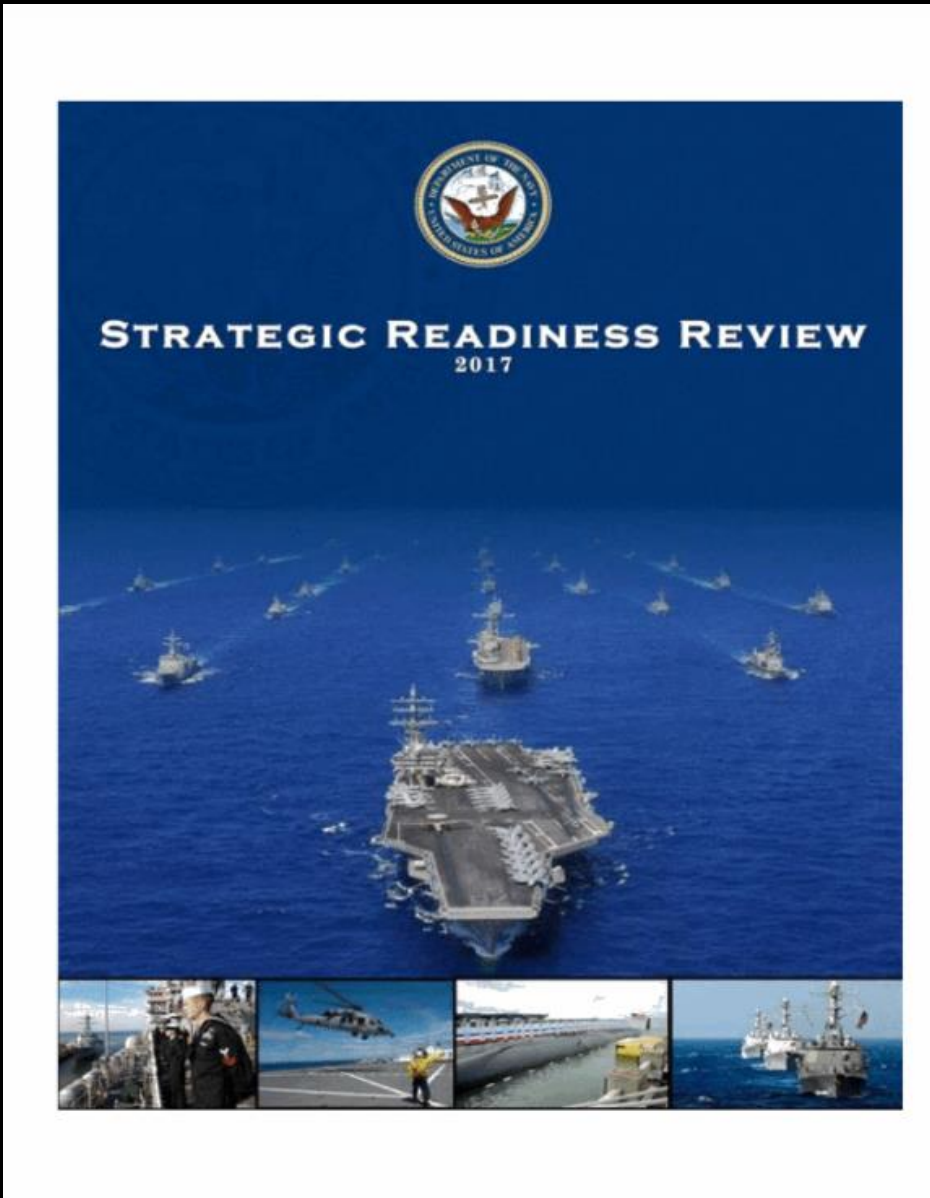
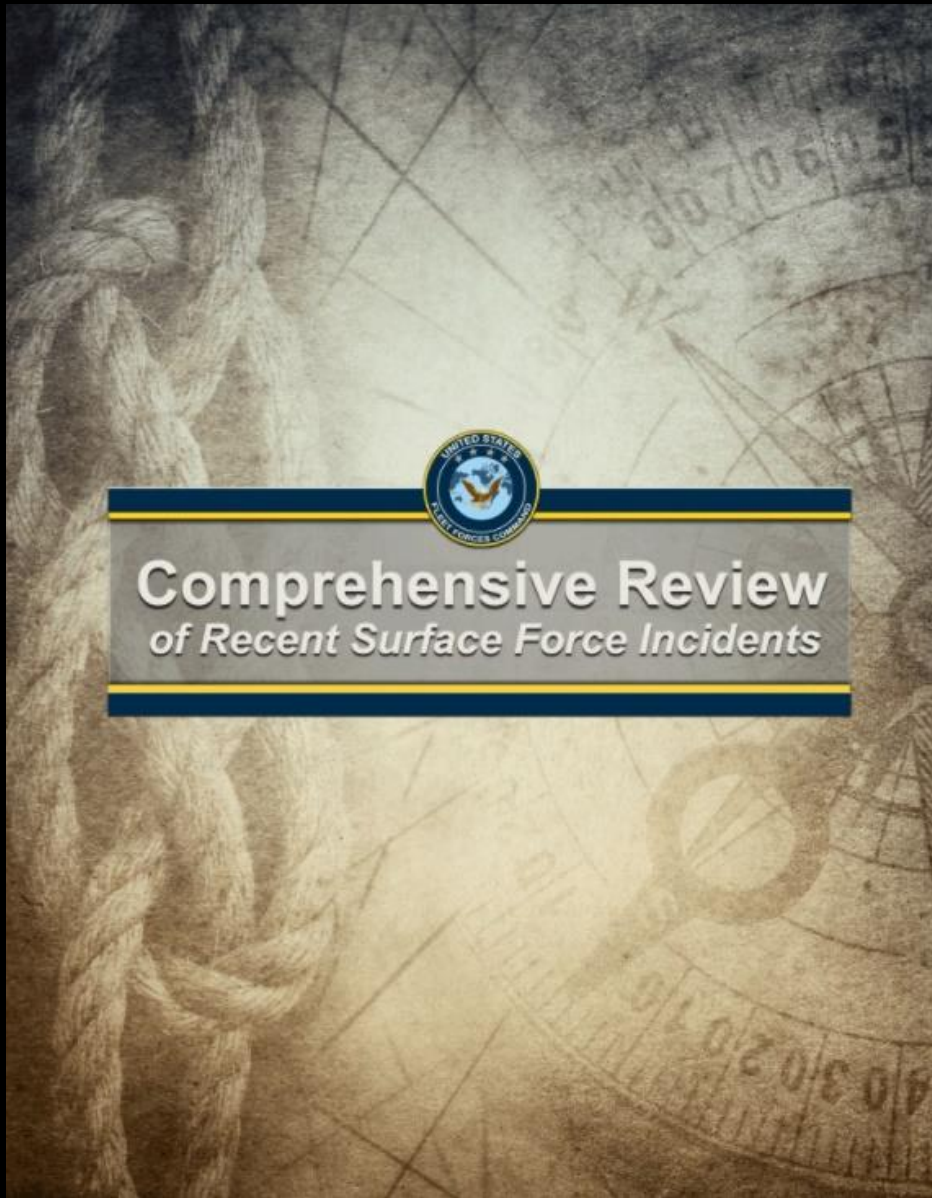

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March 2, 2021

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COMMANDER
NAVAL SURFACE FORCES



To:

Subj:

Date:

\$4B SINCE 2012... THAT WISE? ?

1. SOMEONE DECIDED NOT TO/DID NOT PERFORM A SPECIFIC ACTION ON WHICH THEY HAD BEEN TRAINED AND CERTIFIED

2. LIKELY THE SHIP HAD A NEAR MISS, AND NO ACTION TAKEN TO CORRECT

3. POOR LOG KEEPING (PRESSURE OF TIME)
- ORGANIZATIONAL DUMB

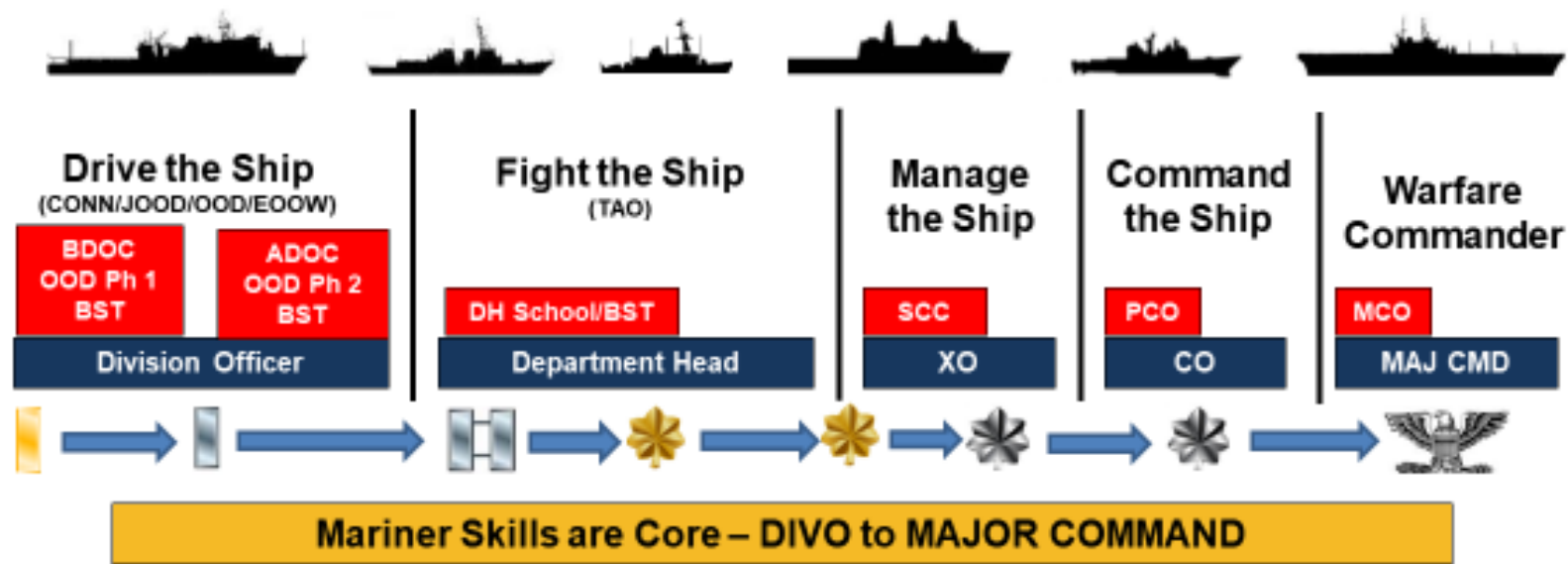
4. SUBSTANDARD RISK MANAGEMENT IN OPERATIONAL AND DAILY PLANNING.

5. LACK OF VERTICALLY TEAM COORDINATION

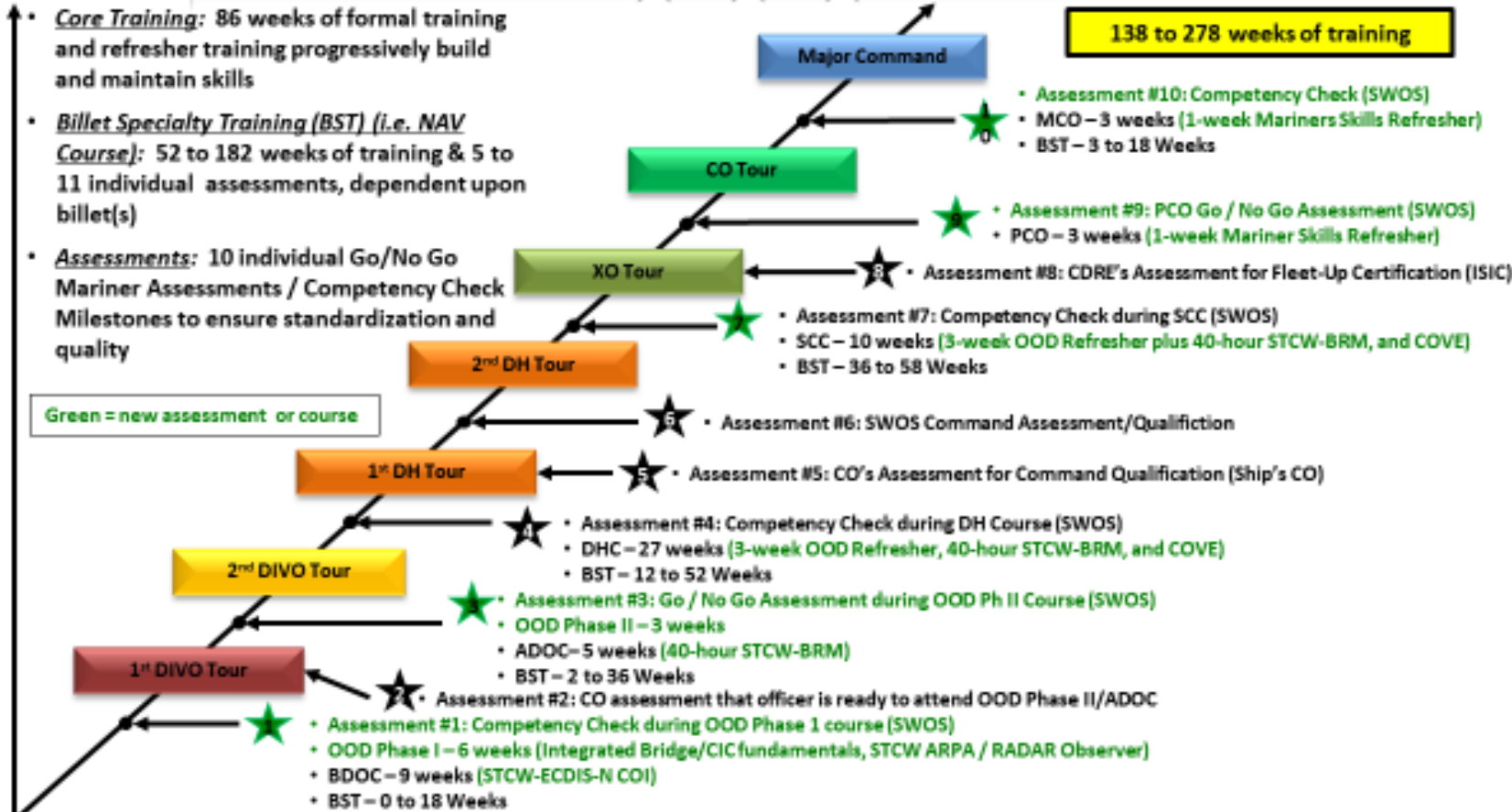
6. SHIPS REGARDED AS ABOVE AVERAGE

SWO Career Pipeline

A Surface Warfare Officer's career is a continuous pipeline of an increasingly complex set of training, sea assignments, and structured assessments to deliver the necessary experience and competency required to Command at Sea.



Revised Career Path SWO Competency Continuum



"We must become more skilled at our jobs as we grow."

(ADM John Richardson, Navy Leader Development Framework)

Maximizing “Human Readiness” in the United States Navy Surface Force

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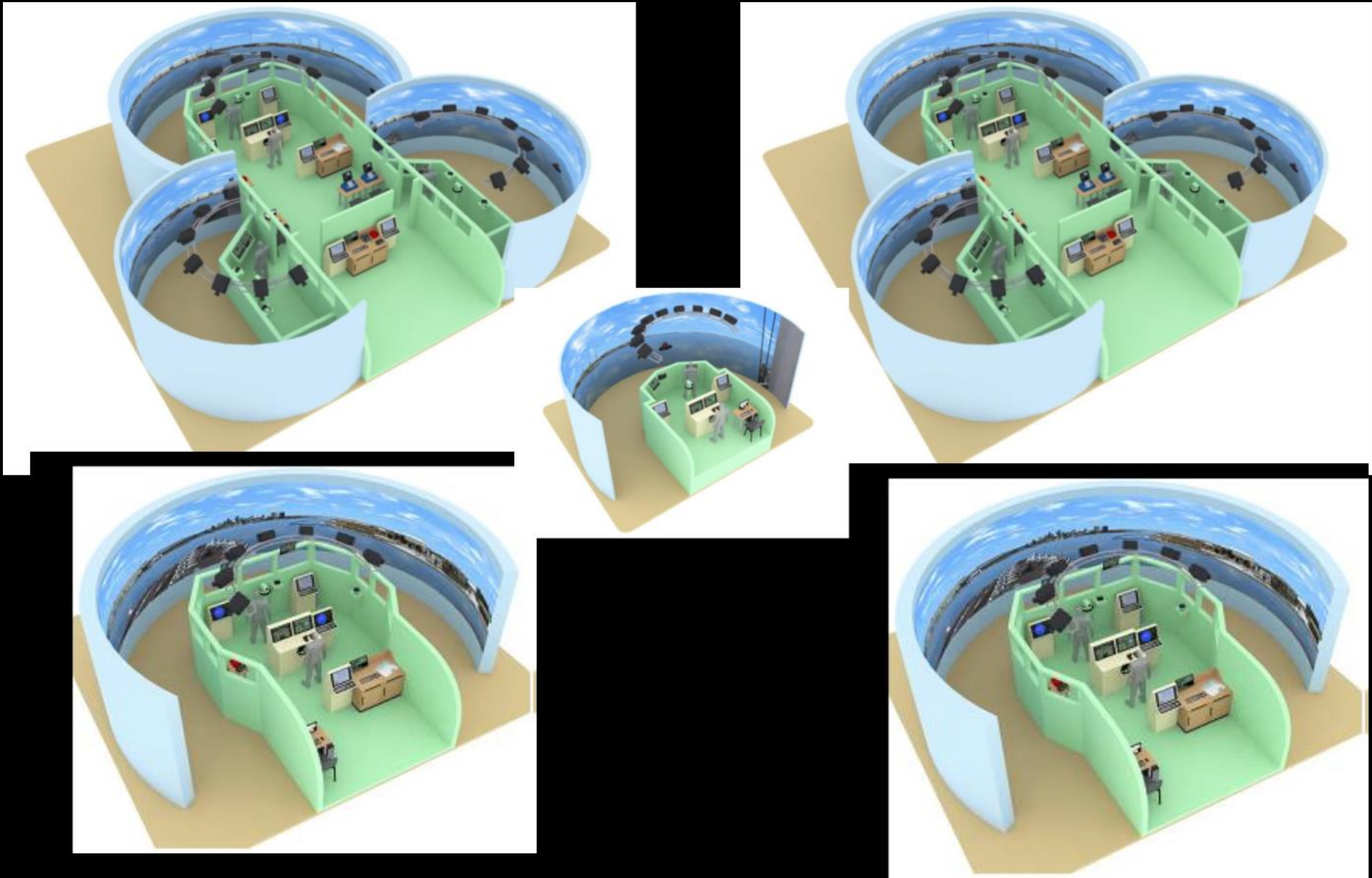
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Former

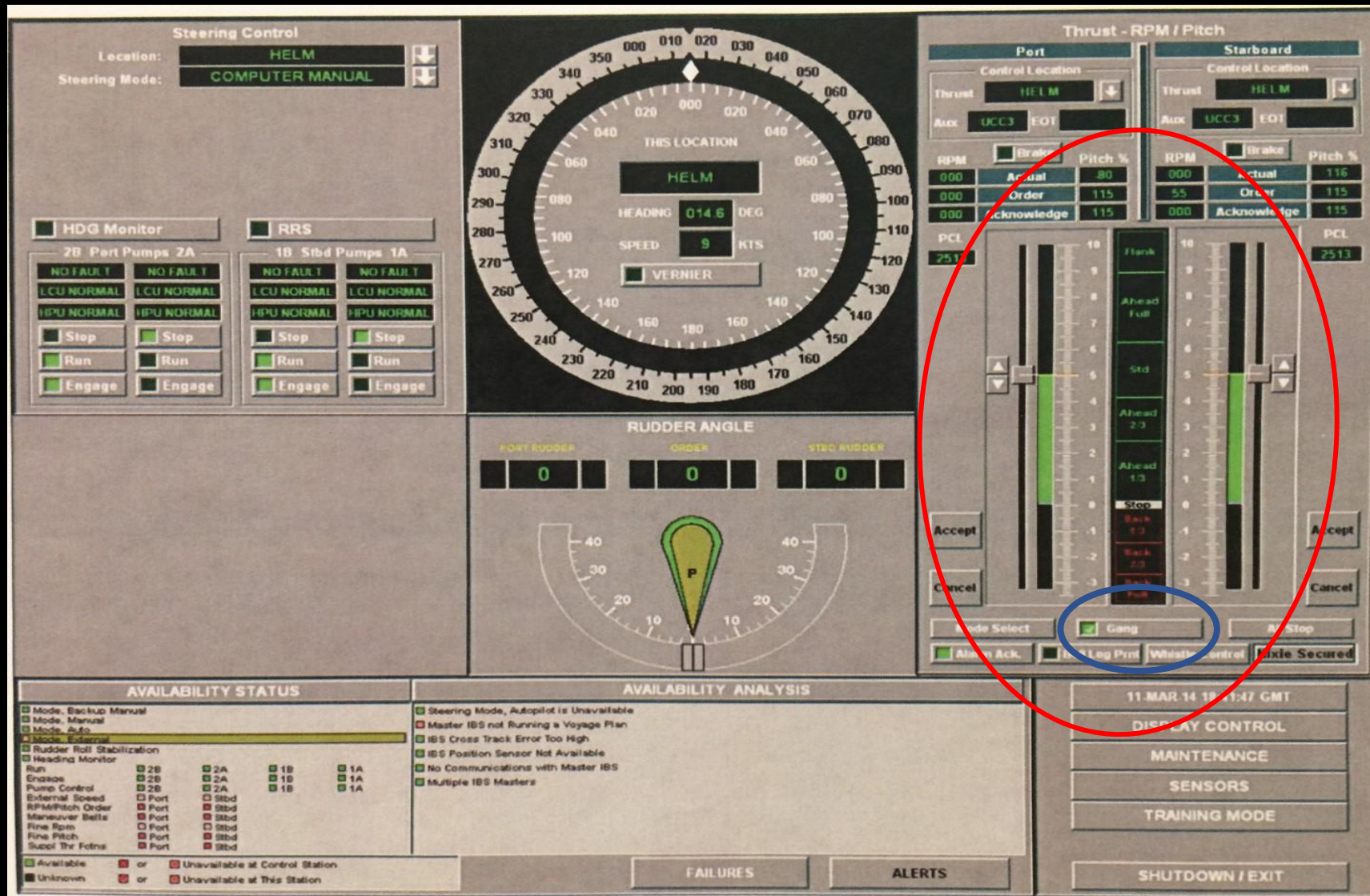
Commander, Naval Surface Forces / Naval Surface Force, U. S. Pacific Fleet

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Guidelines and Tools for Measuring and Assessing Human Readiness

09 MAR 2021

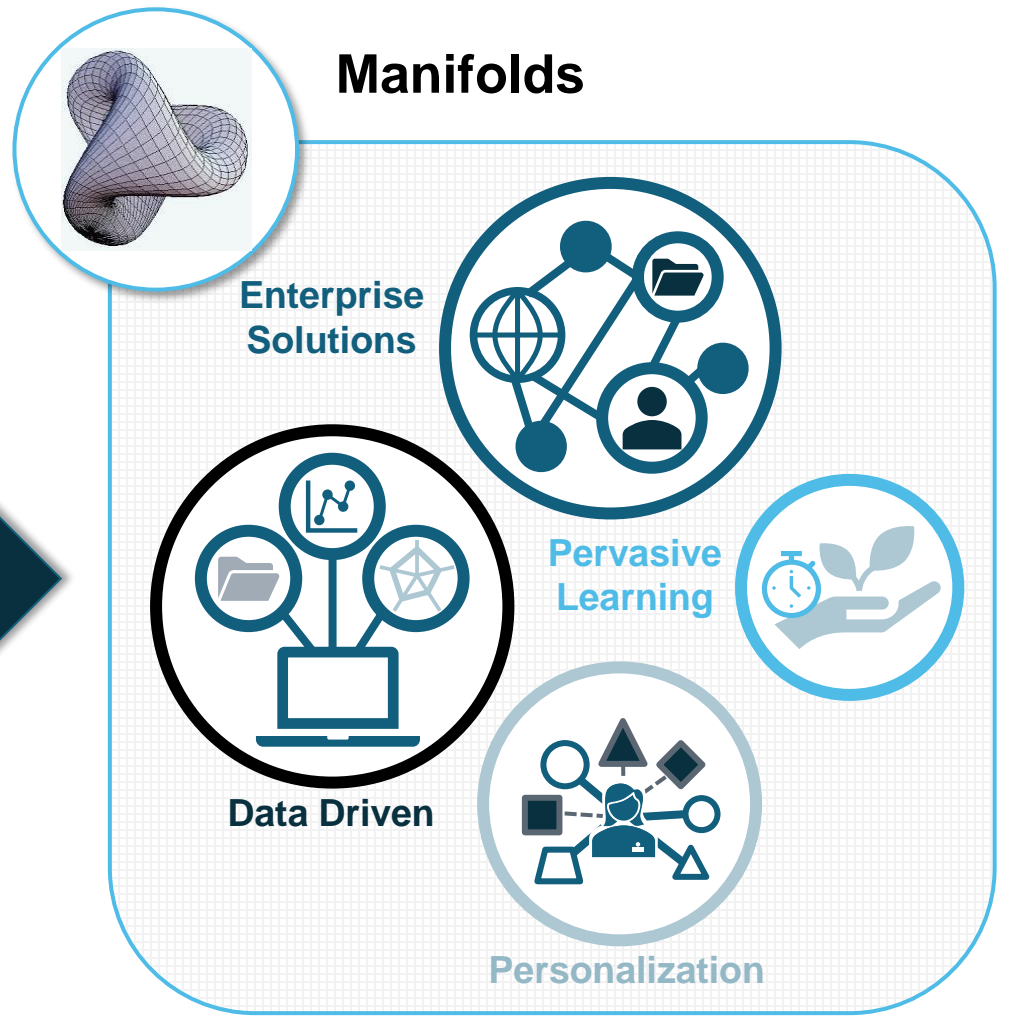
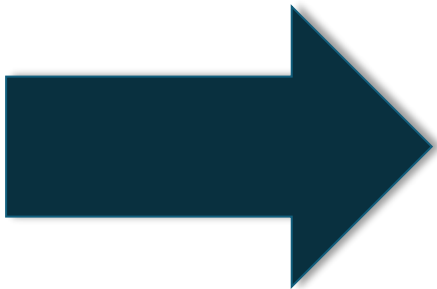
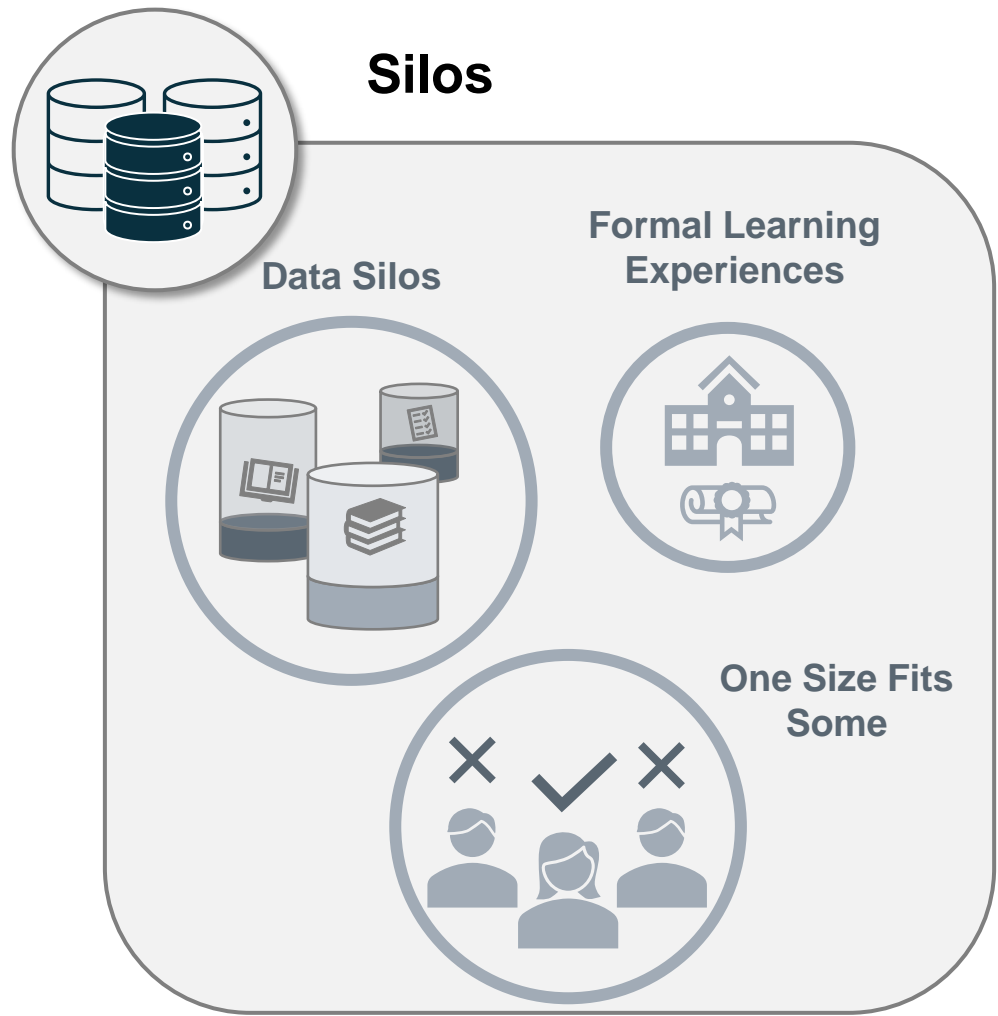
Ashley Howell and Hunter Smith, ADL Initiative (SETA Contractors)

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Agenda

- Total Learning Architecture
 - **Overview**
 - **Data Standards**
 - **Reference Implementation**
- Q&A



Increased DoD-wide Education & Training interoperability and accessibility for more adaptable, strategic, and capable manpower.

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The Total Learning Architecture (TLA) is an R&D project to design a **business enterprise architecture** for learning (education/training) systems.

TLA Business Enterprise Architecture includes:

- Digital learning data strategy
- Data and software interoperability standards
- Specifications for microservices
- Specifications for technology architecture implementations
- Recommendations for business rules and governance

TLA R&D project also includes:

- “Reference Implementations” (i.e., exemplars like model homes)
- Associated Testing with methods and sandboxes

The collage features several key elements:

- GitHub Page:** A screenshot of the GitHub repository 'adlnet / SCORM-to-TLA-Roadmap'.
- Report Cover:** The cover of the 'TOTAL LEARNING ARCHITECTURE 2019 Report' with the AL logo.
- VPC Diagram:** A diagram of a Virtual Private Cloud (VPC) architecture showing components like Reverse Proxy, SSO Portal, Providers, and DataNet.
- Table:** A table with columns for Header, Requirement, Priority, and Comments, listing various system requirements and their status.
- Flowchart:** A complex state-transition diagram for 'Learning Event Skills' involving components like Learning Event Manager, Activity Provider, Competency Manager, and Evaluate Trust.

LEARNING ACTIVITY

(e.g., Run-time rules, individual run-time performance, paradata)

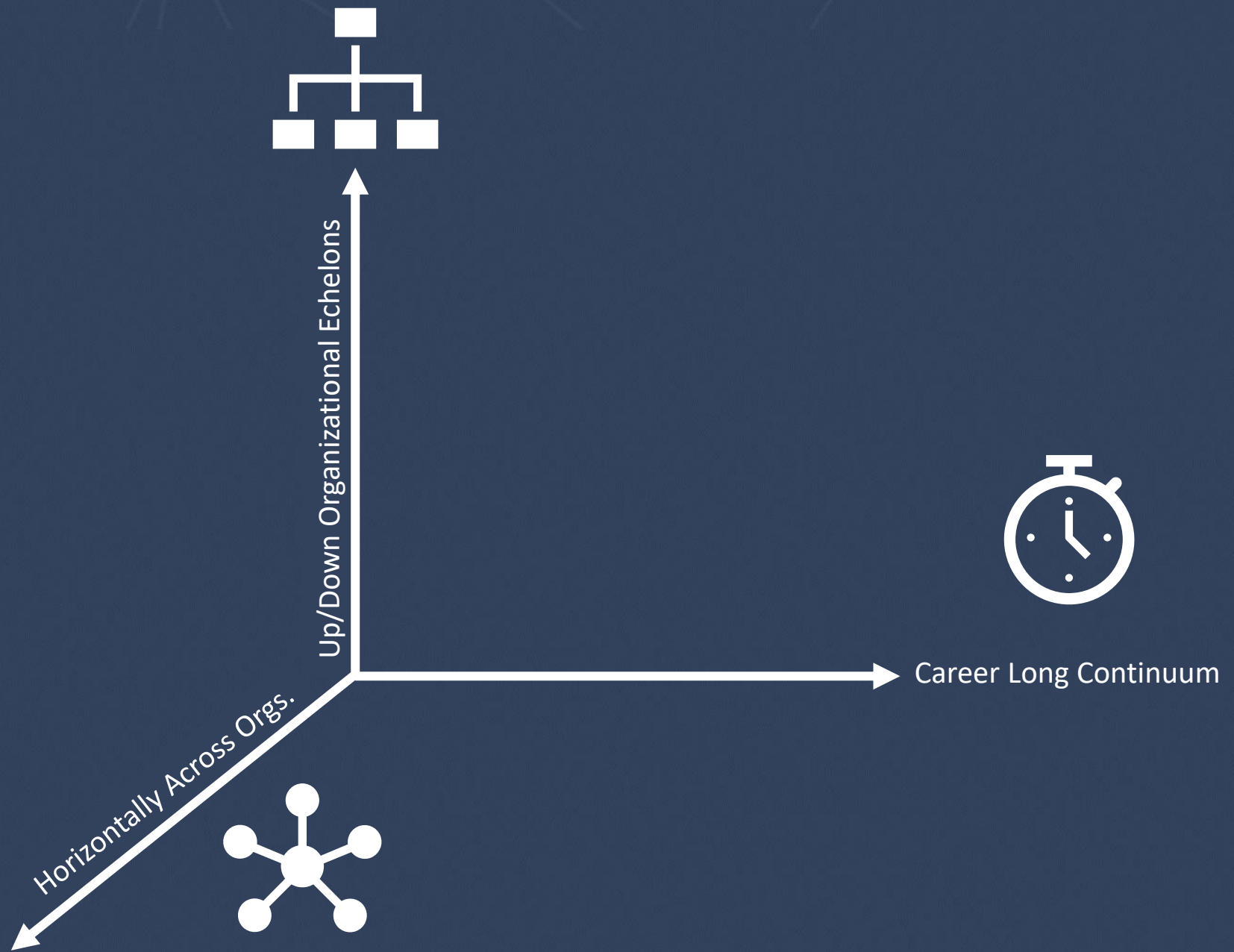
“COURSES”

(Available Learning Opportunities, e.g., enterprise course catalog, activity registry)

Competencies
(Common Currency)

LEARNER PROFILE

(e.g., longitudinal attributes, performance, enterprise learner records)



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LEARNING ACTIVITY

(e.g., Run-time rules, individual run-time performance, paradata)

“COURSES”

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Competencies
(Common Currency)

LEARNER PROFILE

(e.g., longitudinal attributes, performance, enterprise learner records)

The Experience API
(xAPI)
(IEEE 9274.1)

Why xAPI?



**Learning can be recorded
wherever it occurs**

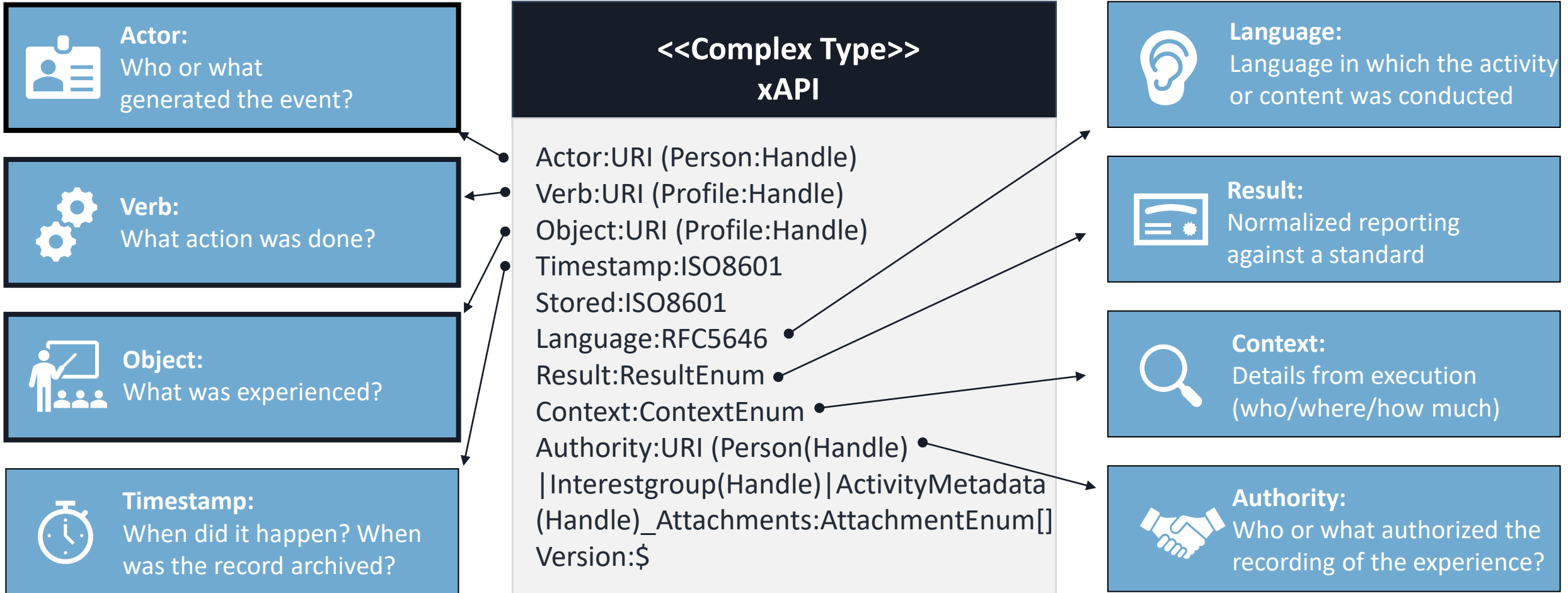


Learning analytics



**Learning does not have to
be “launched” from an LMS**

IEEE 9274.1 xAPI



LEARNING ACTIVITY
(e.g., Run-time rules, individual run-time performance, paradata)

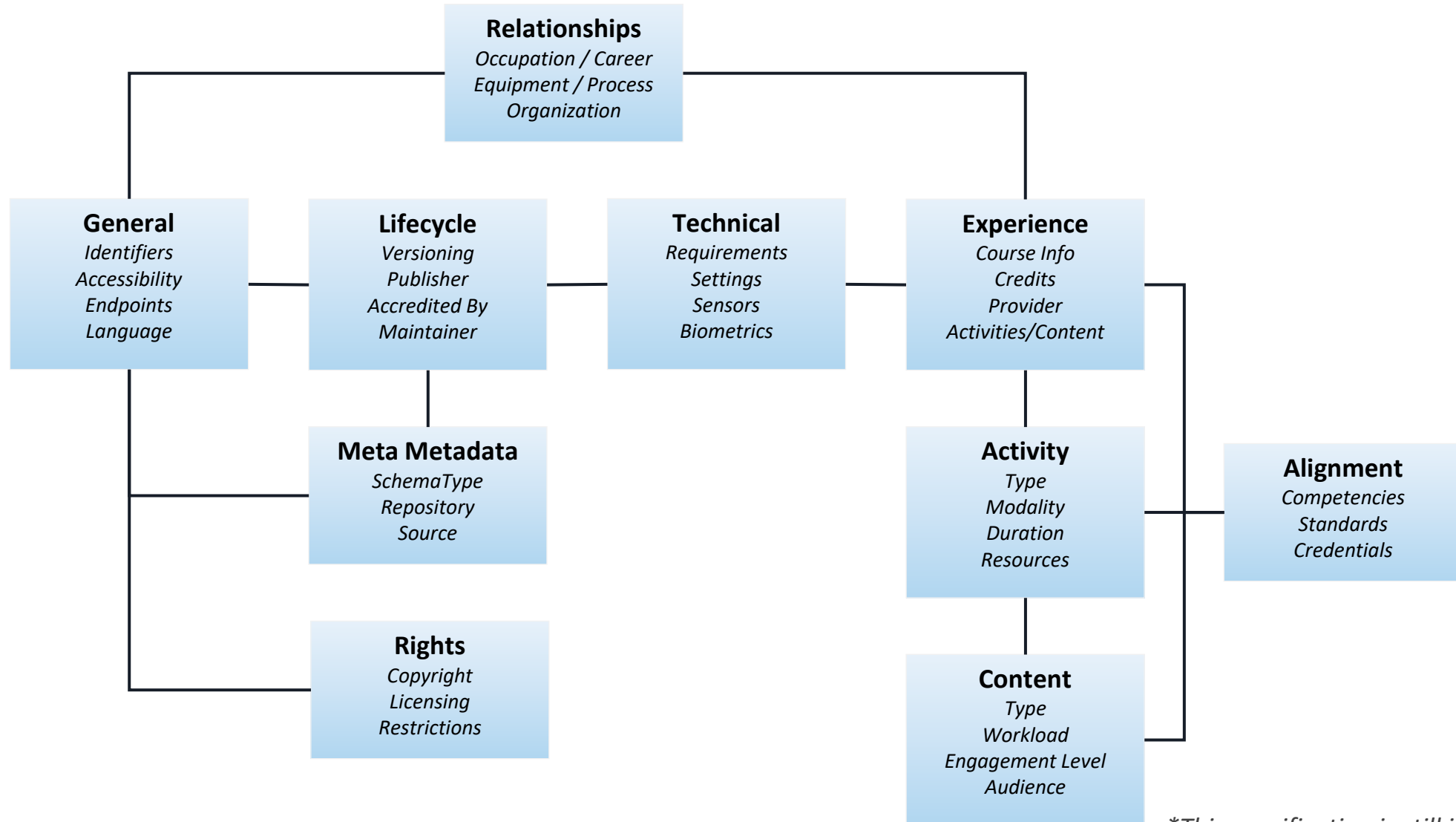
“COURSES”
(Available Learning Opportunities, e.g., enterprise course catalog, activity registry)

Competencies
(Common Currency)

LEARNER PROFILE
(e.g., longitudinal attributes, performance, enterprise learner records)

Learning Activity Metadata (IEEE P2881)

DRAFT IEEE P2881 Learning Activity Metadata



**This specification is still in draft form, and as such may be subject to change*

LEARNING ACTIVITY
(e.g., Run-time rules, individual run-time performance, paradata)

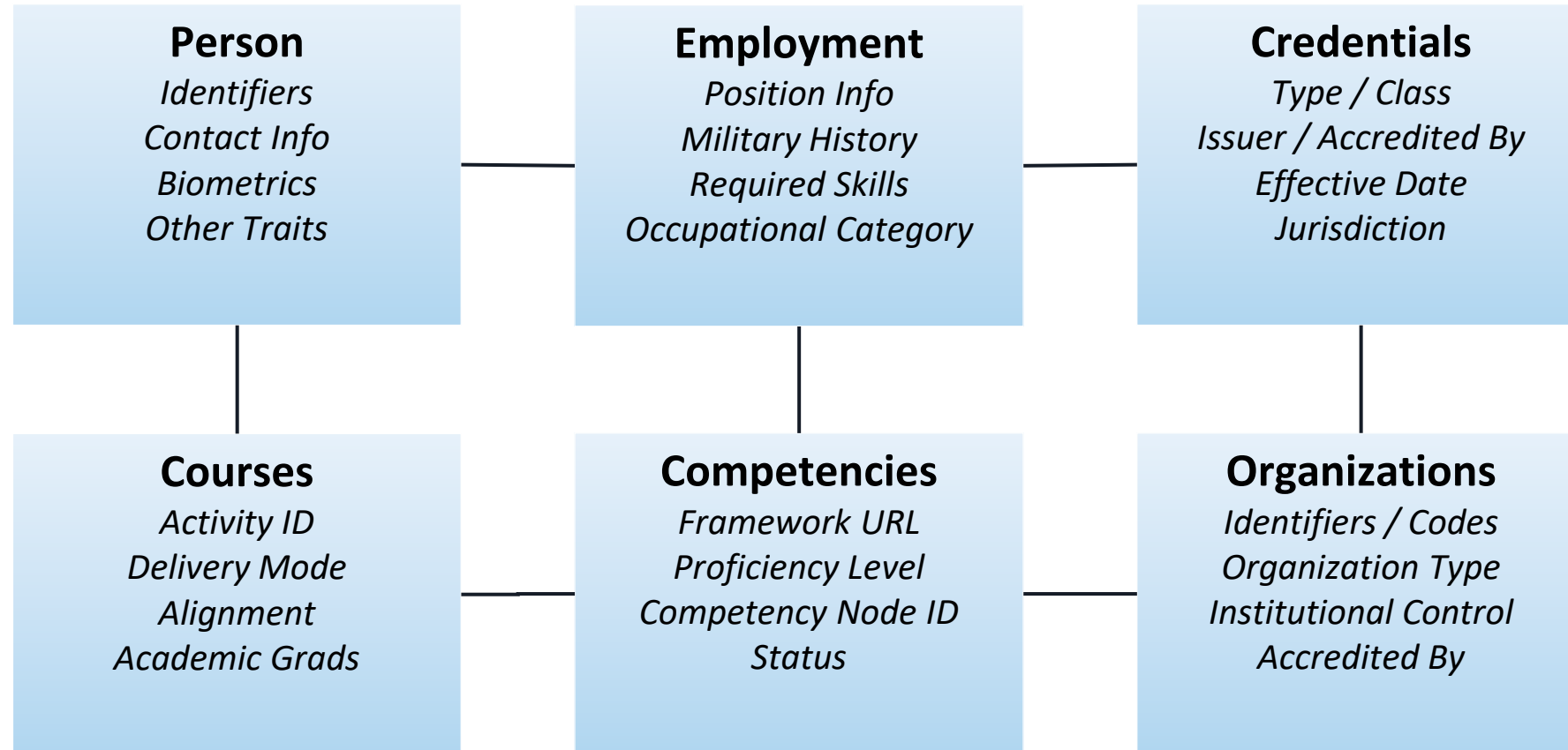
“COURSES”
(Available Learning Opportunities, e.g., enterprise course catalog, activity registry)

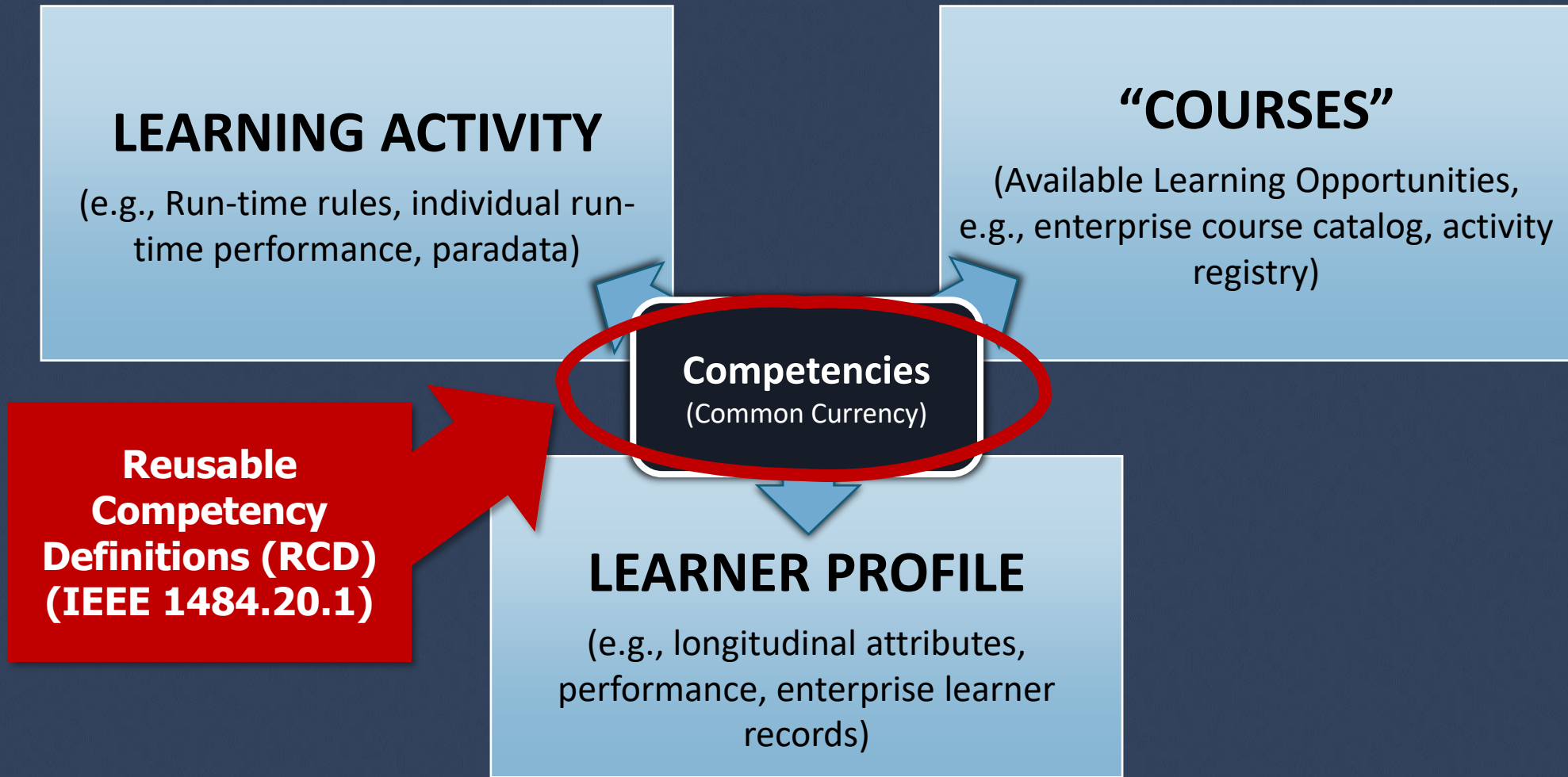
Competencies
(Common Currency)

LEARNER PROFILE
(e.g., longitudinal attributes, performance, enterprise learner records)

Enterprise Learner Record

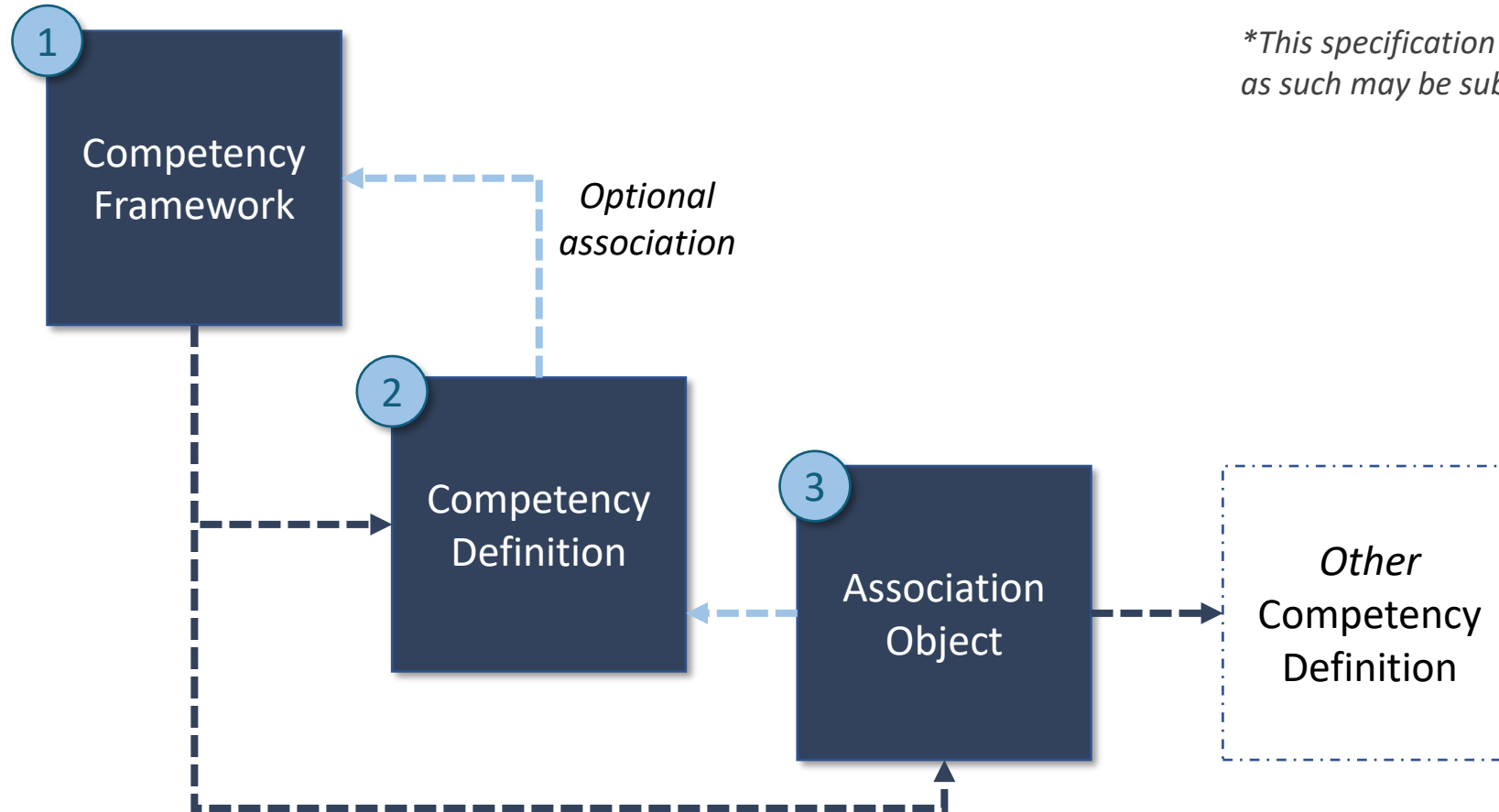
DRAFT IEEE Enterprise Learner Record





IEEE 1484.20.1 RCD

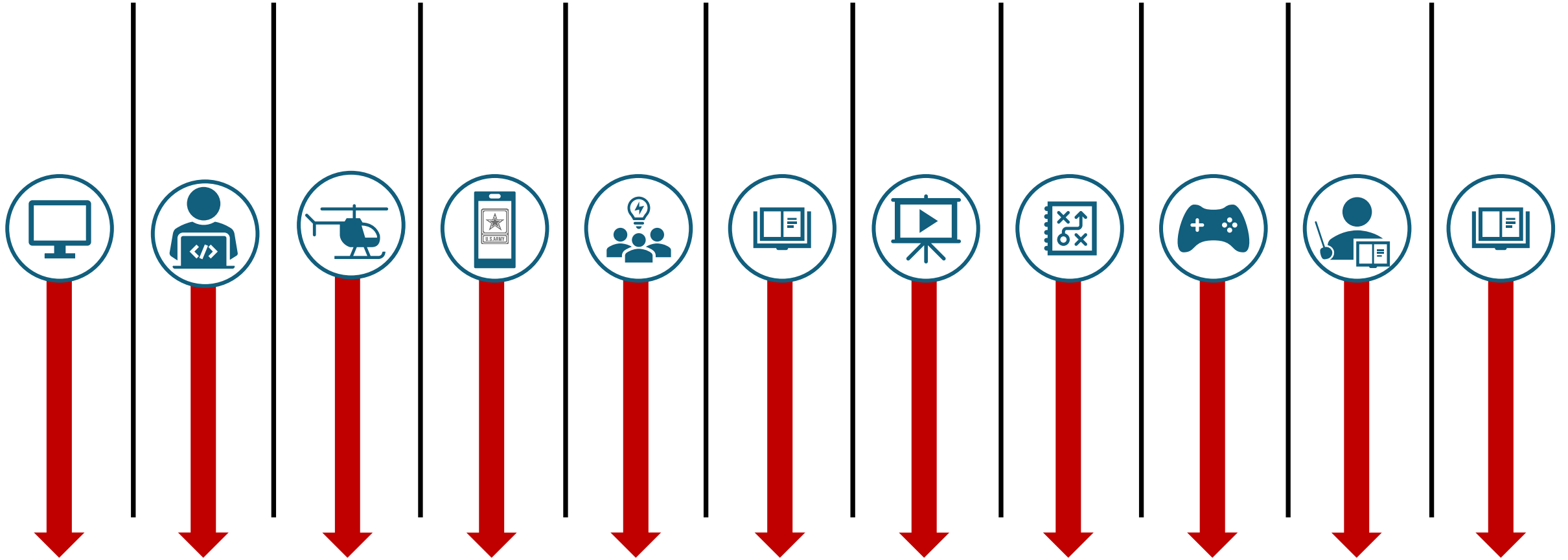
**This specification is still in draft form, and as such may be subject to change*



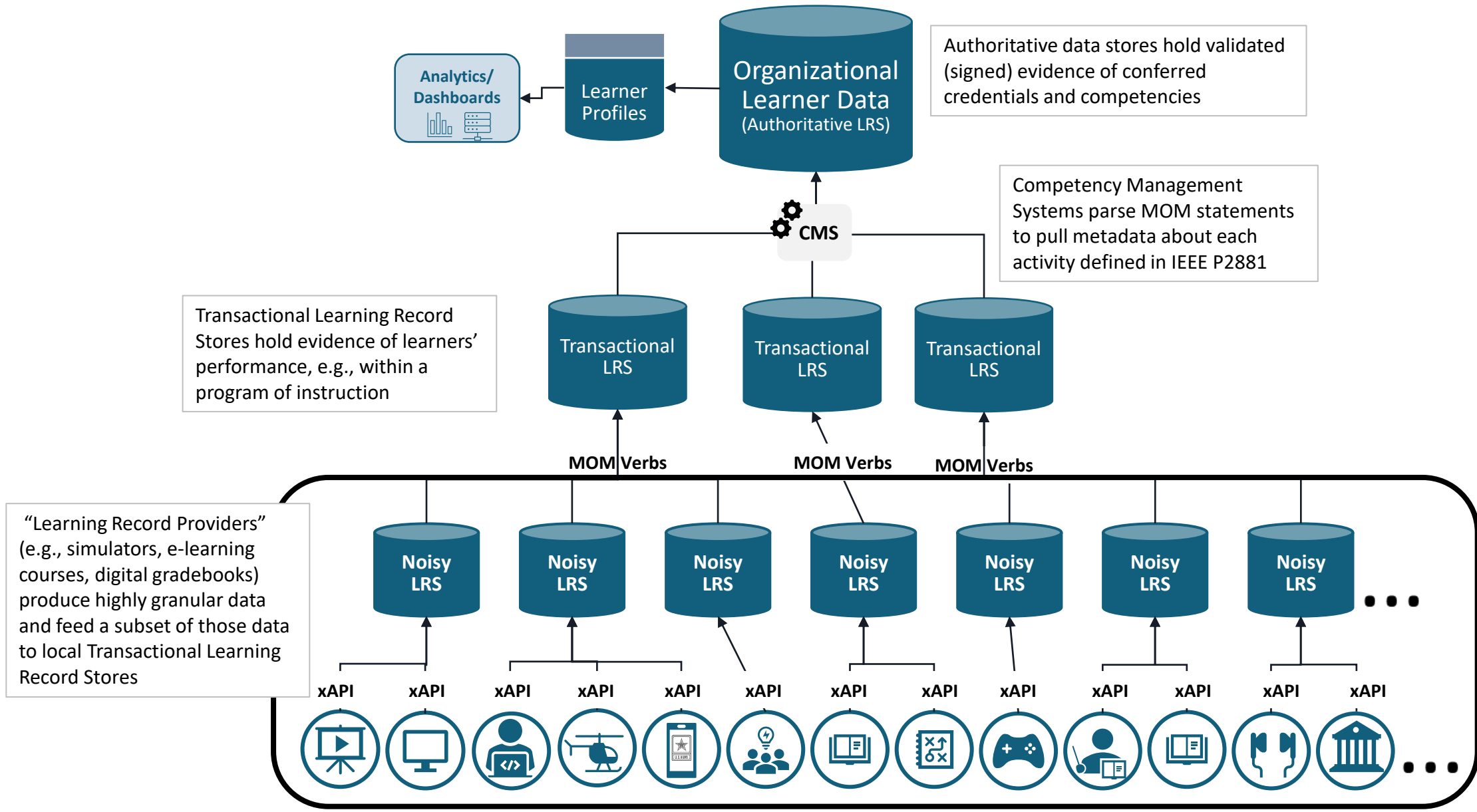
1 Overall "Packaging" of reusable Competency Definitions. They contain pointers to all included Competencies and Associations.

2 Description of a Knowledge, Skill, Ability, or Other behavior (KSAO) a person can have. It MAY point to the framework that contains it, and it can be part of multiple Competency Frameworks.

3 Defines how competencies relate to each other. It can link competencies with external resources.

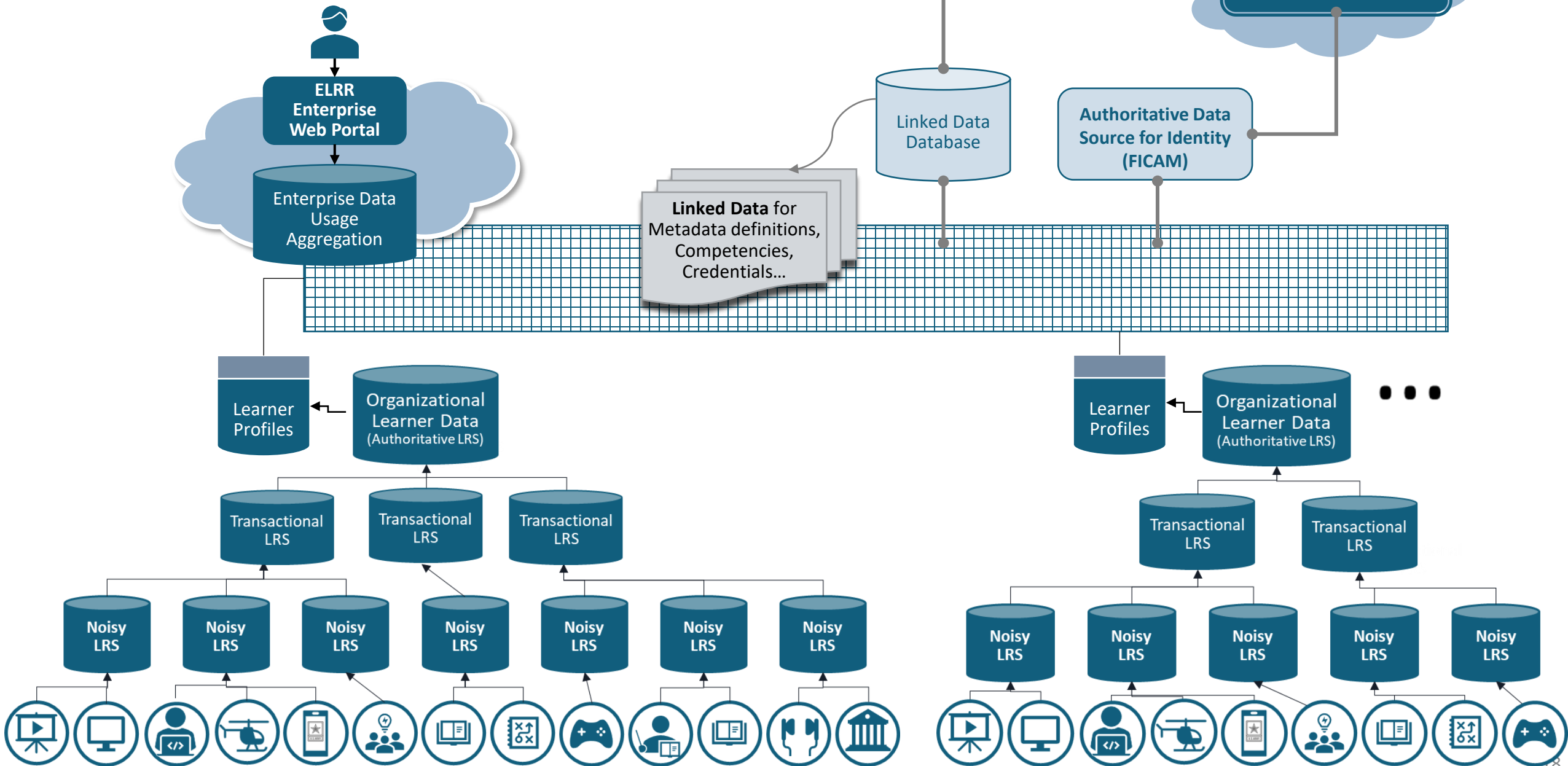


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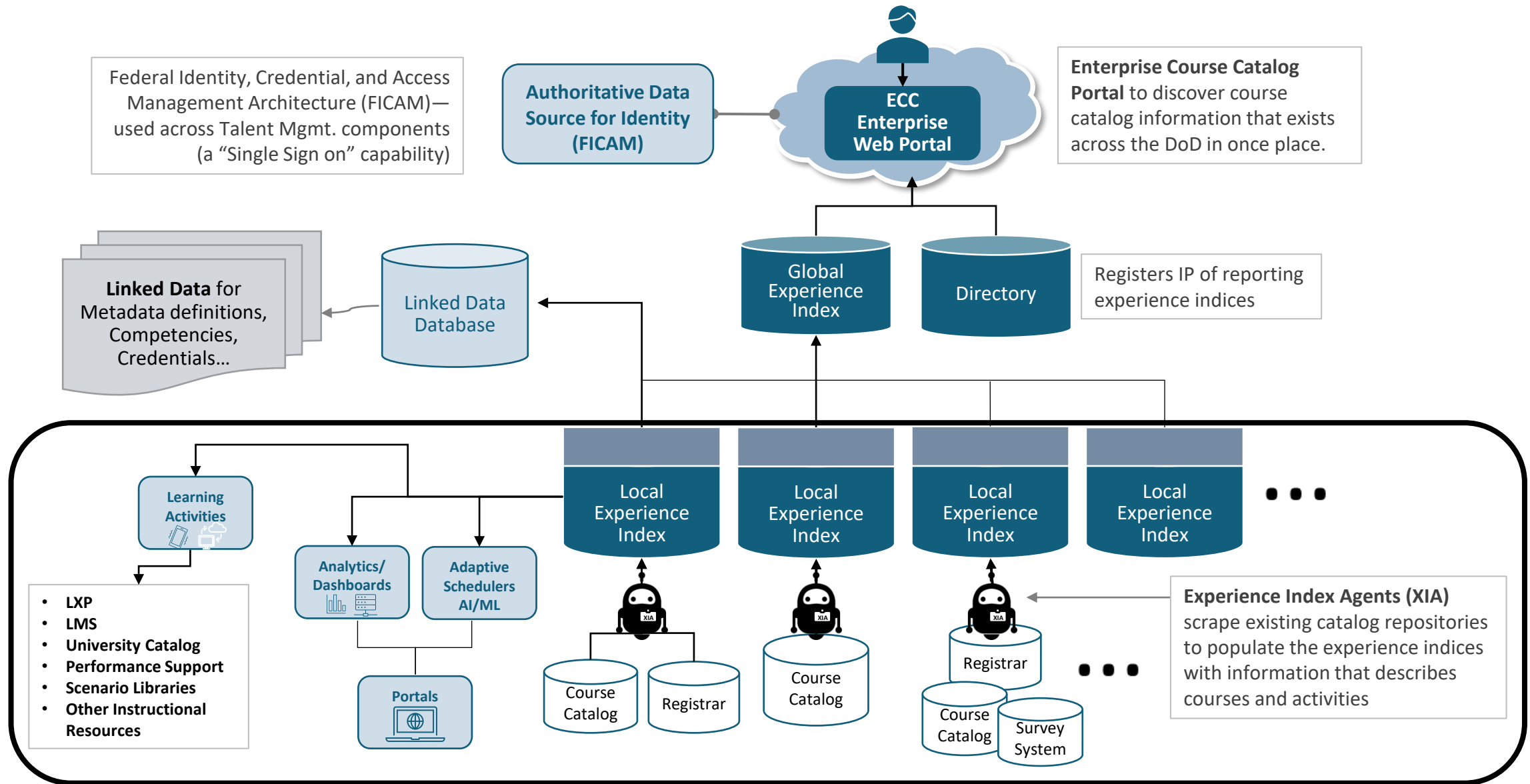


Evidentiary Chain

Enterprise Learner Record Repository



Enterprise Course Catalog



Organizational level

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Resources

- **Building the Infrastructure for DoD Digital Learning Modernization:**
<https://www.adlnet.gov/news/2020/07/30/Building-the-Infrastructure-for-DoD-Digital-Learning-Modernization/>
- **2019 Total Learning Architecture (TLA) Report:**
<https://www.adlnet.gov/resources/publications/2020/04/2019-Total-Learning-Architecture-Report/>
- **2019 ADL Report on Competency-Based Learning:**
<https://www.adlnet.gov/resources/publications/2019/08/Competency-Based-Learning/>
- **2020 Institute for Defense Analyses TLA Report:**
<https://www.adlnet.gov/resources/publications/2020/07/ADLs-Total-Learning-Architecture-IDA-Report-2020/>
- **ADL GitHub:** <https://github.com/adlnet>


ADL Initiative
adlnet.gov

An official website of the United States government Here's how you know

AL Advanced Distributed Learning Initiative
Advanced Distributed Learning

Facebook Twitter YouTube LinkedIn

About Policy R&D Partners **Resources** Contact



Building the Future Learning Ecosystem

R&D for Distributed Learning Modernization *informs* Distributed Learning Policy and Technical Guidelines *guides* Implementation Support and Cross-Coordination

Announcements

<https://adlnet.gov> iFEST 2020: New Features for an Engaging, Interactive Conference Experience **2020**

<https://adlnet.gov>

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Questions?

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Team-based Advanced Resilience Accelerator (TARA)



March 9, 2021

Kristy Kay, M.S.

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SPONSORS

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END-USERS

And with support from Naval Submarine School (NSS) and Submarine Learning Center (SLC) leadership & instructors from the Naval Submarine Base New London.

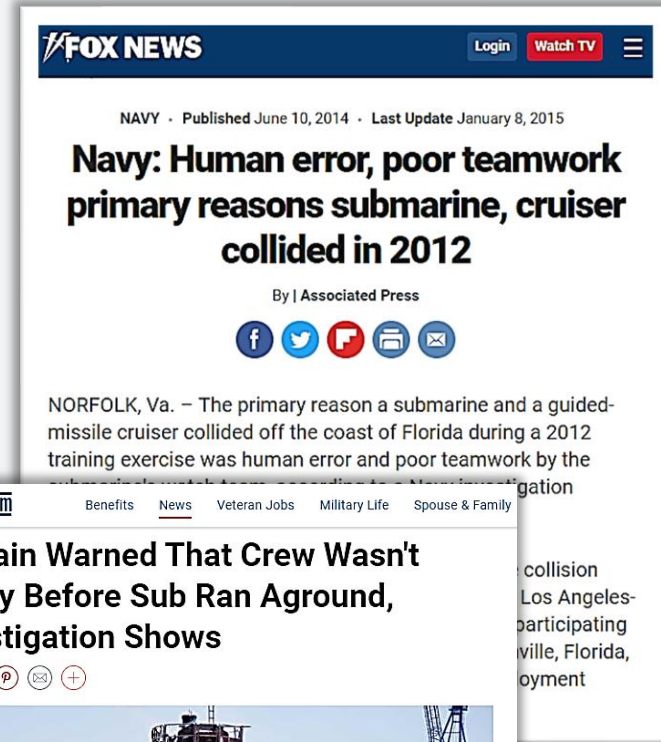
1. Why are we doing this? (Motivation & Goals)
2. How will we accomplish it? (Technical Approach)
3. What did we learn? (Training Environment) And, what did we plan? (Envisioned Enhancements)
4. What did we create? Team-based Advanced Resilience Accelerator (TARA)
5. How well does it work? (Usability Evaluation)
6. What's next? (Current Status & Big Picture Impact)

Motivation: Resilient Teams

Expert, or resilient, teams have a **deep and shared understanding** of the situation, their own roles, and those of the other team members.

This allows them to **anticipate needs** and **coordinate implicitly**, facilitating quicker decision-making.

With these skills, resilient teams are better **poised to recognize danger**, seize opportunity during times of uncertainty, and **bounce back from unexpected or disruptive events**.

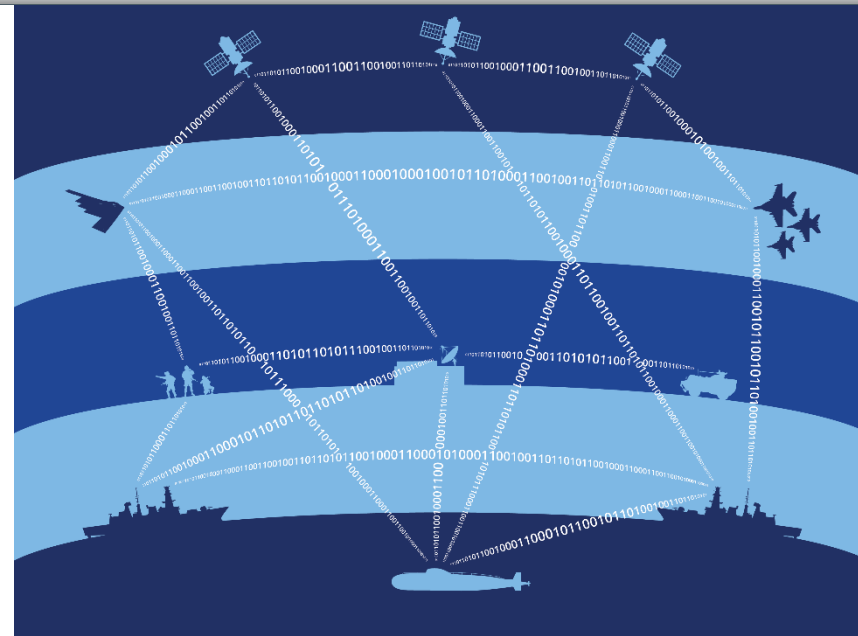


Goal: Mission Readiness

Resilient teamwork behaviors are critical for safe and effective submarine operation and tactical maneuvering.

These non-technical behaviors **tend to be learned implicitly through experience** during training or at sea.

More broadly, beyond submarine team training, support for the development of resilient teams will positively impact overall **mission readiness and performance during multi-domain operations.**



Approach

1. Learn about current team training practices
2. Identify and prioritize areas for improvement
3. Leverage stakeholder feedback throughout design, development, and evaluation iterations
4. Harden system for use in classified environment
5. Deliver system to training environment for in situ use (during an interim evaluation period)



INTERVIEWS



OBSERVATIONS

1. Learn about current team training practices
2. Identify and prioritize areas for improvement
3. Leverage stakeholder feedback throughout design, development, and evaluation iterations
4. Harden system for use in classified environment
5. Deliver system to training environment for in situ use (during an interim evaluation period)

PAIN POINTS

Must do

- ❑ *Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor*
- ❑ *Incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation*
- ❑ *Ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat*
- ❑ *Non proident, sunt in culpa qui officia deserunt mollit anim id est laborum sit amet, consectetur adipiscing elit, sed do eiusmod tempor*

If budget/schedule permits

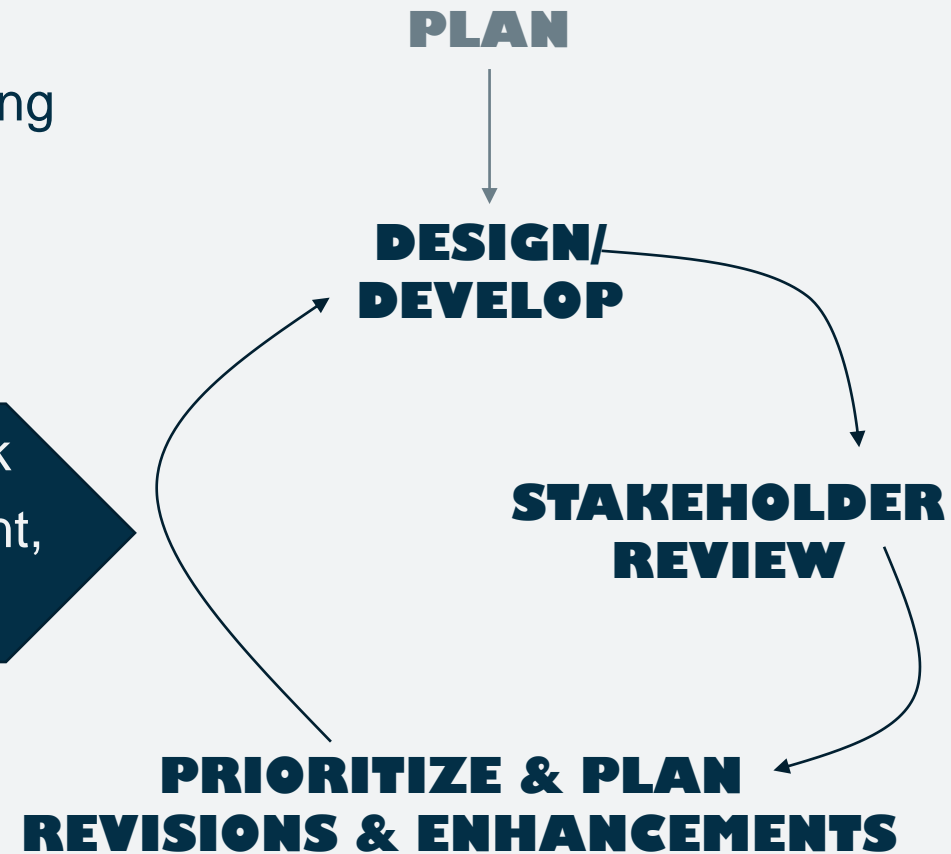
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Save for later

- ❑ *Ratione voluptatem sequi nesciunt. Neque porro quisquam est, qui dolorem ipsum*
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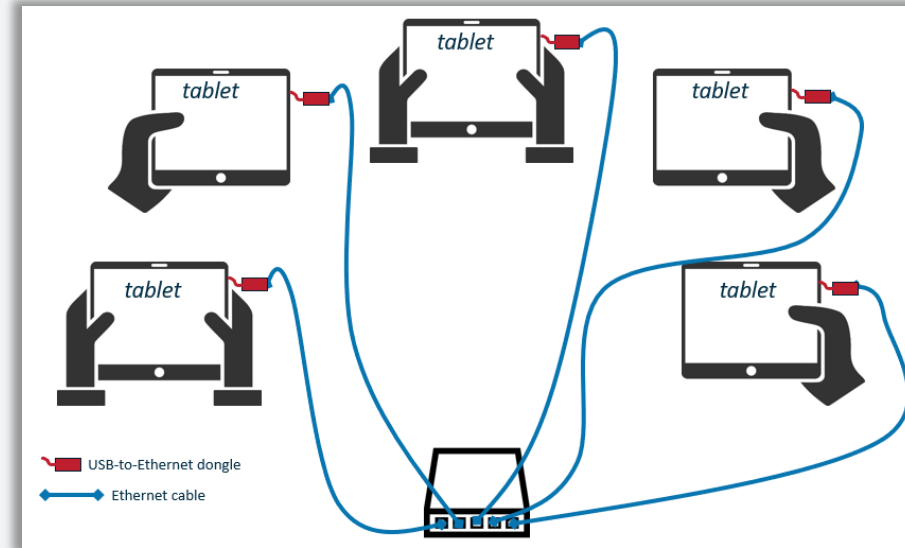
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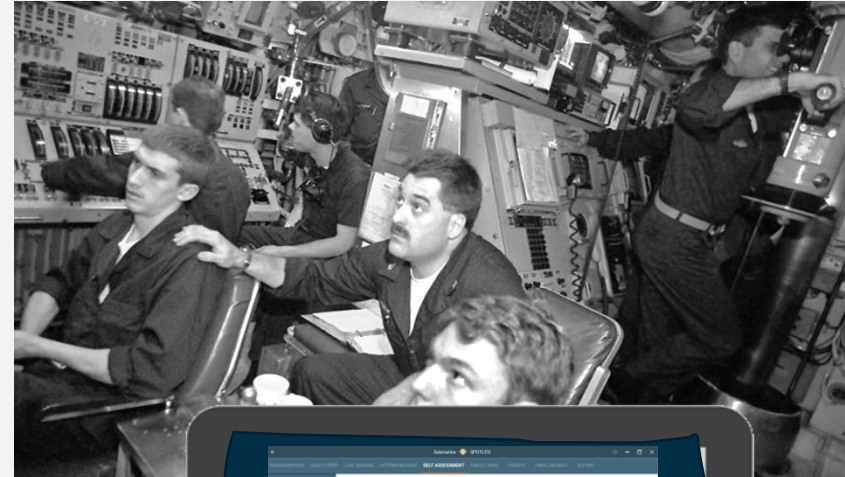


STANDALONE NETWORK

Approach

1. Learn about current team training practices
2. Identify and prioritize areas for improvement
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4. Harden system for use in classified environment
5. Deliver system to training environment for in situ use (during an interim evaluation period)

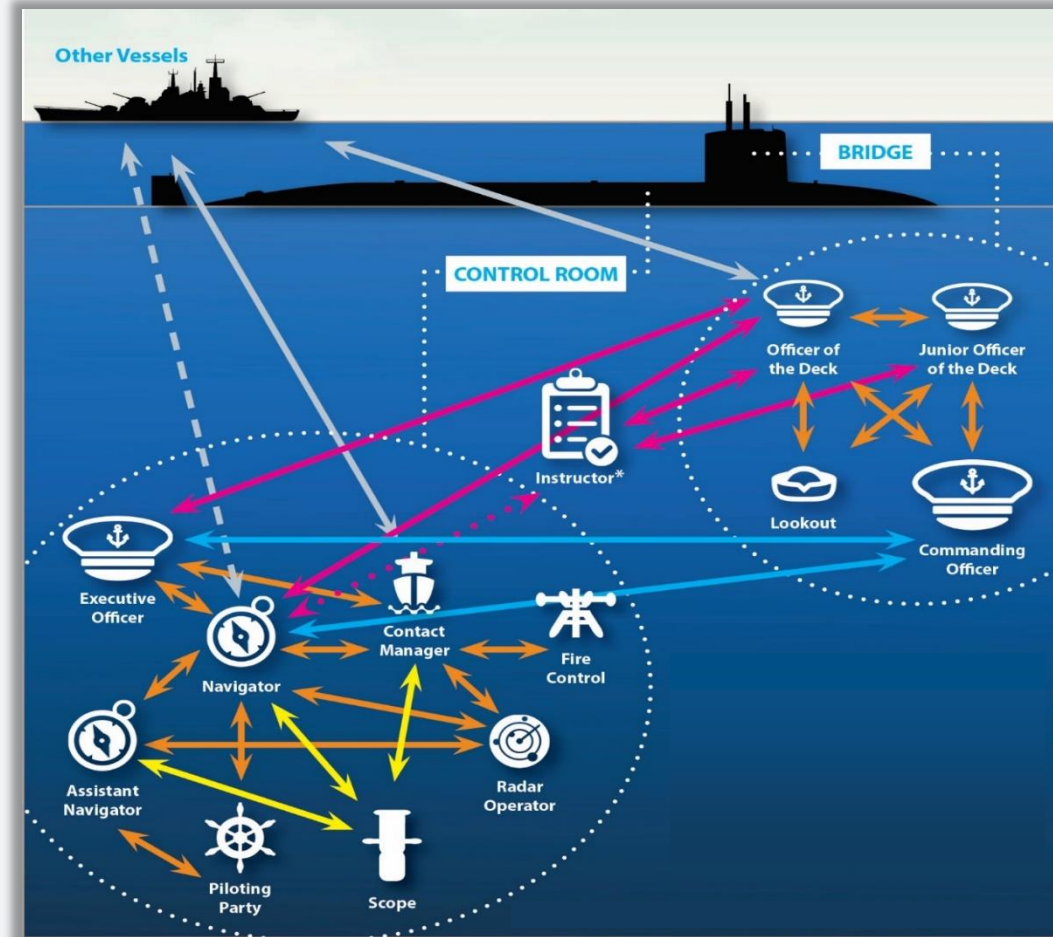
IN SITU EVALUATION



Integrated Submarine Piloting and Navigation (ISPAN) Trainer

Provides the necessary training to submarine crews in order to safely navigate submarines into and out of busy ports

- Scenario-driven
- Simulation-based
- Team training



What did we learn about the training process in this environment?

PLAN: Training Officers use an application (TSU) to schedule teams for training, selecting specific training objectives

PREP: Instructors print sheets with training objectives & tailor scenario for training

OBSERVE: Instructors reference printouts & write notes as they observe team behavior during scenarios

DEBRIEF: Instructors & trainees participate in reviews of performance, referencing hand-written notes and limited screen replay functions

REPORT: Later, Instructors enter scores for each training objective into a record keeping system (CTQS) for qualifications tracking

DATA ANALYSIS & LIFELONG LEARNING: Currently, there are no simple tools for evaluating training trends, etc.

TARA is a combination of two component applications:



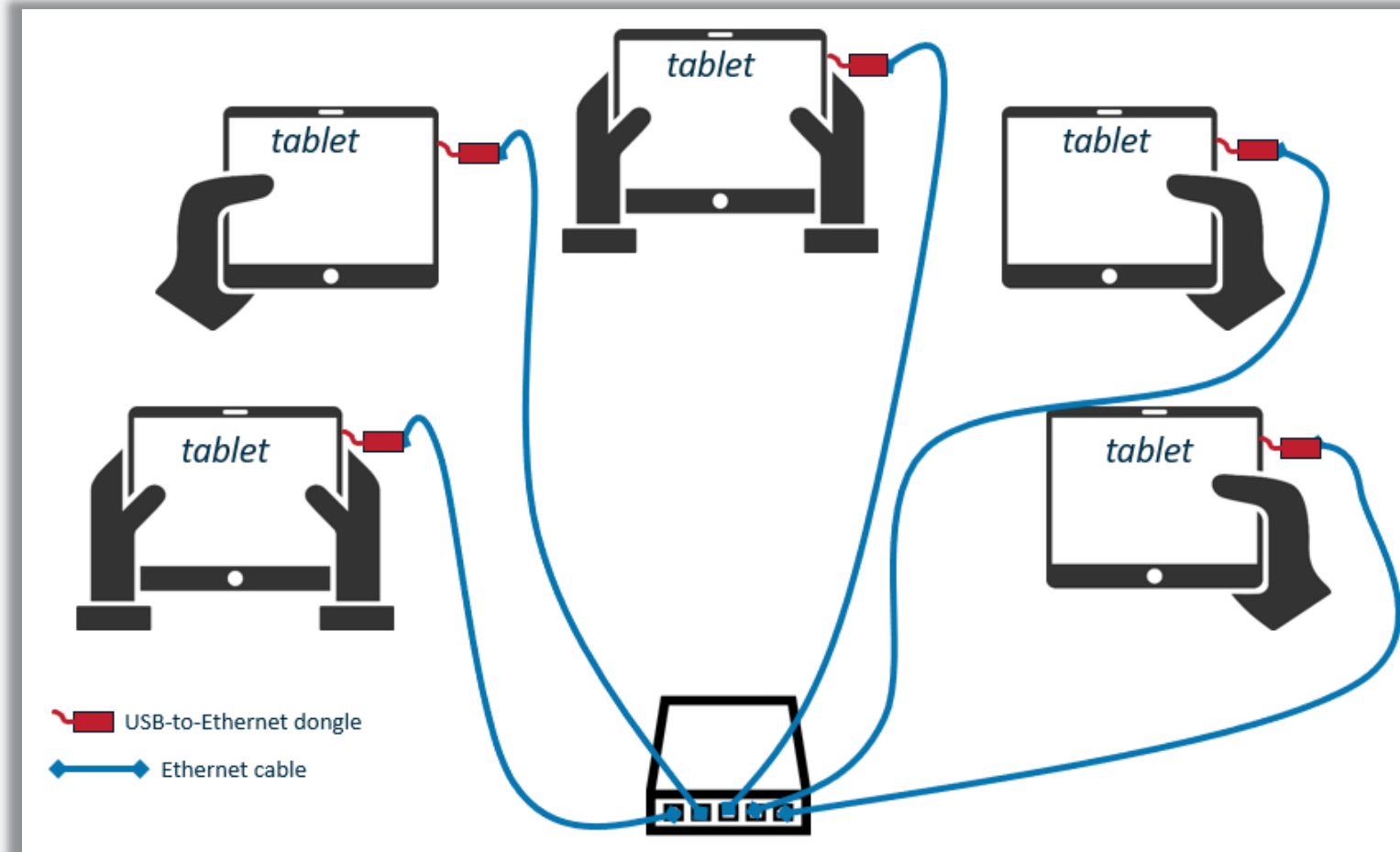
SubmarineSPOTLITE

Observational assessment software



Learning Locker

Learner Record Store (LRS) saves longitudinal performance data in xAPI format



STANDALONE NETWORK

Current	What were we able to accomplish?
<p>PLAN: Training Officers use an application (TSU) to schedule teams for training, selecting specific training objectives</p>	<p>PREP: Training objectives present in application; no printing necessary</p> <p>SET EXPECTATIONS: teams review objectives together</p>
<p>PREP: Instructors print sheets with training objectives & tailor scenario for training</p>	
<p>OBSERVE: Instructors reference printouts & write notes as they observe team behavior during scenarios</p>	
<p>DEBRIEF: Instructors & trainees participate in reviews of performance, referencing hand-written notes and limited screen replay functions</p>	
<p>REPORT: Later, Instructors enter scores for each training objective into a record keeping system (CTQS) for qualifications tracking</p>	
<p>DATA ANALYSIS & LIFELONG LEARNING: Currently, there are no simple tools for evaluating training trends, etc.</p>	

Submarine SPOTLITE

DEMOGRAPHICS TABLET PREP **LIVE TAGGING** INTERIM RATINGS SELF ASSESSMENT TABLET SYNC DEBRIEF FINAL RATINGS REPORT

0 CRITICAL THINKING & PROBLEM SOLVING

0 DIALOG

0 UNCATEGORIZED

RATING/MARKER TIMELINE

00:00:00 00:00:10 00:00:20 00:00:30 00:00:40 00:00:50 00:01:00 00:01:10 00:01:20 00:01:30 00:01:40

Time

0 1 2 3

Bench strength is improved by seniors acting as instructors.

Principal Assistants make Milestone Reports when an aim has been achieved & a new phase needs to be initiated.

Under stress, discussions still have a professional tone.

Leader facilitates collaborative discussions without dominating; have clear problem statements, involve all right members & engage all participants.

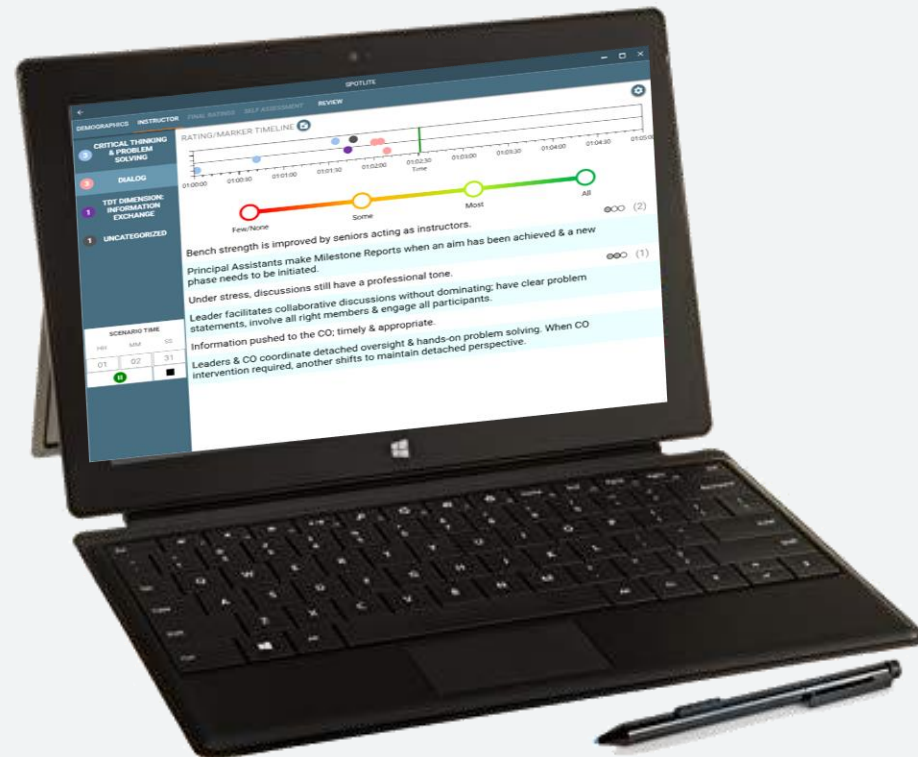
Information pushed to the CO; timely & appropriate.

Leaders & CO coordinate detached oversight & hands-on problem solving. When CO intervention required, another shifts to maintain detached perspective.

SCENARIO TIME

HH	MM	SS
00	00	00
▶		■

Tablet-based form-factor enables instructors to move through the training environment during the scenario, quickly rating behaviors and annotating ratings with notes for use during debrief



Submarine SPOTLITE

DEMOGRAPHICS TABLET PREP **LIVE TAGGING** INTERIM RATINGS SELF ASSESSMENT TABLET SYNC DEBRIEF FINAL RATINGS REPORT

18 CRITICAL THINKING & PROBLEM SOLVING

18 DIALOG

1 UNCATEGORIZED

RATING/MARKER TIMELINE

Time

0

1

2

3

Bench strength is improved by seniors acting as instructors. ●●○ (3)

Principal Assistants make Milestone Reports when an aim has been achieved & a new phase needs to be initiated. ●○○ (5)

Under stress, discussions still have a professional tone. ●●○ (3)

Leader facilitates collaborative discussions without dominating; have clear problem statements, involve all right members & engage all participants. ●●● (2)

Information pushed to the CO; timely & appropriate. ●●○ (3)

Leaders & CO coordinate detached oversight & hands-on problem solving. When CO intervention required, another shifts to maintain detached perspective. ●●● (2)

SCENARIO TIME

HH	MM	SS
14	04	31

||

Current	What were we able to accomplish?
<p>PLAN: Training Officers use an application (TSU) to schedule teams for training, selecting specific training objectives</p>	<p>PREP: Training objectives present in application; no printing necessary</p>
<p>PREP: Instructors print sheets with training objectives & tailor scenario for training</p>	<p>SET EXPECTATIONS: teams review objectives together</p>
<p>OBSERVE: Instructors reference printouts & write notes as they observe team behavior during scenarios</p>	<p>OBSERVE: Instructors note real-time observations of team behavior and then finalize scores on a tablet; teams practice SELF-ASSESSMENT skills</p>
<p>DEBRIEF: Instructors & trainees participate in reviews of performance, referencing hand-written notes and limited screen replay functions</p>	
<p>REPORT: Later, Instructors enter scores for each training objective into a record keeping system (CTQS) for qualifications tracking</p>	
<p>DATA ANALYSIS & LIFELONG LEARNING: Currently, there are no simple tools for evaluating training trends, etc.</p>	

Observational Assessment Tool

Following the completion of the scenario...

- While trainees each grab a tablet and begin entering their self-assessment ratings of how the team performed on each of the training objectives
- Instructors review, edit, and add to their observational ratings

Next, tablets are synchronized through the standalone network to ensure identical data on each one



TRAINEES



INSTRUCTOR

Current	What were we able to accomplish?
<p>PLAN: Training Officers use an application (TSU) to schedule teams for training, selecting specific training objectives</p>	<p>PREP: Training objectives present in application; no printing necessary</p>
<p>PREP: Instructors print sheets with training objectives & tailor scenario for training</p>	<p>SET EXPECTATIONS: teams review objectives together</p>
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<p>DEBRIEF: Instructors & trainees participate in reviews of performance, referencing hand-written notes and limited screen replay functions</p>	<p>DEBRIEF: Instructors & trainees participate in reviews, referencing quantitative visualizations of performance</p>
<p>REPORT: Later, Instructors enter scores for each training objective into a record keeping system (CTQS) for qualifications tracking</p>	
<p>DATA ANALYSIS & LIFELONG LEARNING: Currently, there are no simple tools for evaluating training trends, etc.</p>	



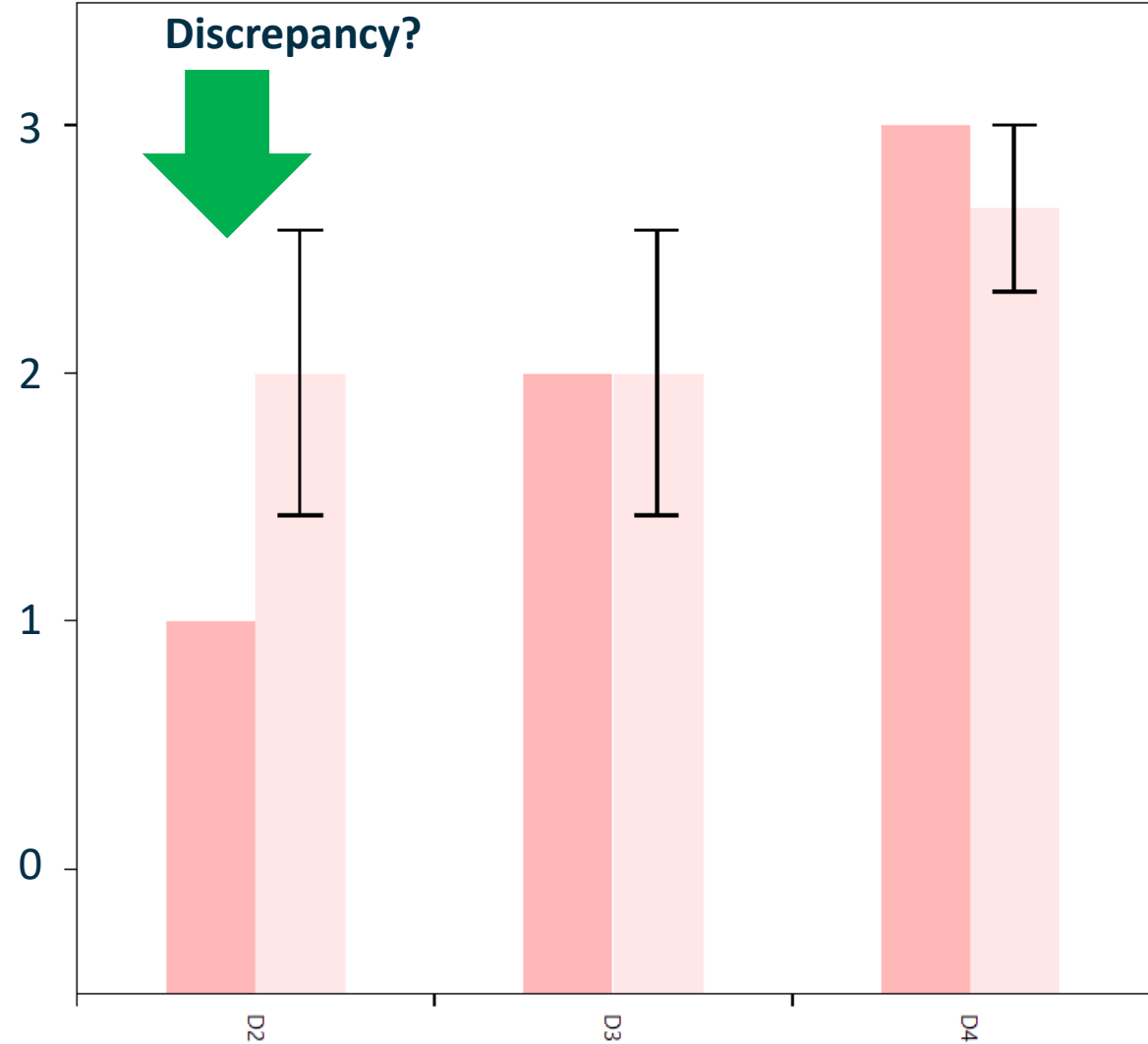
- C1: Team manages problems capably & balances safety & stealth.
- C2: Team has "big picture" & anticipates implications of situation & actions.
- C3: Teams operate at the information & context levels, not at the indication & data level.
- C4: Team challenges & revises its hypothesis to keep aligned with developing situation.
- C5: Leaders provide high-level context using briefs, principals-to-the-plot, and questions to the team.
- C6: Team actively keeps tripwires & checklists aligned with situation.
- C7: During routine watch turnovers, information is shared with other watch teams to discern trends & lessons about the mission.
- C8: Briefs timed to minimize disruption & proportional to situation. In-process reports have ownership, use



- Instructor Finalized
- Live Tagging Average
- Team Average
- Error Bars

Finish Debrief

Instructor's Final Rating Team's Average Rating

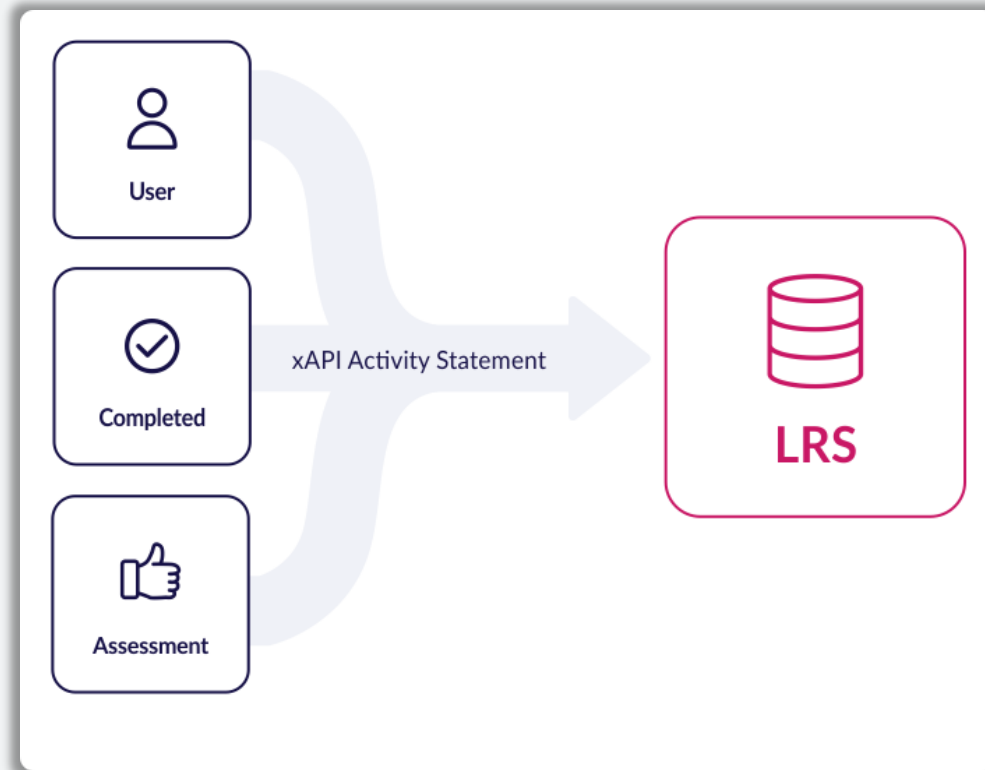


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<p>REPORT: Later, Instructors enter scores for each training objective into a record keeping system (CTQS) for qualifications tracking</p>	<p>REPORT: No manual data-entry; final scores for training objectives are saved automatically into record systems for long term tracking</p>
<p>DATA ANALYSIS & LIFELONG LEARNING: Currently, there are no simple tools for evaluating training trends, etc.</p>	<p>DATA ANALYSIS & LIFELONG LEARNING: xAPI formatted data enables exploratory analyses of training trends & supports integration with other systems that capture training events & experiential learning</p>

Following the completion of the debrief...

- Instructors finalize their observational ratings, making updates based on debrief discussions

Lastly, observational assessment data are saved in xAPI format in the Learning Locker database to facilitate future integration with other performance tracking systems



xAPI FORMAT

Expected Benefits of TARA

- **Enhance training transparency:** setting expectations at the outset when instructors and learners can preview training objectives during pre-briefs
- **Increase the accuracy and ease** with which instructors evaluate learners' performance in real time
- Provide trainees **practice with self-assessment**
- **Facilitate learning** during debriefs with immediately available graphical visualizations of both self-assessment and actual performance ratings

Objective

Learn from novices (i.e., those who have never seen the tool) about what aspects of the software are intuitive vs. confusing

Participants

Current and retired submarine team instructors (n=6)

Protocol

Participants were given a brief overview of the purpose of the software, and then performed a series of tasks with minimal instructions or prompting; lastly, they completed a survey

Results

The evaluation resulted in a number of fixes and enhancements, the majority of which have been implemented; see next slides for survey results

Usability Evaluation Feedback

**RATING
SCALE:**



Strongly disagree



Disagree



Neutral



Agree



Strongly agree

Usability Statement	Mean	Standard Deviation
I felt confident using the tool without additional help	4.17	0.41
I would use this tool in my job	4.0	0.63
The tool would help me do my job	4.17	0.41
The tool would help improve team training evaluation	4.33	0.52
The tool would help Submariners develop resilient team skills to be successful as a team	3.83	0.41
I would recommend the tool to others	4.17	0.41

Current Status

At Technology Readiness Level (TRL) 7, TARA received interim approval for use in the ISPAN environment during an **experimental evaluation period**.



During this time, instructors will use TARA on their own during team training events.

Next steps

- Receive feedback from NSS instructors and leadership
- If there is continued interest in this tool, seek out mechanisms for further development and integration with other training-related systems (e.g., TSU, CTQS)

- TARA will **streamline team training and assessment processes**
- Instructors will spend more time observing team behaviors and providing helpful, guiding feedback, thereby **speeding up the development of resilient teams**
- TARA can be **easily adapted to other environments**, e.g., wherever learners must satisfy (or surpass) detailed training objectives to qualify for deployment

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Warrior Performance Platform For Comprehensive Warrior Fitness

WP2 for United States Air Force:
Enabling Remote Fitness Coaching and
Wellness Tracking Capabilities for
Geographically Distributed Populations



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Distribution A/ Unclassified



ABOUT THE TEAM



SOFTWARE PROUDLY MADE IN THE USA

EXPERIENCE WITH OVER 30% OF ALL PRO SPORTS IN USA

CIRQUE DU SOLEIL.



DOD TEAMING PARTNER



TIAG brings a history of transformational leadership advancing military medical science and telehealth technology

- Holds CMMI Maturity Level 3 for Services, ISO 9001:2015, and ISO 27001 certifications.
- Delivers cutting-edge health IT solutions (e.g., VA's open-source EHR)
- Developed the Army's Research Management Enterprise System, providing autonomous big data management across numerous laboratories
- Legacy system data interoperability as part of MHS Genesis Cerner EMR implementation in DoD

SUCCESSFUL SBIR PHASE III TRANSITIONS

Kiosk Interface



Readiness Evaluation Interfaces and Dashboards (REDI)



NAVY SBIR N171-079 – PHASE II

HUMAN PERFORMANCE SELF-SERVICE KIOSK AND APPLICATION

Operational Need and Improvement: The Navy seeks a software and hardware platform that displays and shares human performance and is supported by commercially available wearable devices to include phones, tablets and physical activity tracking devices.

Phase I and Phase II work period: JUN 2017 – NOV 2020

PHASE III TRANSITION APPROVED FOR 2021

USAF SBIR AF191-005 – PHASE II

REMOTE FITNESS COACHING FOR AIRMEN

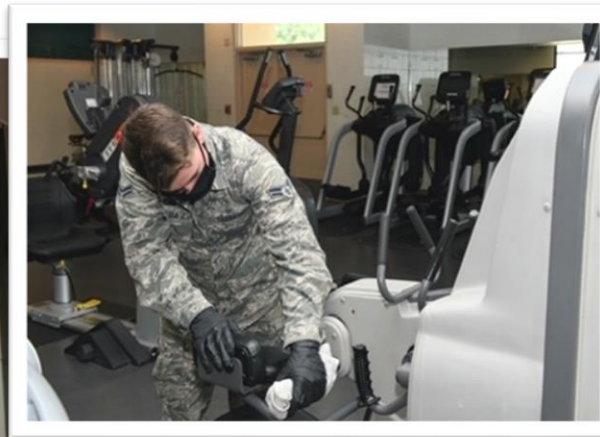
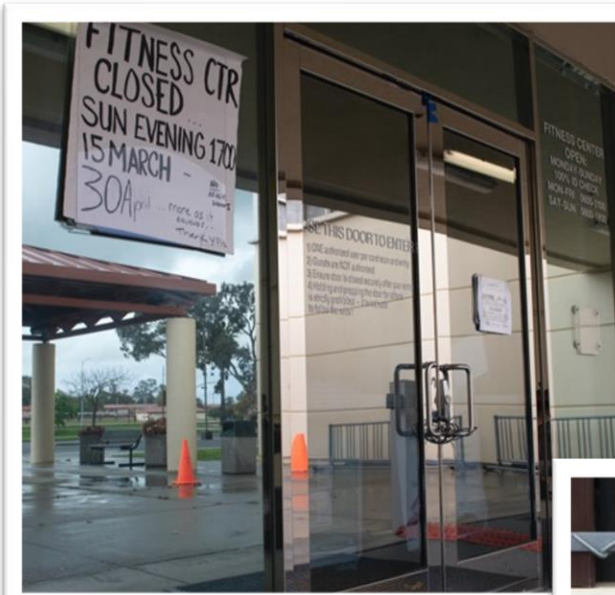
Operational Need and Improvement: Airmen in the reserve components (Air National Guard and Air Force Reserve) go through the same intensive training as their active duty counterparts.

Phase I and Phase II work period: MAR 2019 – NOV 2020

PHASE III TRANSITION APPROVED FOR 2021

COVID19 – LIMITS ACCESS TO FITNESS

PROBLEM



“Remote Work” has become the new normal due to the recent pandemic. With fitness centers closed across the DoD, it is more important than ever to provide Remote Fitness Training solutions.

“When testing resumes, the Air Force will take a systematic approach to reintegrating official physical fitness assessments. All policies and procedures should reinforce physical distancing, use of personal protective equipment, Airmen health and personal hygiene, and cleaning, sanitizing and disinfecting work spaces and common areas.”

Lt. Gen Brian Kelly

ENTERPRISE SOFTWARE

SOLUTION – CONFIGURABLE BASED ON NEED

HOLISTIC HUMAN PERFORMANCE PROFILE



MOBILE AND
TABLET
ACCESS



WORKOUT
BUILDER /
TRACKER



NUTRITION /
HYDRATION
TRACKING



WEARABLE
DEVICE
INTEGRATION



SUBJECTIVE
WELLNESS
TRACKING

PDFS,
NOTES,
VIDEOS

SCHEDULING,
MESSAGING,
NOTIFICATION

DATA IMPORT
AND EXPORT
API

FORCE MULTIPLIER

GENERAL POPULATION

10,000 – 500,000 Airmen

GOAL: Behavior Change / Education

Limited Staff – High Automation

AT-RISK POPULATION

1,000 - 10,000+ Airmen

GOAL: Monitoring / Tracking

Blended Staff – High Automation

SPECIALIZED POPULATION

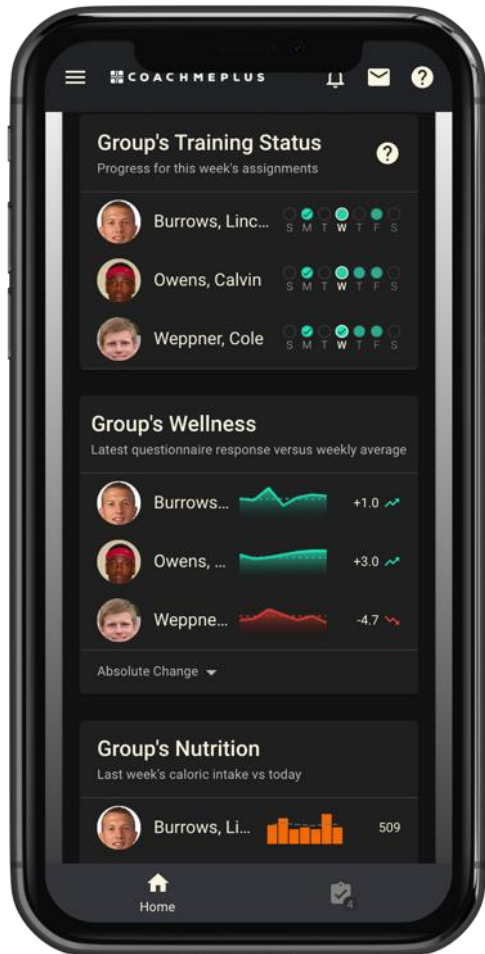
20 - 2,000 Airmen

GOAL: Optimized Performance

Embedded High Performance Staff

MOBILE APP EXPERIENCE

COACH AND ATHLETE APP EXPERIENCE



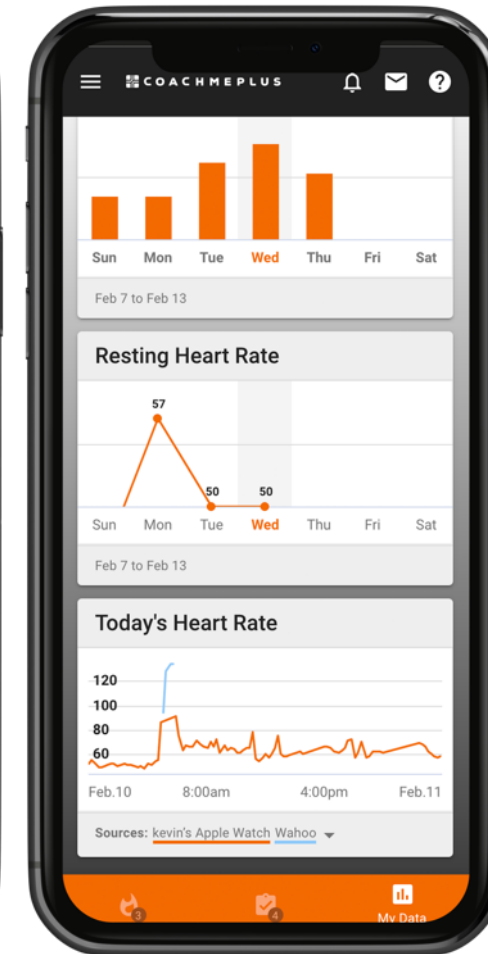
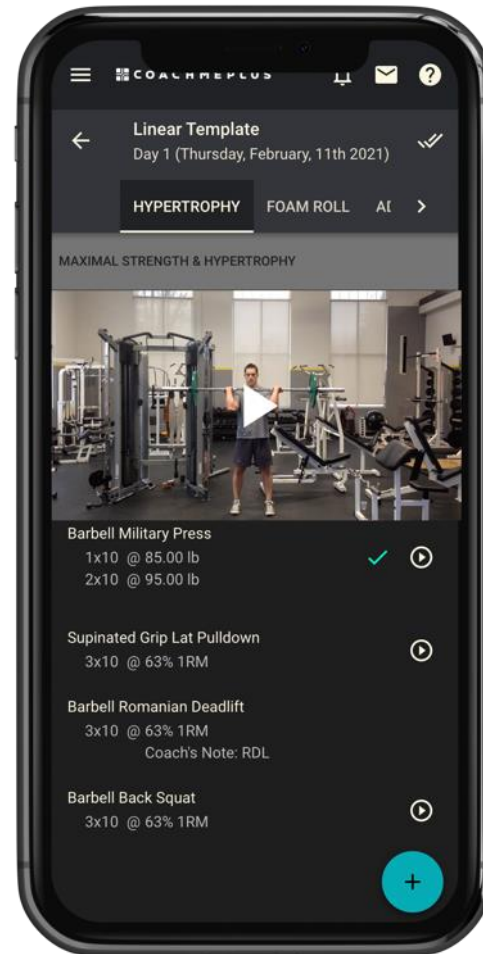
COACH APP

Coaching Toolkit, Create Workouts, Wellness Questionnaires, Testing, Communication.



ATHLETE APP

Workouts, Nutrition, Hydration, Wellness, Wearables Integration, Testing, Communication.

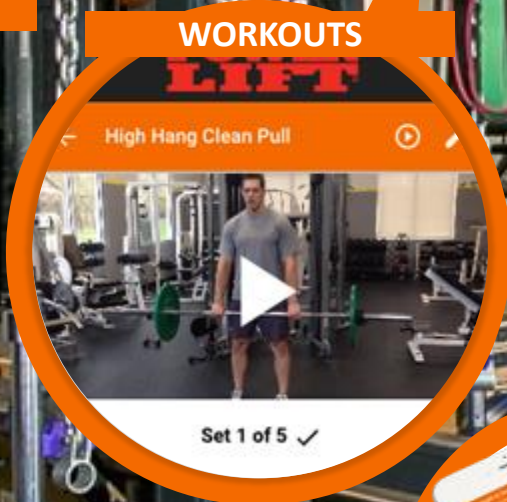


INTRODUCE COMPETITIVE ACTIVITY

RE-ENGAGE WHEN ATHLETES ARE IN FACILITIES



DASHBOARDS



WORKOUTS



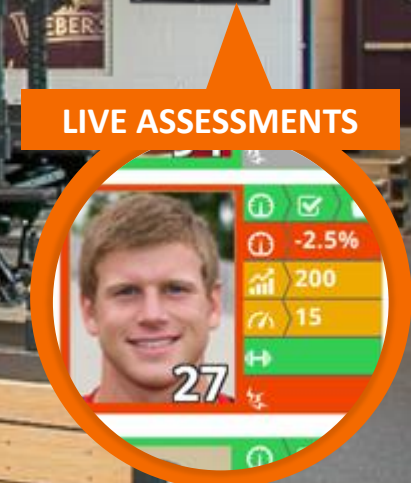
PHONE APP

RANK	ATHLETE	BACK
1	#13 Pace, Charlie	425lb
2	#94 Owens, Calvin	400lb
	#27 Weppner, Cole	375lb

LEADERBOARDS



INTEGRATION



LIVE ASSESSMENTS

OPERATIONAL NEED & IMPROVEMENT



TECHNOLOGY AS A FORCE MULTIPLIER

An enterprise platform that works under multiple operational conditions

GENERAL POPULATION

GOAL: Behavior Change / Education

AUTOMATION / LIMITED STAFF

Nutrition / Hydration / Workouts

AT-RISK POPULATION

GOAL: Remediation / Return to Duty

SEMI-AUTOMATION / SPECIALIZED STAFF

Sleep / Pain / Mood / Stress / Fatigue

SPECIALIZED POPULATION

GOAL: Optimized Performance

CUSTOMIZATION / SPECIALIZED STAFF

Load Monitoring / Tech Based Training

TRACKING - KEEPING IT SIMPLE

LOW-COST MEASURES OF EFFECTIVENESS – IMPROVE ROI

STUDY AFTER STUDY SUPPORTS THE IDEA THAT FITNESS EDUCATION AND MONITORING IMPROVES FITNESS RESULTS.

WORKOUTS

75% of users who track workouts are more active than those who do not. Increasing fitness metrics increases the likelihood of passing physical training testing. Body Mass Index measurements of those who track workouts are 6.5% lower than those that do not.

SUBJECTIVE SLEEP

Subjective reporting of sleep hours and quality can alert to potential sleep issues: **poor quality or less than 8 hours average sleep showed a risk increase of 44% of MSKI.** Self-reporting shows that 13% self-testing athletes require consultation with a sleep consultant.

PERCEIVED EXERTION

Participants subjectively report exertion during a training session. Creating a training stress balance value can indicate periods of overtraining. **Injury risk increases 3-4 times when training stress balance exceeds 200%** compared with 50-99%.

SUBJECTIVE SORENESS AND STRESS

Neuromuscular and subjective fatigue measures deteriorate 24 hours following extreme physical activity; modification of subsequent physical training targets the goal of lowering training intensity during periods of increased risk which reduces incidents of injury.

HYDRATION

Users tracked pre-workout and post-workout body-weight measurements to indicate dehydrated values: **2% loss of body weight can cause 10% performance drop, 5% of body weight loss can cause a 30% decline in work capacity.** Increased compliance of fluid replacement can sustain performance levels, increasing recovery and reducing risk of injury.

SUBJECTIVE PAIN

Subjective reporting of increased pain associated with previous injury areas can alert to potential risk. **Individuals with two or more previously reported injuries had a 300% greater risk of recurrence of injury.** Improved reporting reduces injury risk per session.

SBIR AF191-005: REMOTE FITNESS COACHING FOR AIRMEN



SBIR AF191-005: REMOTE FITNESS COACHING FOR AIRMEN

- As part of the Phase II SBIR, WP2 was piloted at various USAF sites to gauge platform effectiveness and perform a gap analysis between the as-is platform capability and the ideal end state for USAF's specific needs.
- Focus on two distinct use-cases: Practitioner-Driven vs Project HeRO/Population Health
- Study outlined how the WP2 technology satisfies DoD needs "out of the box," with additional capabilities available to further enhance USAF operations.
- Just as in professional sports, we found that no two locations had the same operational environment.
- Pilot activities were launched directly into the headwinds of COVID-19.
- While each USAF pilot site had a different set of challenges and objectives, we discovered we could leverage common strategies while solving each site's unique requirements.

PRACTITIONER-DRIVEN USE CASE

ELLINGTON JOINT RESERVE BASE
FAIRCHILD AIR FORCE BASE
HANCOCK FIELD AIR NATIONAL
GUARD BASE
JOINT BASE ELMENDORF
RICHARDSON

PATRICK AIR FORCE BASE – USAF
RESERVE
SEYMOUR-JOHNSON AIR FORCE
BASE
WHEELER ARMY AIRFIELD

PROJECT HERO USE CASE

EGLIN AIR FORCE BASE
MACDILL AIR FORCE BASE
OSAN AIR BASE (OCONUS)

MISSION NEED

PROJECT HeRO & AIR FORCE HEALTH PROMOTION

PROMOTE HEALTH

Capability-based concept of operations adopted where a HP team (dietitian and HPC) was established to go into squadrons and embed HPP into Air Force culture.

ASSESS, ENGAGE, INTERVENTION

Target at-risk squadrons using data and evidence-based interventions to minimize work-days lost to preventable illness or injury.

BEHAVIOR CHANGE

Annual personal health assessment questionnaires so our teams can identify squadrons showing high rates of negative health behaviors.



MISSION NEED

TACP NATIONAL GUARD AND RESERVE

HUMAN PERFORMANCE

Required to meet the same fitness standards as their active duty counterparts, while only being required to train two days per month.

HEALTH AND FITNESS

10-15% physical fitness standard failure rate with a significant percentage at risk of failure.

REDUCING INJURY RISK

It costs well over \$100,000 to develop and train an Airmen through his/her career.



RELEVANT PILOT RESULTS

EGLIN AFB

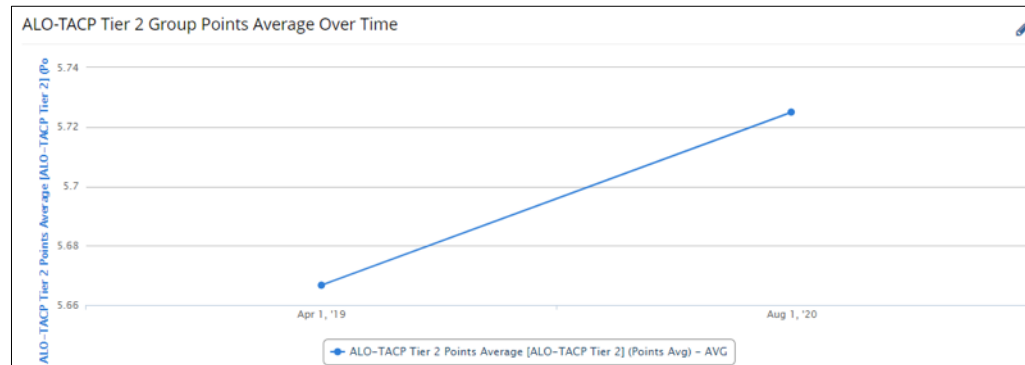
Test	Month	Score	Findings
Recovery	February Average	3.18	Recovery scores have significantly improved over pilot duration.
	June Average	3.94	
	Pilot % Change	24%	
Sleep	February Average	3.31	Sleep scores have significantly improved over pilot duration..
	June Average	4.00	
	Pilot % Change	21%	
Mood	February Average	3.69	Mood scores are stable over pilot duration.
	June Average	3.88	
	Pilot % Change	5%	
Energy	February Average	3.59	Energy scores are stable over pilot duration.
	June Average	3.88	
	Pilot % Change	8%	
Pain	February Average	3.06	Pain scores have significantly improved over pilot duration.
	June Average	3.88	
	Pilot % Change	27%	

SEYMOUR-JOHNSON AFB

Test	Month	Score	Findings
Recovery	December Average	3.59	Recovery scores are stable over pilot duration.
	June Average	3.76	
	Pilot % Change	5%	
Sleep	December Average	3.75	Sleep scores are stable over pilot duration.
	June Average	3.91	
	Pilot % Change	4%	
Mood	December Average	3.82	Mood scores are stable over pilot duration.
	June Average	4.00	
	Pilot % Change	3%	
Energy	December Average	3.64	Energy scores are stable over pilot duration.
	June Average	3.80	
	Pilot % Change	4%	
Pain	December Average	3.70	Pain scores are stable over pilot duration.
	June Average	3.41	
	Pilot % Change	-8%	

HANCOCK FIELD

Test	Month	Score	Findings
Recovery	January Average	3.57	Recovery scores are stable over pilot duration.
	July Average	3.36	
	Pilot % Change	-6%	
Sleep	January Average	3.56	Sleep scores are stable over pilot duration.
	July Average	3.50	
	Pilot % Change	-2%	
Mood	January Average	3.89	Mood scores are stable over pilot duration.
	July Average	3.81	
	Pilot % Change	-2%	
Energy	January Average	3.64	Energy scores are stable over pilot duration.
	July Average	3.76	
	Pilot % Change	3%	
Pain	January Average	3.41	Pain scores are stable over pilot duration.
	July Average	3.19	
	Pilot % Change	-6%	

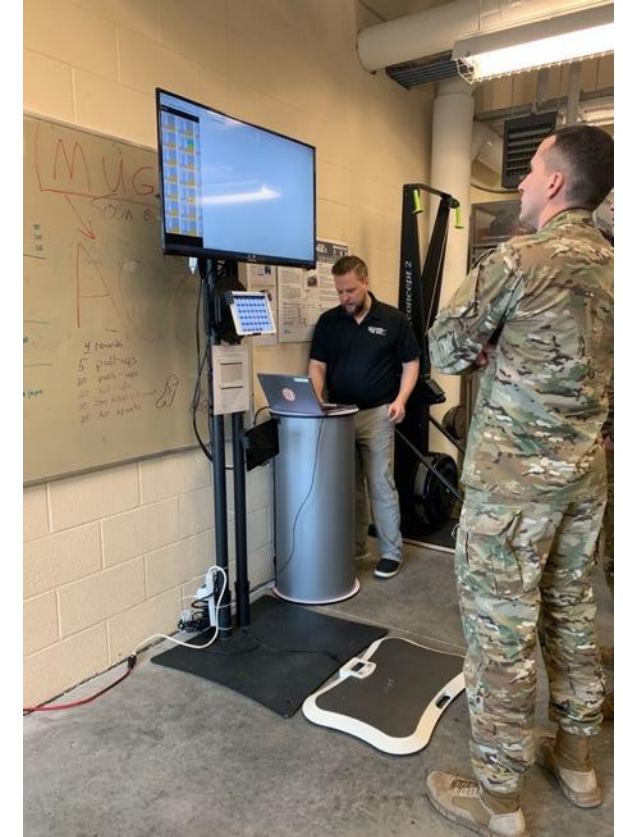


April 2019 vs August 2020
ALO-TACP Tier 2 testing scores for
Airmen at Hancock Field ANGB

ANECDOTAL PILOT FINDINGS

Throughout the pilot, the WP2 team collected powerful anecdotes regarding the applicability of the platform to the USAF community. We consistently observed the following:

- Airmen are interested in the idea of improved mobile fitness resources.
- Airmen are already equipped to access and make beneficial use of WP2.
 - Ubiquitous access to smart phones
 - Many users have already invested in personal wearables
- Airmen and leadership alike benefit from standardized reporting.
- TACP Airmen are high-end athletes interested in the upper echelons of fitness.
- Airmen want access to improved nutrition tools.
- Airmen already invested in commercial fitness apps can/should continue to use those apps, integrate data.
- Remote fitness tools make it easier for National Guard units to share human performance professionals.

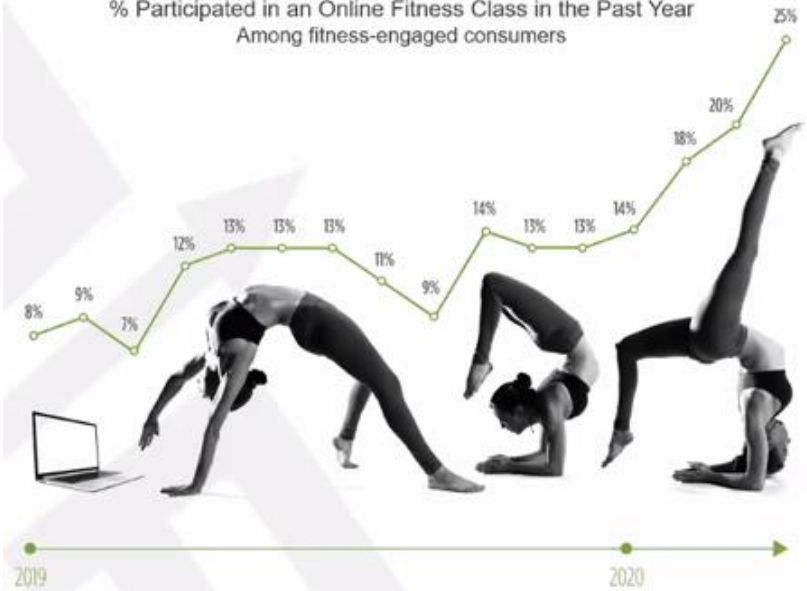


**CONNECTED BLUETOOTH SCALE
AND MONITOR
(HANCOCK AIR NATIONAL GUARD TACP)**

REMOTE AND ON DEMAND FITNESS 2020 INDUSTRY TRENDS

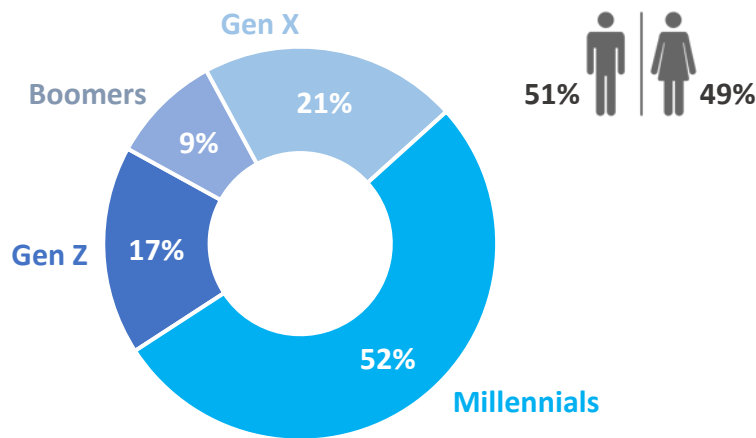
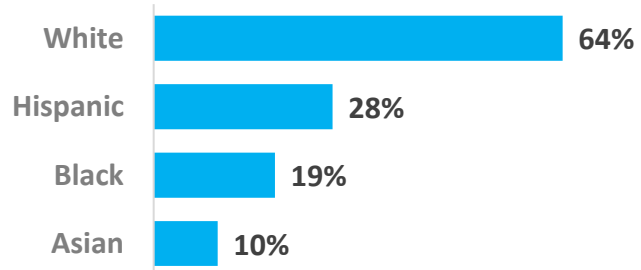
Participates in Online Fitness Classes

% Participated in an Online Fitness Class in the Past Year
Among fitness-engaged consumers



1 in 4 Adults

Use online fitness services more than once a month



USER'S MOTIVATION TO MOVE ONLINE SINCE COVID-19

- 29%** Wanted to maintain fitness levels
- 28%** Wanted convenience
- 24%** Gym or studio closed

VIDEOS AND CASE STUDIES

Pro Sports – Buffalo Bills
https://youtu.be/GB_iWcWswmA



Military – H2F US Army
<https://youtu.be/KoK8LtfoOUw>



Small College – Niagara
<https://youtu.be/DMUiXSVkNYc>



Military – US Air Force
https://youtu.be/uu2IIIu7_y0



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U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – SOLDIER CENTER

Adding Stressors to Tactical Combat Casualty Care and Care Under Fire Virtual Reality Performance Assessments Using Haptics and Integrated Immersive Technologies

William Y Pike, PhD

Conner Parsey

SFC Paul Ray Smith Simulation and Training Technology Center (STTC)

Joanne Barnieu

Engineering & Computer Simulations, Inc.



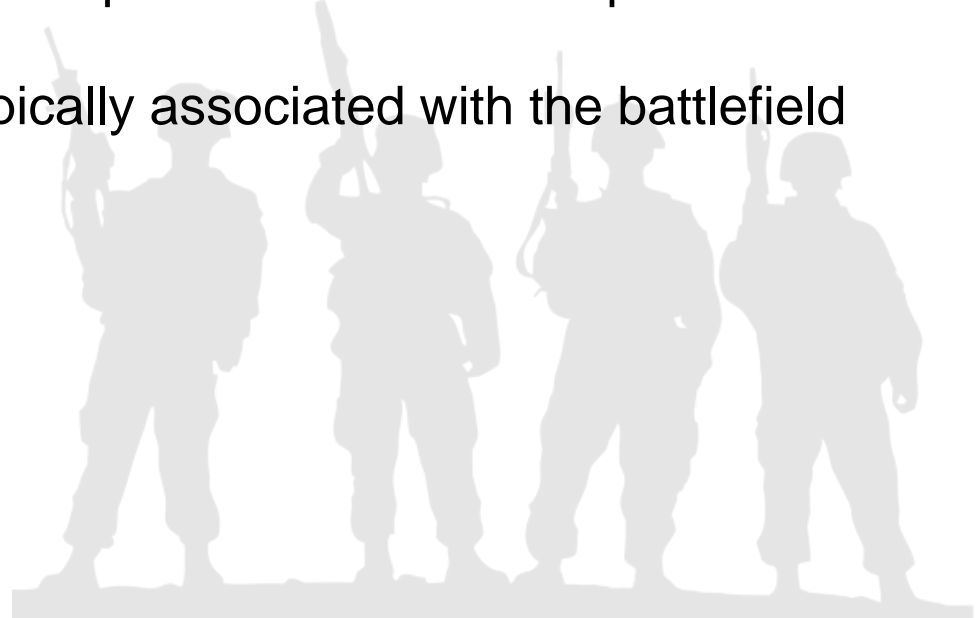
PROBLEM STATEMENT



- Virtual Reality (VR) has advantages over live training & assessments such as:
 - Access to more and varied scenarios with increasing complexity
 - More realistic stressors (bloodshed, explosions, etc.)
 - More cost-effective
- Yet, VR alone has its limitations in how it can effectively measure warfighter performance in a real-life battlefield scenario, notably:
 - Lack of tactile input from weapon recoil or a tourniquet as it is being applied
 - Lack of olfactory input typically associated with the battlefield



Tactical Combat Casualty Care (TC3) VR Environment



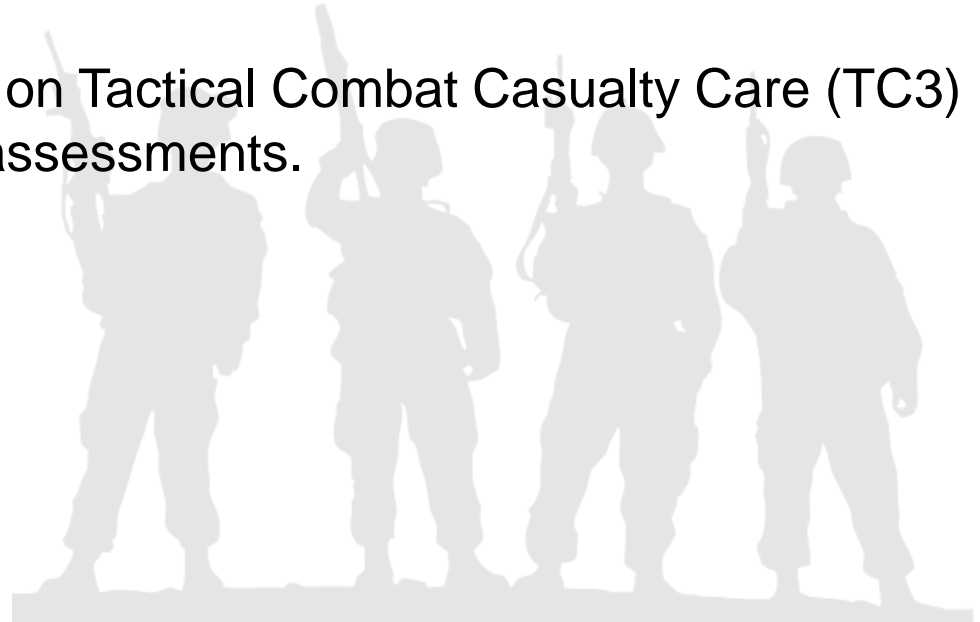


HYPOTHESIS

- The US Army is interested in exploring immersive and innovative technologies that can be added to VR scenarios to increase realism such as:
 - Haptic gloves
 - Haptic-based weapons
 - Olfactory devices
- By adding stressors to the scenario through use of immersive technologies, the assessment could be a more effective measurement of warfighter readiness.
- The focus for the research is on Tactical Combat Casualty Care (TC3) and Care Under Fire (CUF) assessments.



Haptic gloves with haptic weapon

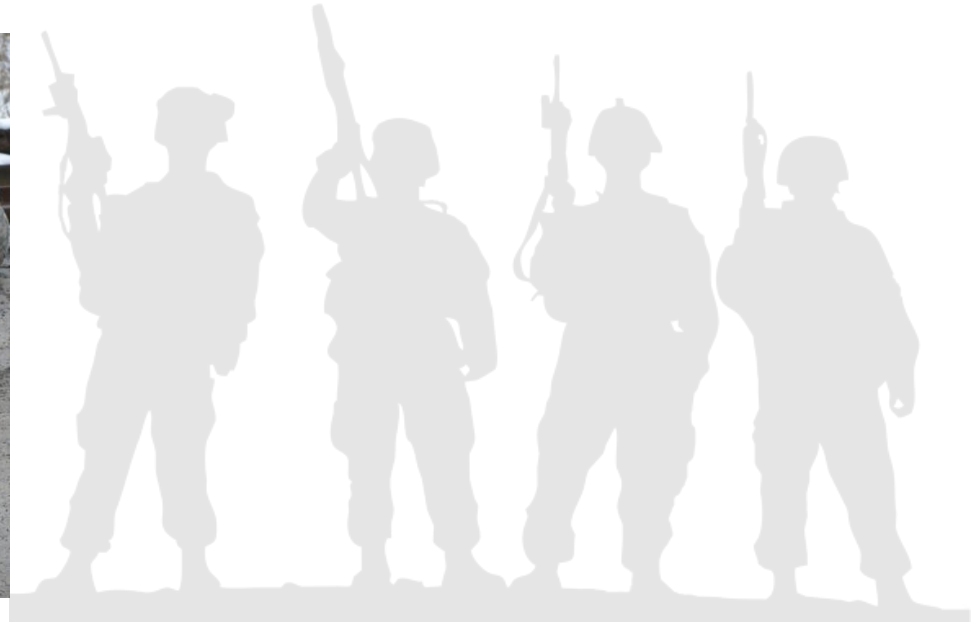




METHODS



- Front-end analysis
 - Reviewed current CUF assessment rubrics
 - Observed a combat medic course with field assessments
 - Interviewed combat medic course instructors
 - Investigated different haptic gloves & haptic-based weapons
 - Investigated olfactory devices and researched optimal scents

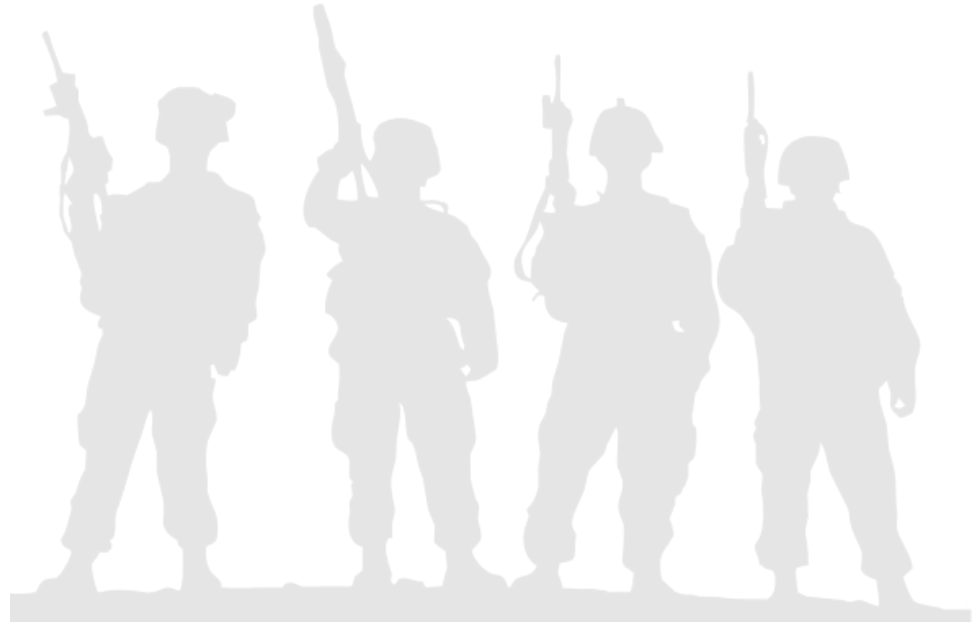




METHODS



- Designed and developed a CUF VR assessment prototype with haptics and olfactory device integration (including a haptic-based weapon)
 - Includes a scoring mechanism to rate performance on individual CUF tasks on a scale of 1-4.

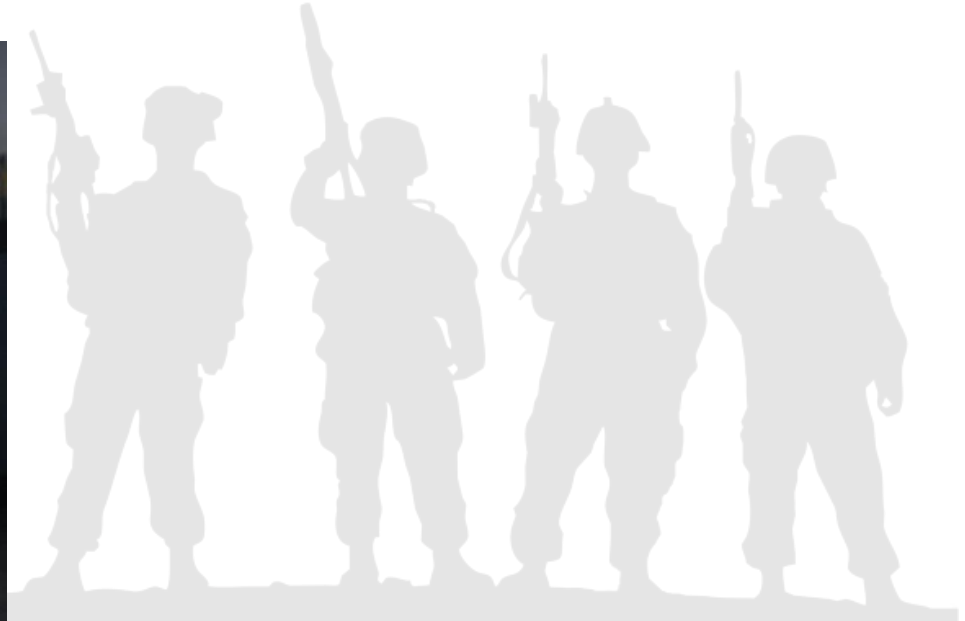




METHODS



- Designed a usability study to collect data from either Combat Lifesavers (CLS) or combat medics as they go through the assessment with added technologies. Data collection instruments will address:
 - Impact of realism on performance
 - General reaction on how certain technologies increased realism
 - Usability, Functionality, and Human Factors / Ergonomic benefits or challenges
 - Prior training or experience with technologies





NEXT STEPS

- Despite the ongoing pandemic challenges, in 2021, the team plans to:
 - Execute the usability study during a CLS or combat medic course with the Army Guard and Reserve component.
 - Include a data collection concerning instructor impact. Instructors will be interviewed concerning:
 - Increased workload
 - Concerns or challenges with setting up or breaking down equipment or equipment troubleshooting during assessments.
 - Perceived challenges with implementing these assessments long-term.
 - Learning curve concerning the use of these technologies (during set up, break-down, or while assessment is in progress).
 - General reaction and perceived effectiveness for assessment (and training).
 - Compile, synthesize, analyze, and report out on study findings.



QUESTIONS



Haptic weapon



VR environment



Haptic glove



U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND SOLDIER CENTER

Measuring and Predicting Soldier Performance and Lethality Through Soldier-Systems Modeling

Robb Wilcox, Ph.D., P.E.

Human Systems Performance S&T Lead (A)

US Army DEVCOM Soldier Center



PROBLEM AND APPROACH



Limited means to objectively and holistically measure and predict Soldier, Squad and integrated systems performance and lethality

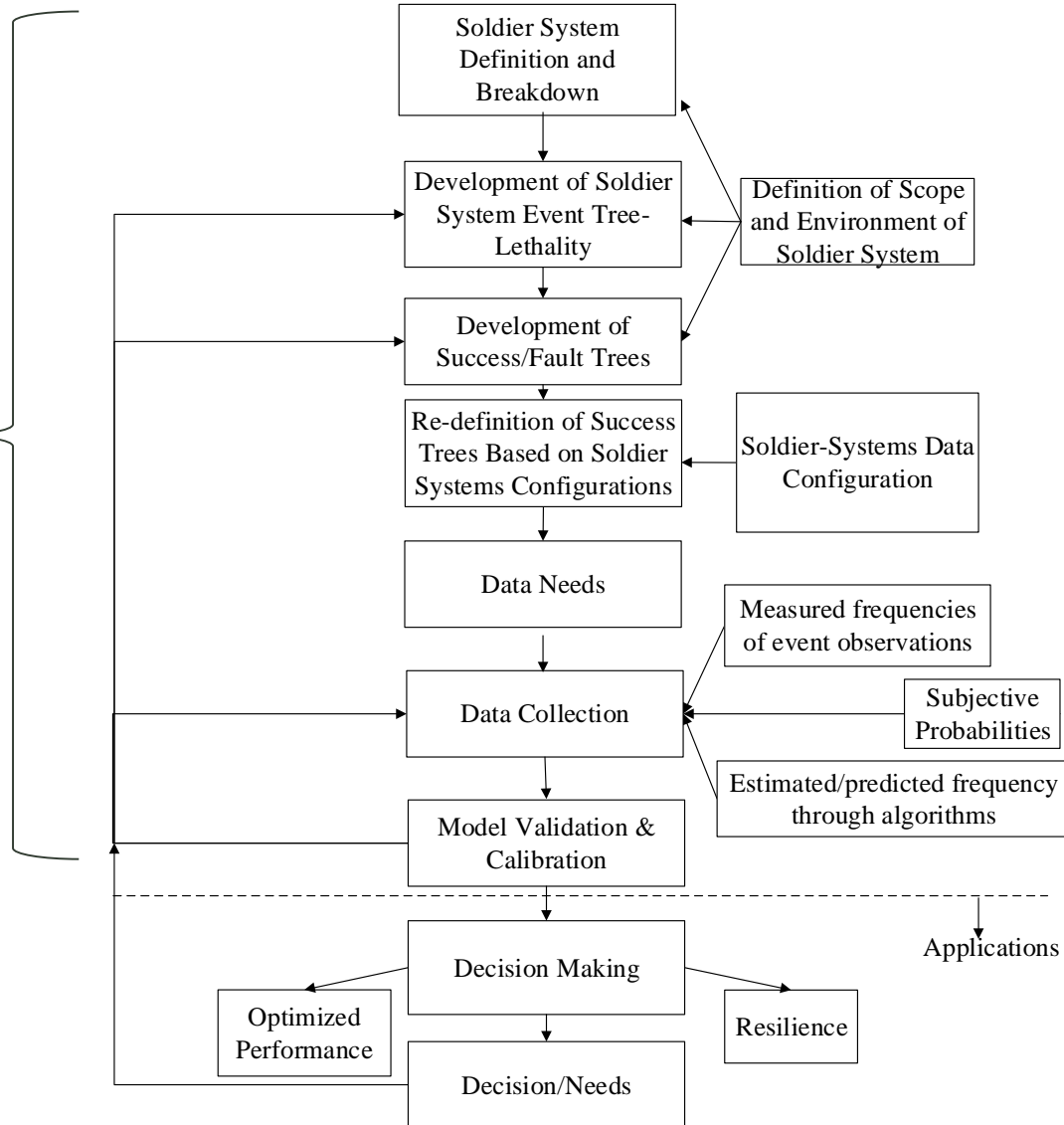
- Today we have the means to measure Soldier-Systems performance by ever increasing quantitative means
- Understanding the complexity of soldier systems requires a modelling process that integrates performance indicators, MOP, MOE and human-systems states that ultimately indicate task or function reliability
- A proposed methodology is proposed to include modelling through a combination of Event Tree and Success Tree analysis provides a framework to model and understand Soldier –System performance and lethality to support decisions improving lethality



SOLDIER SYSTEMS PERFORMANCE ASSESSMENT AND DECISION SUPPORT METHODOLOGY

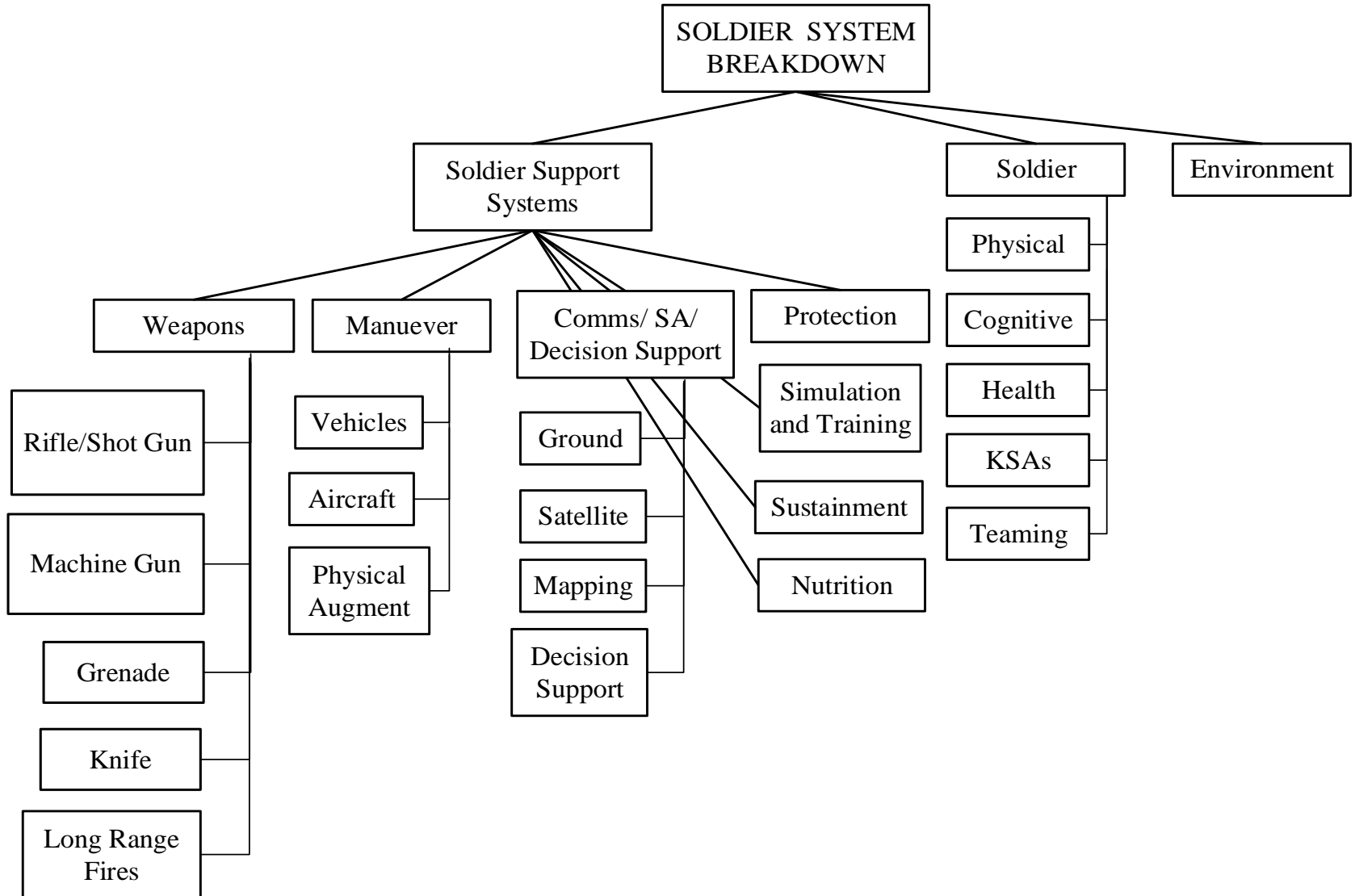


Modeling Approach





SOLDIER SYSTEM BREAKDOWN



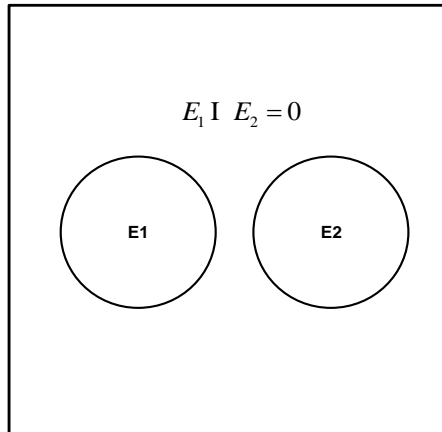


SYSTEM'S RELIABILITY MODELING

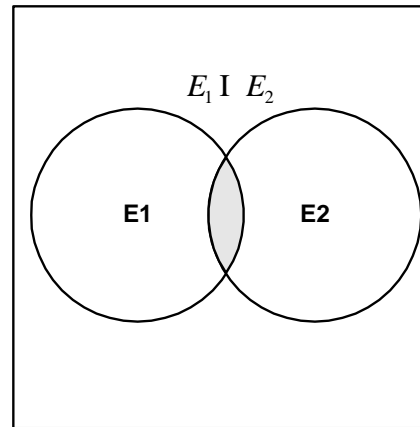


Probability Theory and Reliability Analysis Modeling

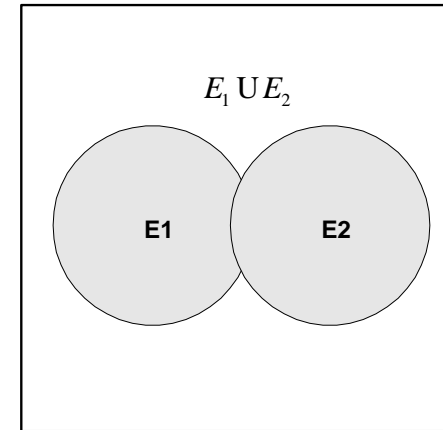
– Set Theory



Mutually Exclusive Events



Intersection of Two Sets



Union of Two Sets

- Event Tree and Success Tree Analysis based on probability theory provides framework for Soldier-Systems performance modelling



EVENT TREE ANALYSIS (SCENARIO DEVELOPMENT MODEL)



- **Description**

- Inductive reasoning approach
- Graphical model identifying scenarios (events- actions, tasks, functions) resulting in some consequence due to some initiating event
- Appropriate when operation depends on a successive group of events

- **Strengths**

- Accounts for timing and dependence of events
- Used for quantitative or qualitative system performance evaluation
- Shows success and failure scenarios of systems

- **Weaknesses**

- Analysis quality depends on experience of experts
- Limited to one initiating event per event tree
- May need to collect many to get needed representation for model



EVENT TREE ANALYSIS

(SCENARIO DEVELOPMENT MODEL CONT.)



Process

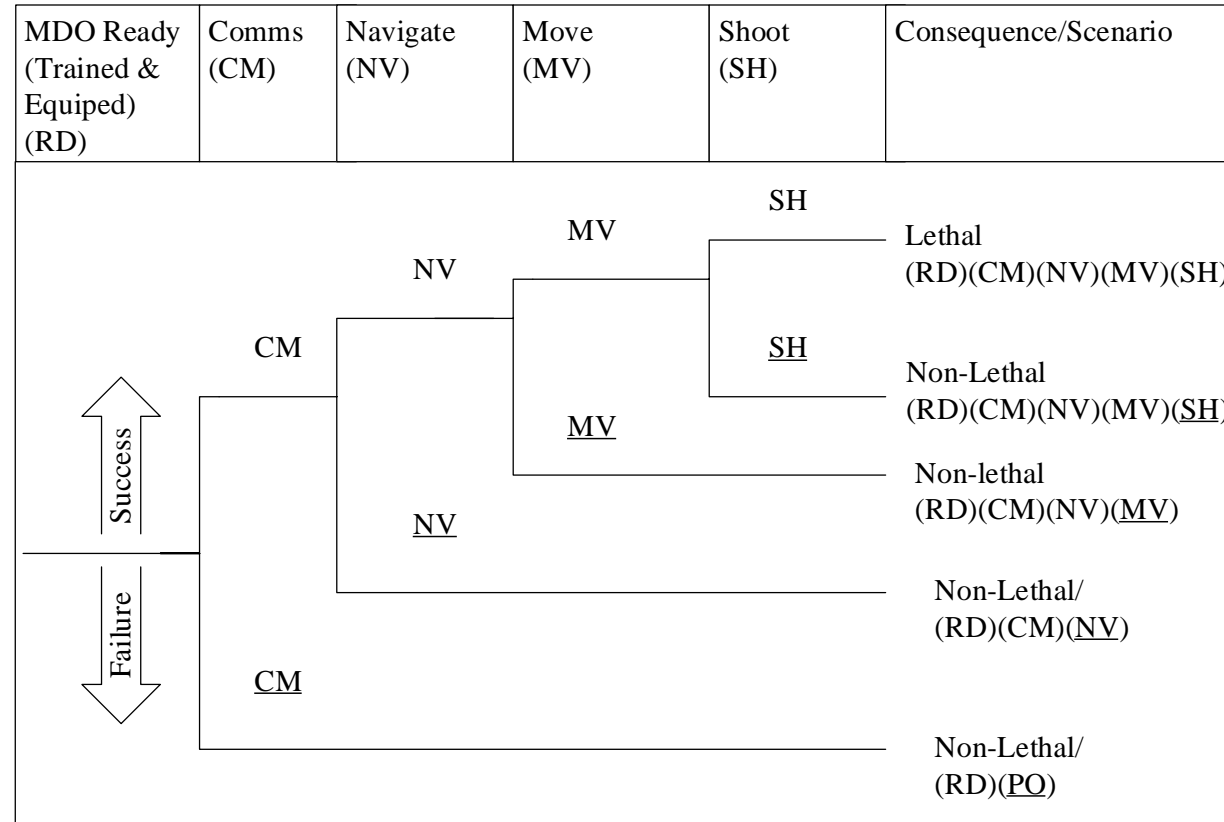
- Define system/activity of interest
- Identify initiating event of interest
- Identify reactionary events (systems functions/task analysis)
- Define follow-on scenarios (both success and failures)
- Identify scenario sequence outcomes
- Summarize results- can quantify the results
- Use the results in decision-making- Decisions regarding systems performance and lethality



EVENT TREE ANALYSIS FOR SOLDIER LETHALITY (Example)



- This modeling approach provides a framework to identify what is needed for a successful Lethality scenario
- Identifies and captures the probability of different states of Soldier-System activity. These states will depend on soldier environment, KSAs, ability to perform tasks in scenarios
- Tasks/Events can be further modeled to provide more comprehensive model. Task reliability or probability of performing the task can be used as a measure of performance.





SUCCESS TREE ANALYSIS

(Boolean logic to describe events)



- **Description**

- Deductive reasoning approach
- Graphical model identifying event combinations resulting in some specific system success or “Top Event”
- Applies Boolean logic relationship between events-equipment functions and/or human tasks successes leading to a successful event (MOE/MOP)
- For human performance-physical and cognitive task analysis can support model development

- **Strengths**

- Excellent for Identifying causes of specific human-system failures/successes
- Used for quantitative or qualitative evaluation

- **Weaknesses**

- Does not account for time dependency
- Tree structure may vary based on analysts knowledge



SUCCESS TREE ANALYSIS



Process

- Define system/activity of interest
- Define the top event(s) for analysis
- Define the sub-events (Actions, tasks, functions, indicators that lead to the top event)
- Identify boolean logic for combining events (AND/OR)
- Solve the success tree for combinations of events leading to the top event success
- Perform quantitative/qualitative analysis
- Use the results in decision-making



SUCCESS TREE EXAMPLE- Communicate Reliability



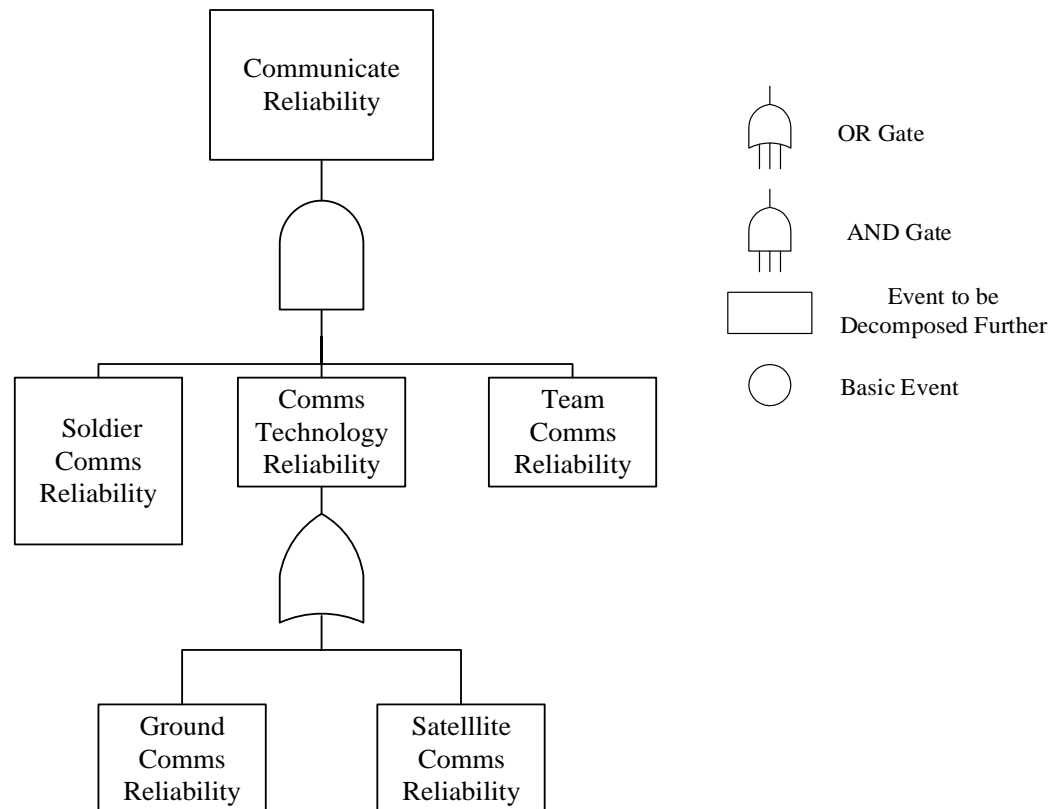
- Success trees provide the Boolean logic for combining events/tasks/functions of the model to an overall aggregated performance for the higher level entity
- This provides a hierarchy of understanding performance elements and combinations.
- When combined with the event tree structure, success trees provide an overall reliability/probability model for overall human-systems performance. In our example the probability of Soldier lethality.

Measure of Effectiveness (MoE) —

A criterion used to assess changes in system behavior, capability or operational environment that is tied to measuring the attainment of an endstate, achievement of an objective or creation of an effect. (JP 3-0); Functional Effectiveness- ex. Communicate Reliability (measureable, collectable, relevant)

Measure of performance (MoP) –

A criterion used to assess friendly actions that is tied to measuring task accomplishment. (JP 3-0); ex. Soldier Comms Reliability



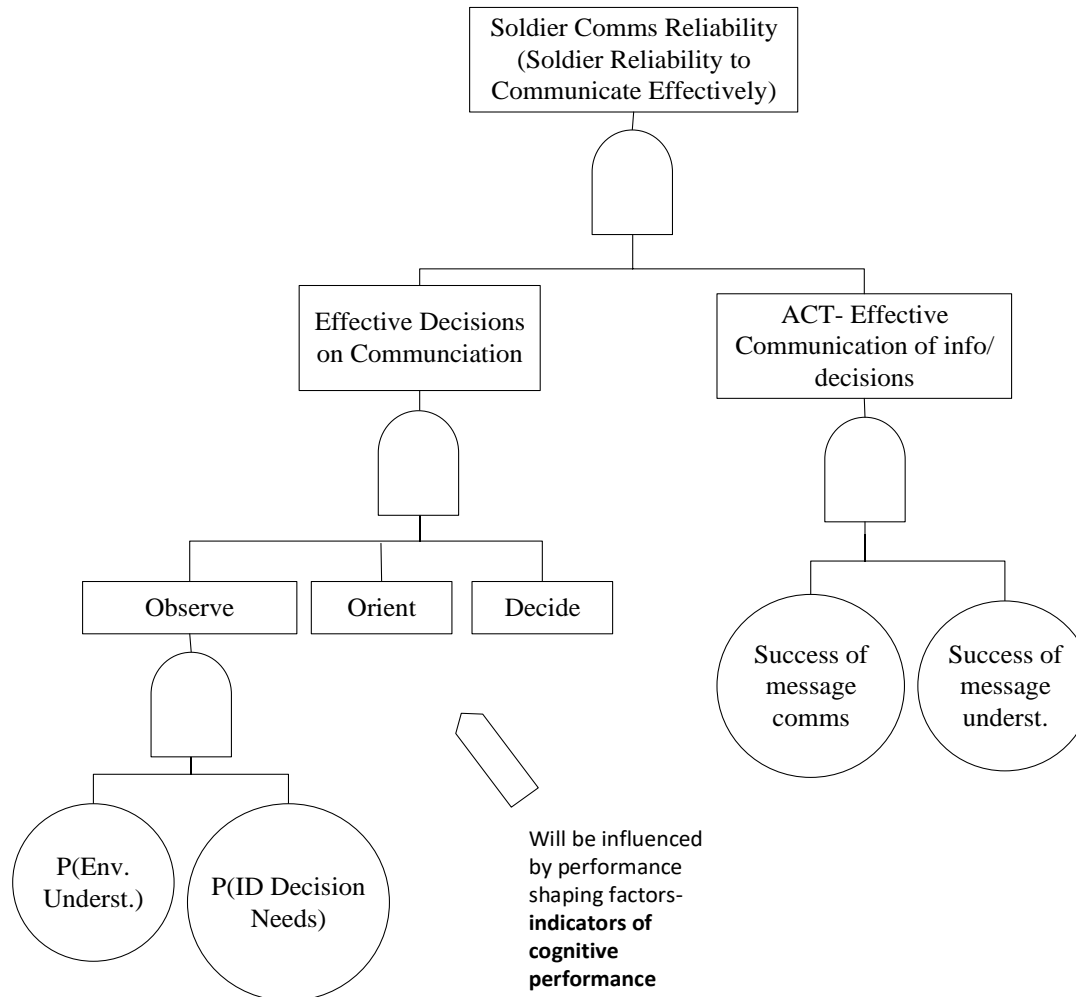


SUCCESS TREE EXAMPLE

COMMUNICATE RELIABILITY



- More detailed model of Soldier Comms Reliability



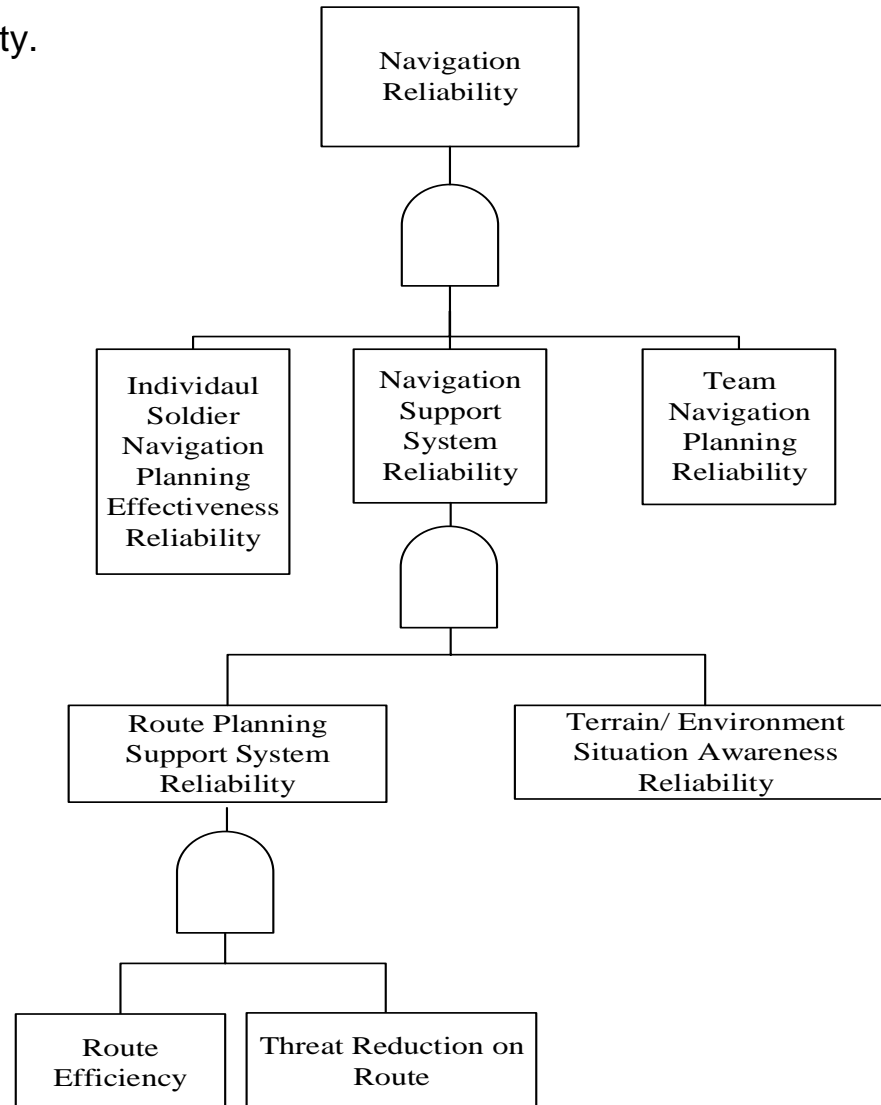


SUCCESS TREE

NAVIGATION RELIABILITY



- Success tree for navigation reliability.

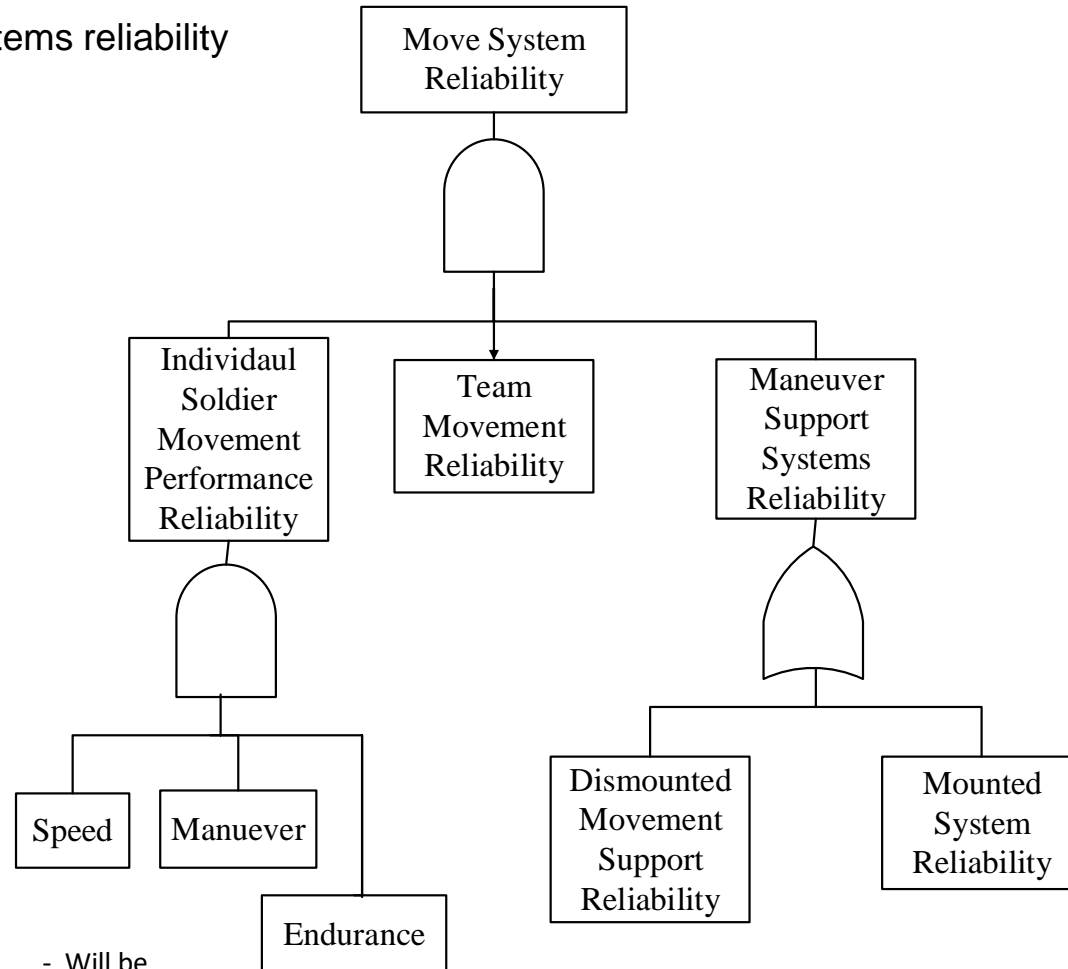




Success Tree Move Reliability



- Success tree for move systems reliability



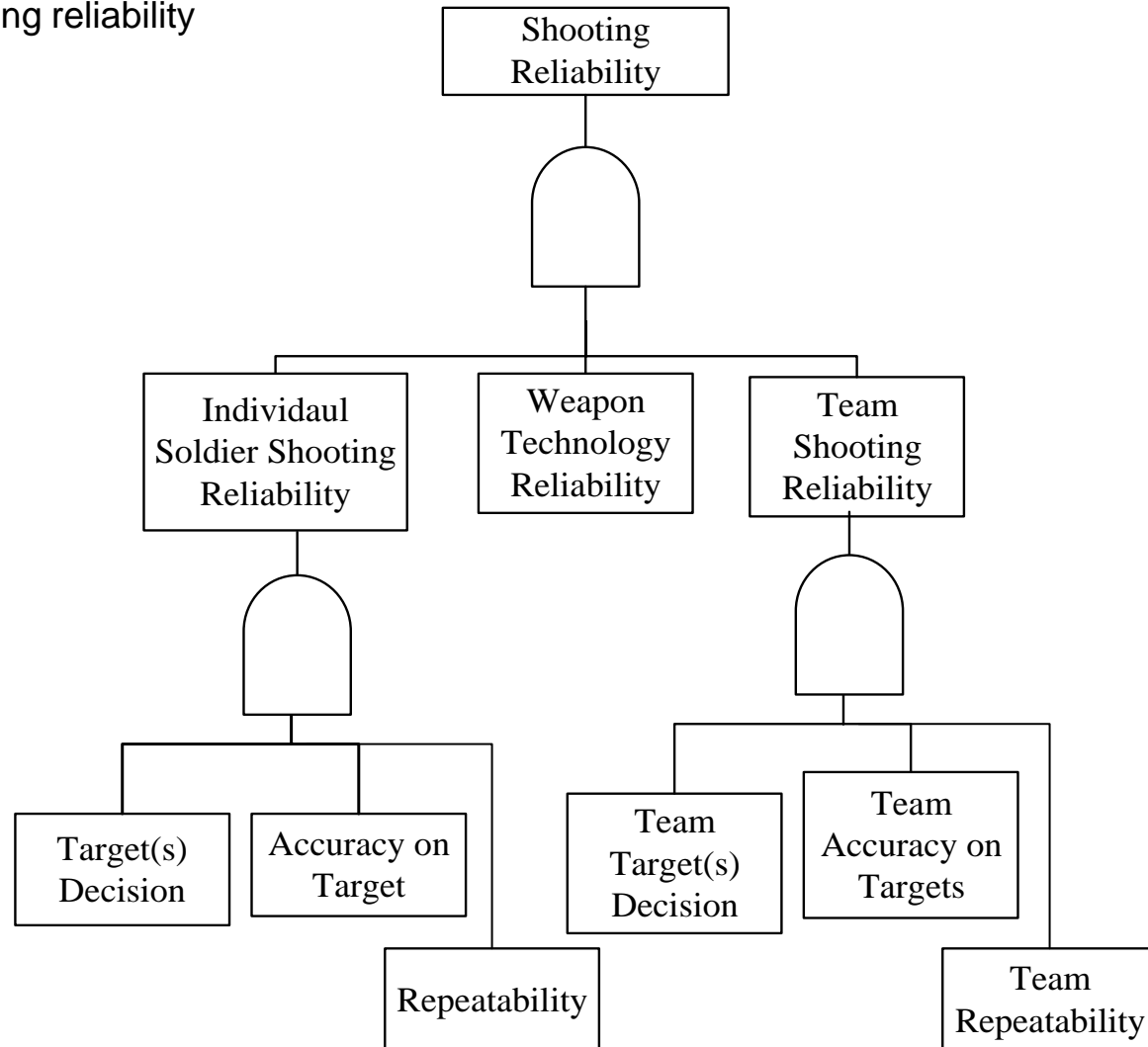
- Will be influenced by **physical performance** shaping factors



SUCCESS TREE SHOOTING RELIABILITY



- Success tree for shooting reliability

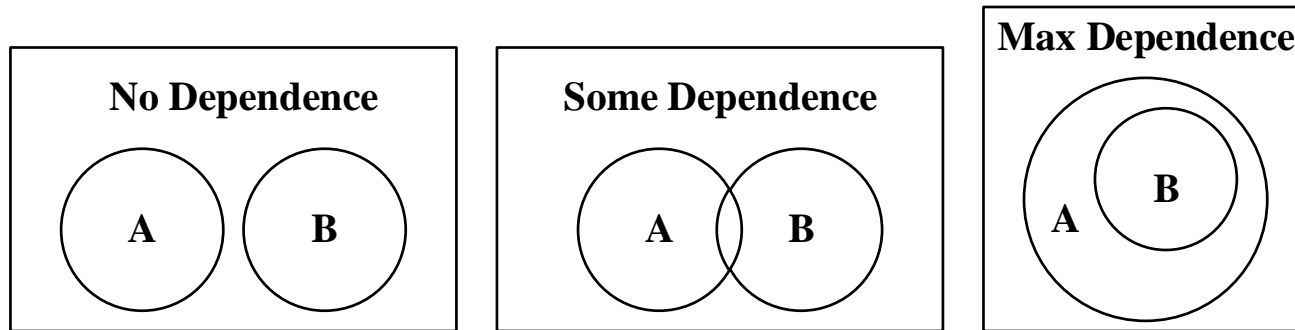




MODEL COMPLEXITY



- Model complexity and accuracy can be improved through better understand of event interactions such as dependency between events.



Union of Events (A U B)	$P(A) + P(B)$	$P(A)+P(B)-P(A)P(B)$ or $P(A)+P(B)-D(\text{Min}(P(A), P(B)))$	$\text{Max}(P(A), P(B))$
Intersection of Events (A I B)	0	$P(A)P(B)$ or $D(\text{Min}(P(A), P(B)))$	$\text{Min}(P(A), P(B))$



QUALITATIVE/QUANTITATIVE ANALYSIS



Qualitative

- Apply when data is lacking
- When cost to obtain data is too high
- When knowledgeable experts are available
- When relative performance measurement is necessary

Quantitative

- When data is available
- When quantitative detail is necessary for decisions
- When absolute performance is necessary

Apply Qualitative/ Quantitative Analysis

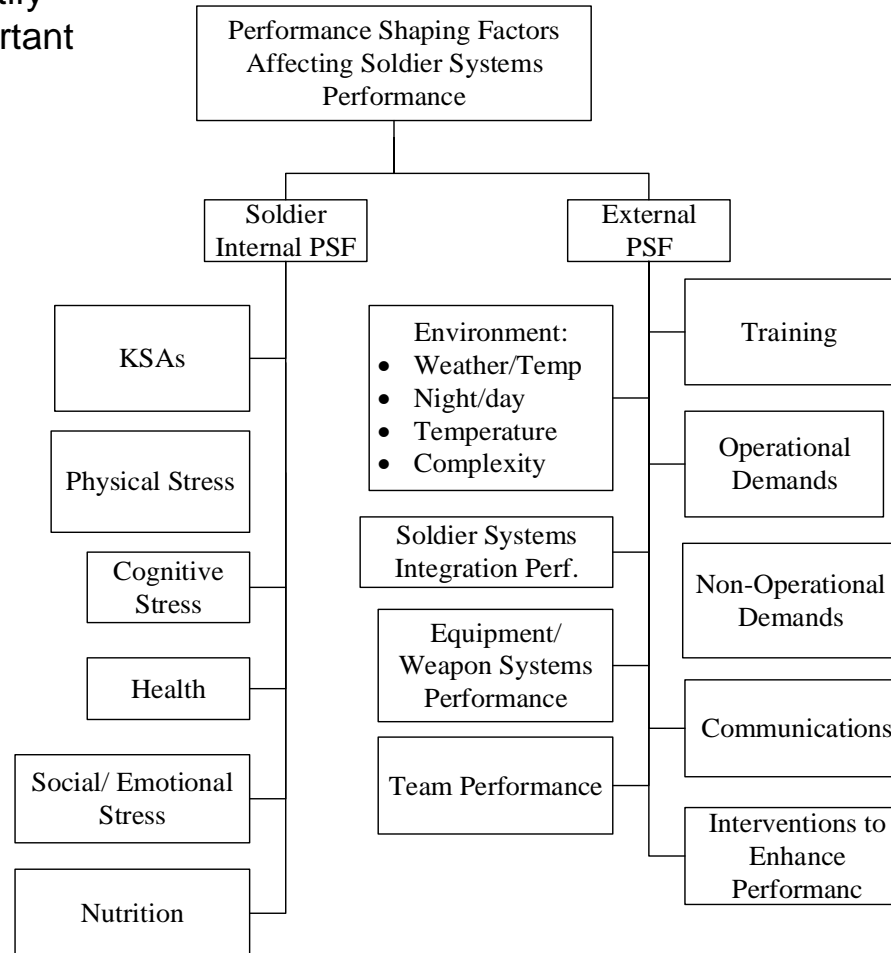
- Consider time/budget/ information
- Both can be used to rank human-systems performance and lethality



Performing Shaping Factors- Means to Monitor and Improve Soldier Systems Performance



- There are many PSFs- indicators impacting overall systems performance
- By increasing the model details and complexity... greater model accuracy is possible
- By maximizing performance conditions under PSF, you maximize performance and lethality
- The model can also identify what PSF are most important





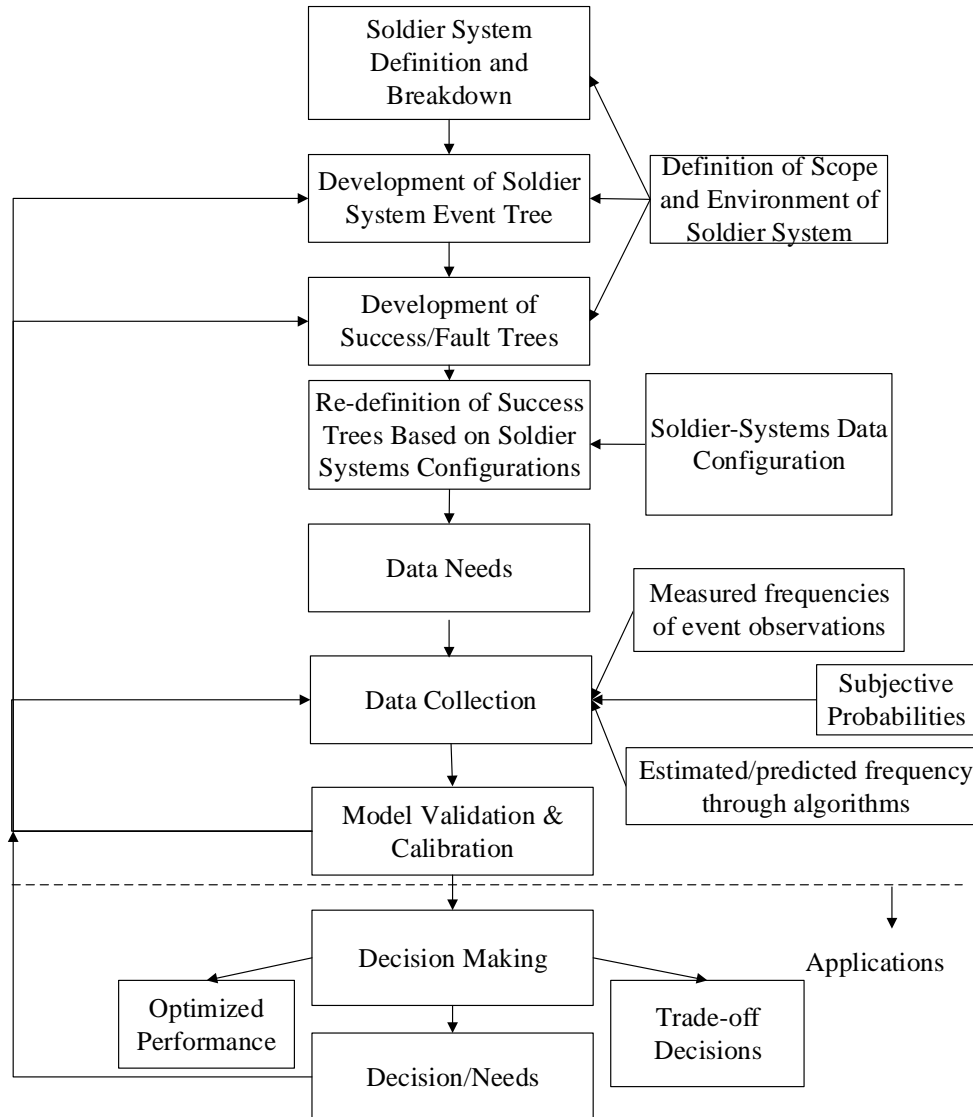
IMPROVING SOLDIER PERFORMANCE AND LETHALITY



- **Improve the Likelihood of Positive Performance-Lethality Probability**
 - Positive Performance Shaping Factors- MOP/ MOE
 - Improved Soldier Systems Integration
 - Improved Task Performance
 - Improved Functional Performance
 - Support Systems Performance- Enhancements
 - Add Redundancy in System
 - Reduce complexity- ex. effective decision support systems



SOLDIER SYSTEMS PERFORMANCE ASSESSMENT AND DECISION METHODOLOGY



March 23, 2021

Revolutionizing Preventative Maintenance Checks and Services with Augmented Reality

Ms. Charis Horner

Product Engineer

Design Interactive, Inc.



The effort depicted is supported by the U.S. Army Research Office. The content of the information does not necessarily reflect the position or the policy of the Government, and no official endorsement should be inferred.

Distribution A/ Unclassified

Agenda

March 23, 2021

01. Need and Opportunity

02. Solution Vision

03. Development

04. Demonstration

05. Applications, Limitations & Future Work

06. Q & A



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Vehicle Maintenance and Multi-Domain Operations

- Vehicle maintenance is critical to Army operations
 - Increasingly so with emphasis on multi-domain operations (MDO)
- MDO requires wide range of Army & Joint capabilities
 - Land domain must be ready to deploy at a moment's notice
- MDO increases importance of mission ready and deployable vehicles



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Preventive Maintenance Checks & Service (PMCS)

- Many existing maintenance processes are analog
 - Reliant on paper-based forms and manuals
- Example: PMCS
 - Dependent on potentially damaged or misplaced paper manuals
 - Limited visibility into vehicle maintenance history
 - Fault escalation relies on easily damaged, lost, or indecipherable forms

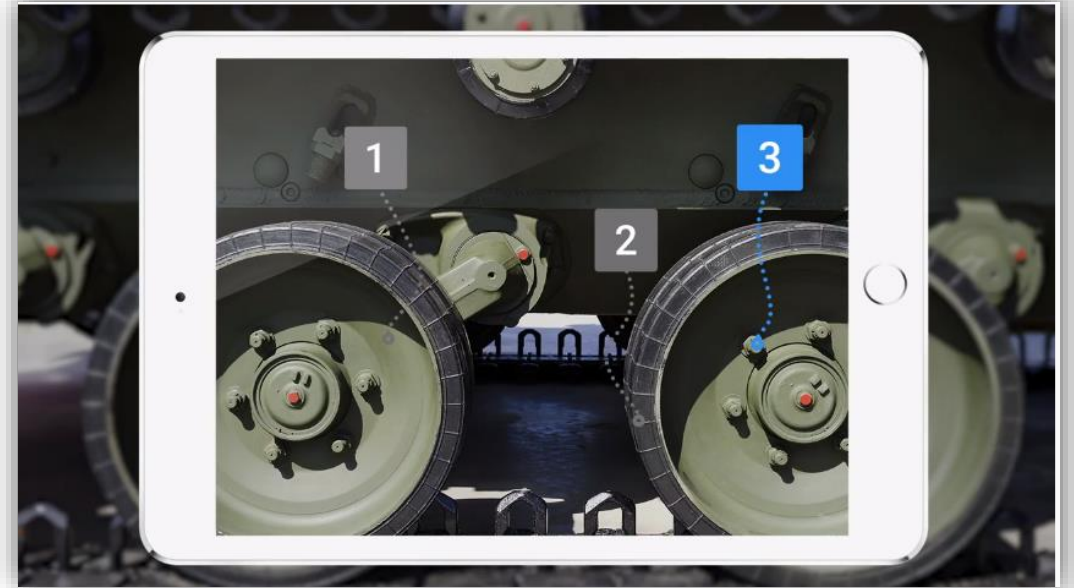
The Battalion needs a way to aid PMCS and accelerate fault escalation from days to hours and minutes, getting vehicles up and running faster



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Augmented Reality (AR) as Enabling Technology

- AR has been shown to immensely benefit maintenance applications
 - Reduce errors, execution time, downtime, and cost
 - Increase productivity, efficiency, compliance, and readiness

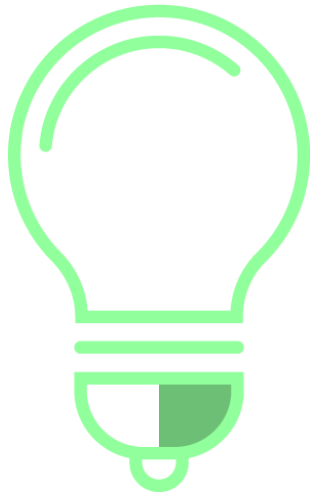


Opportunity: Update paper-dependent PMCS to a digital AR platform, enabling efficiencies in *inspection*, *fault escalation*, and *validation* thereby *reducing PMCS from days to hours and minutes*



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Digital Repair, Inspection, Validation Environment (DRIVE)



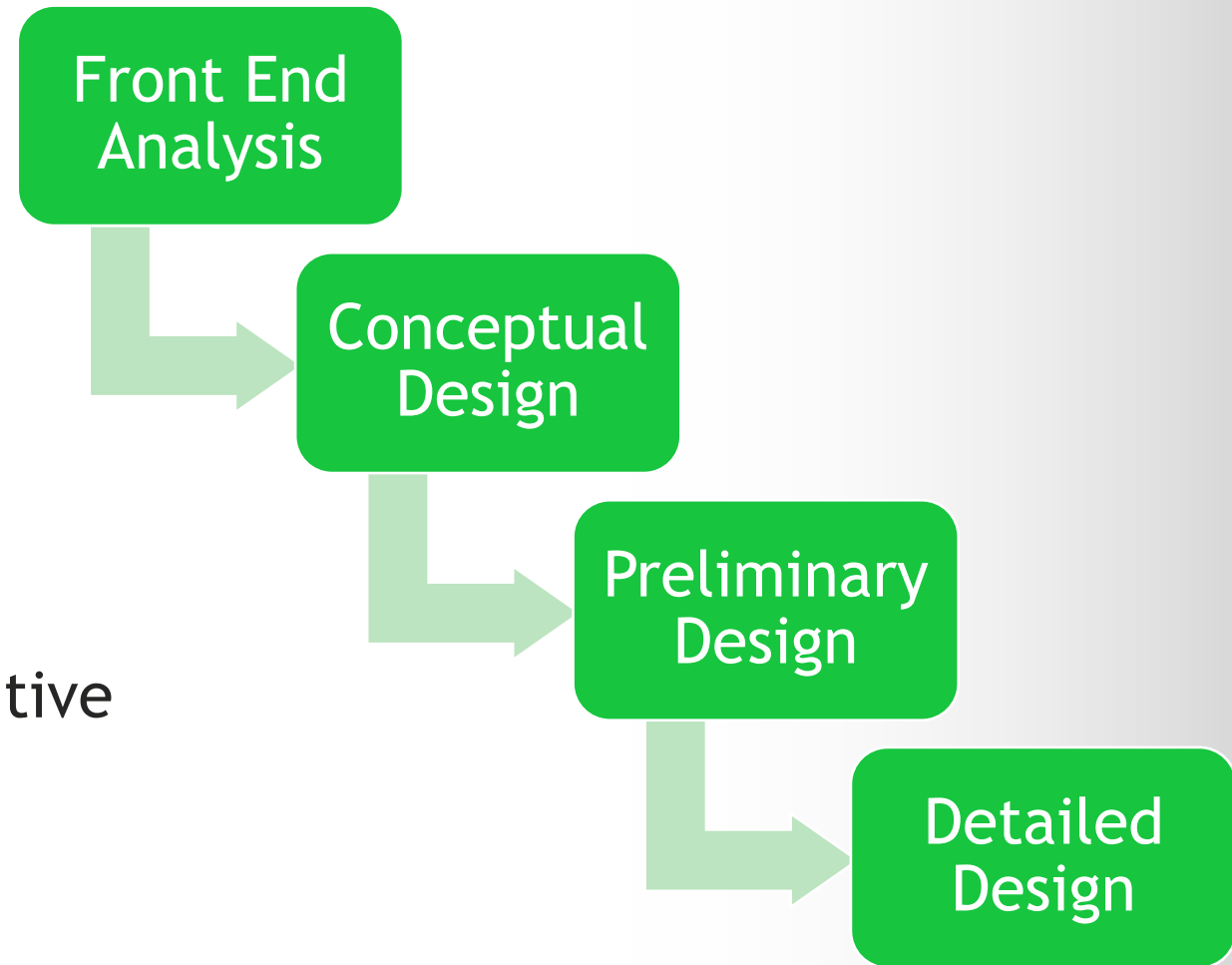
- Soldier-inspired solution providing 21st century update to PMCS
- End-to-end AR solution providing vehicle history, digital fault escalation, and step-by-step procedural guidance
- DRIVE results in an expected **60% increase in efficiency** during individual inspections
- Designed to alleviate frustrations with paper-based processes
 - Introduces point-of-need AR support
 - ***Gets vehicles up and running faster***



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Solution Development

- Employed a rigorous design
 - Ensured solution **empowered Soldiers**
- Key Activities:
 - Field Study conducted at Ft. Hood
 - End User Interviews
 - Application of Human Factors and Cognitive Science Principles
 - Low and High-Fidelity Mockups
 - Usability and End User Evaluations



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RECEIVE Support



IDENTIFY Faults



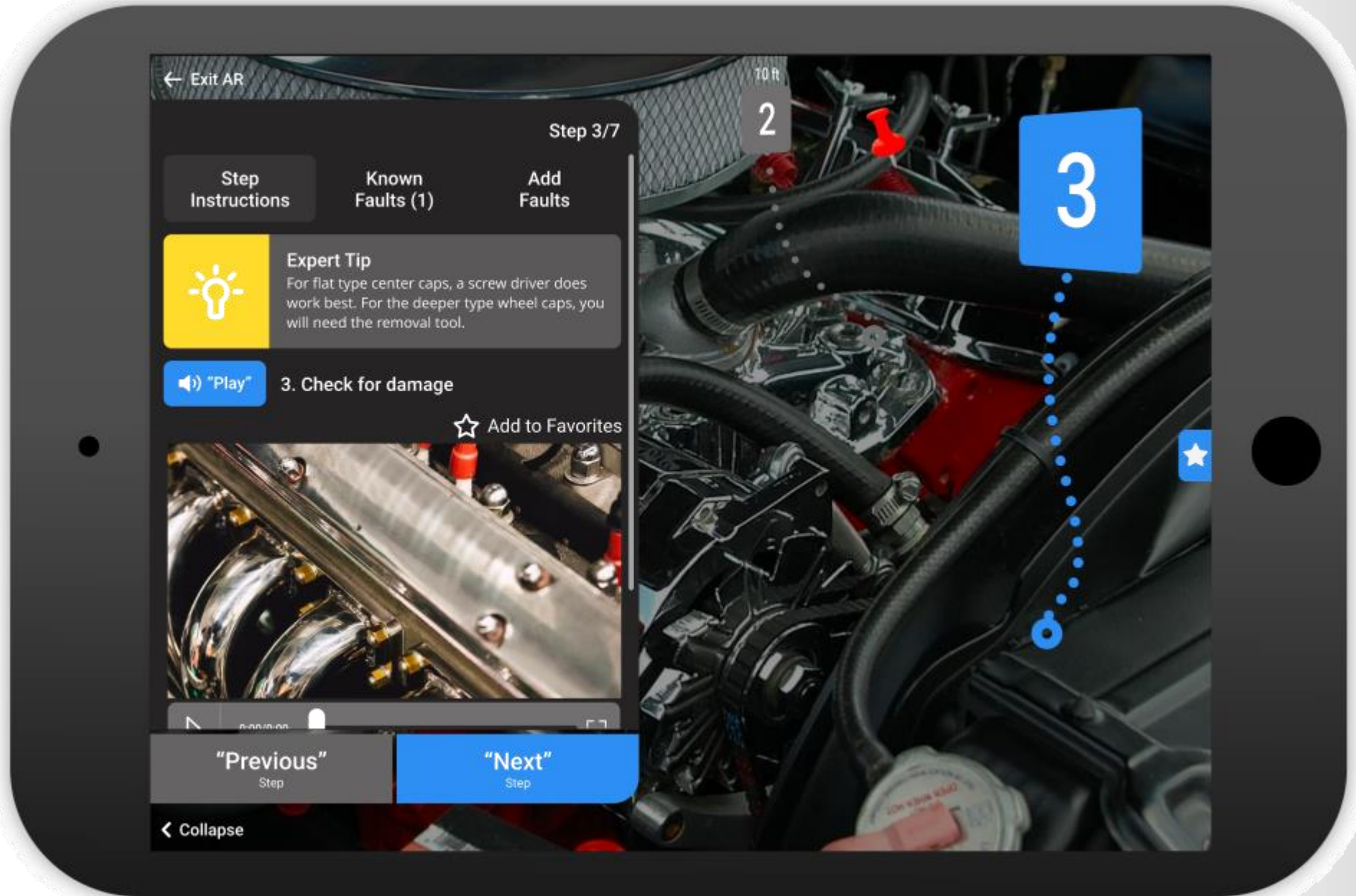
VERIFY Faults



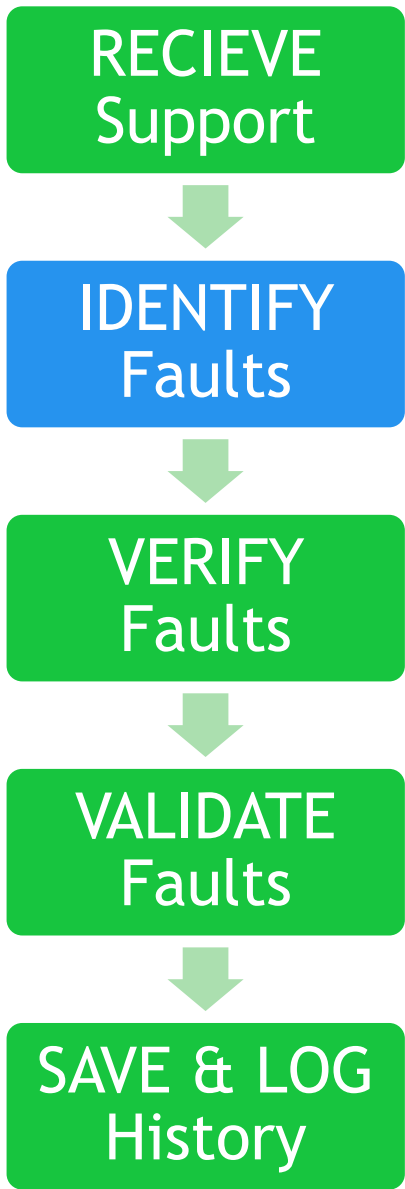
VALIDATE Faults



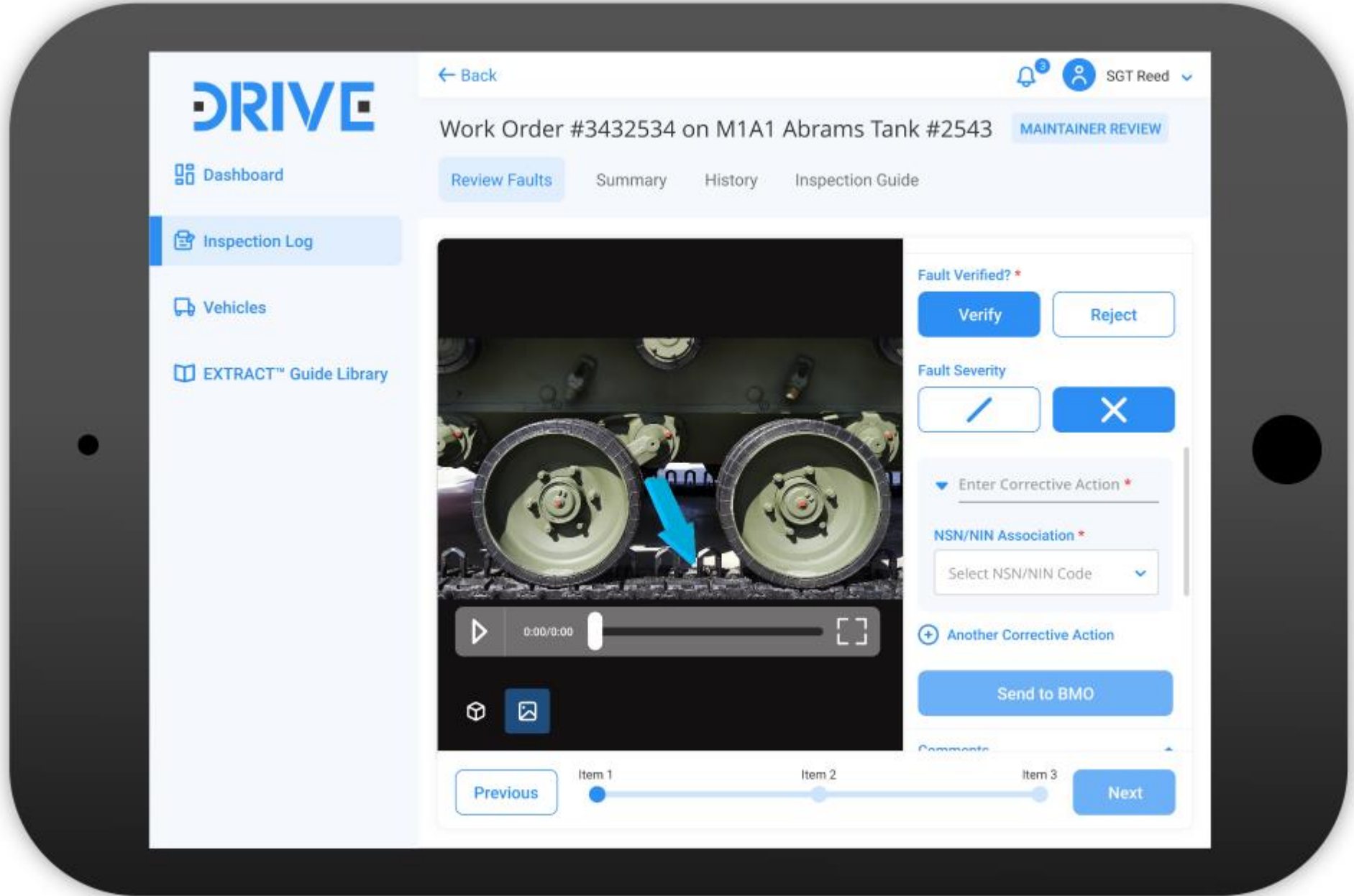
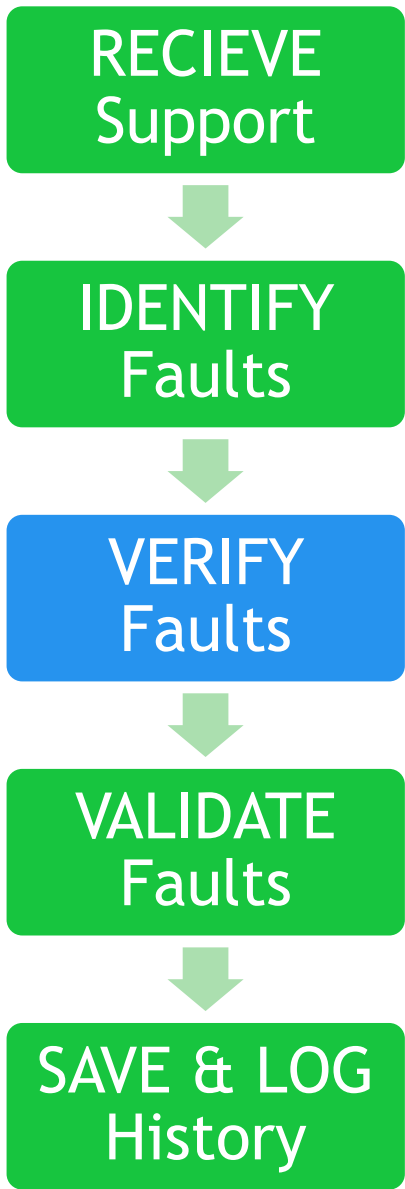
SAVE & LOG History



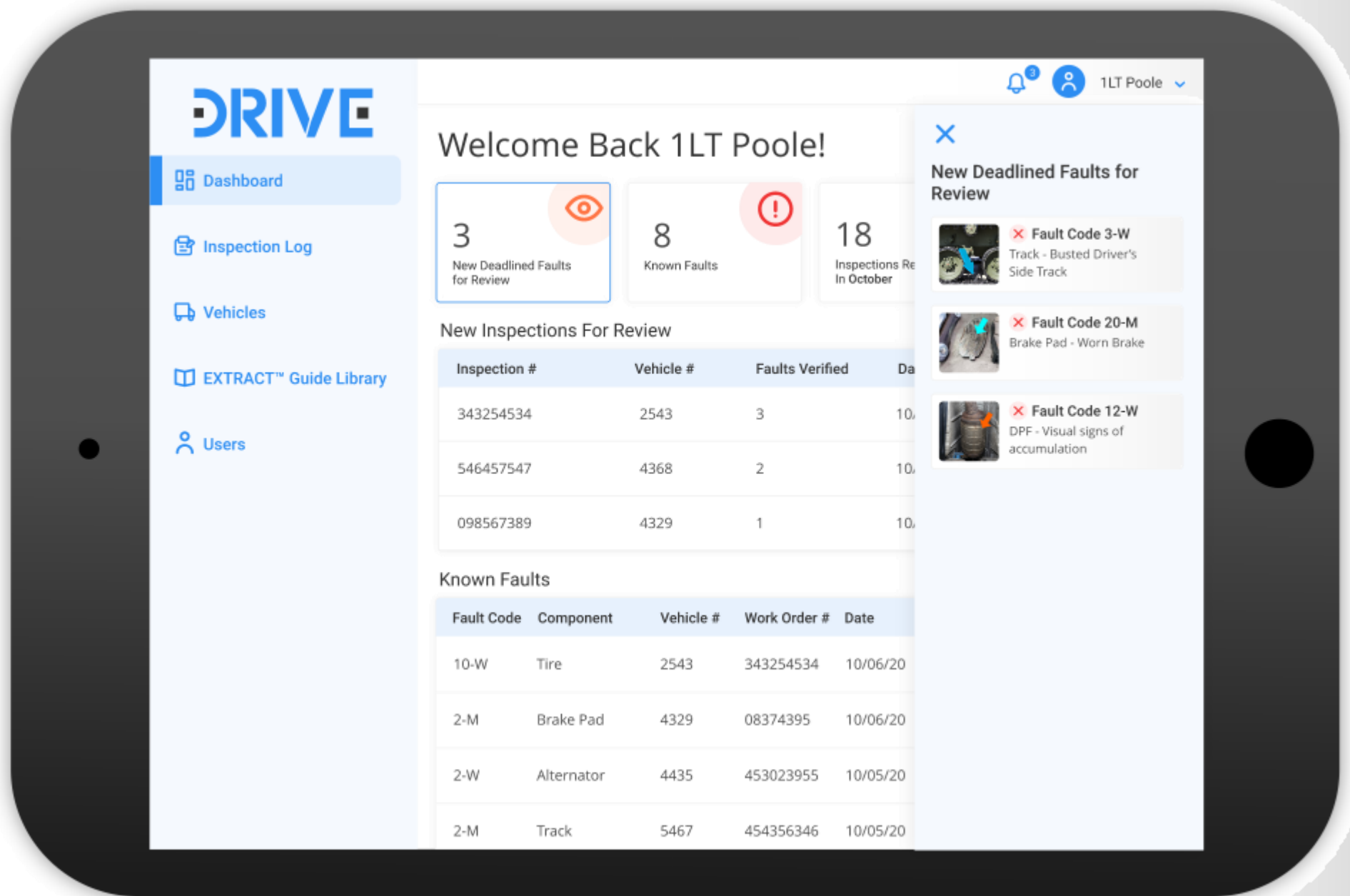
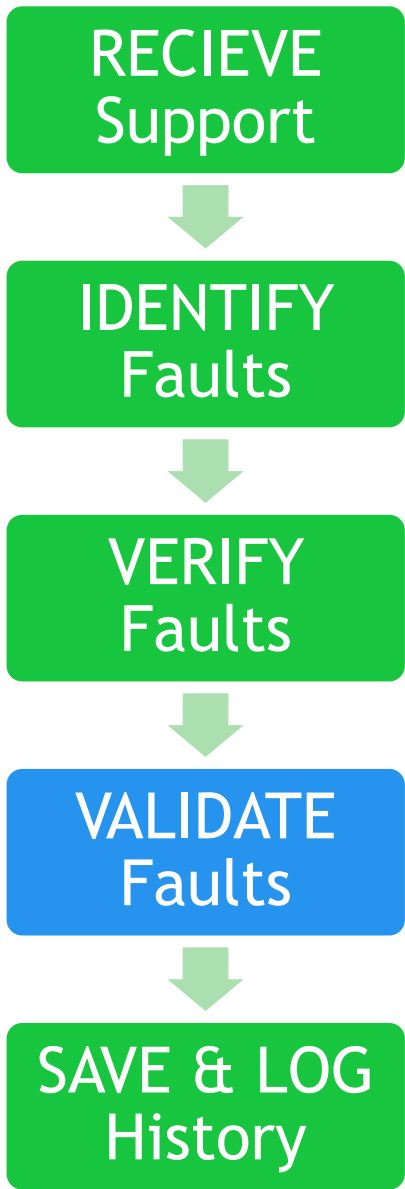
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RECEIVE Support



IDENTIFY Faults



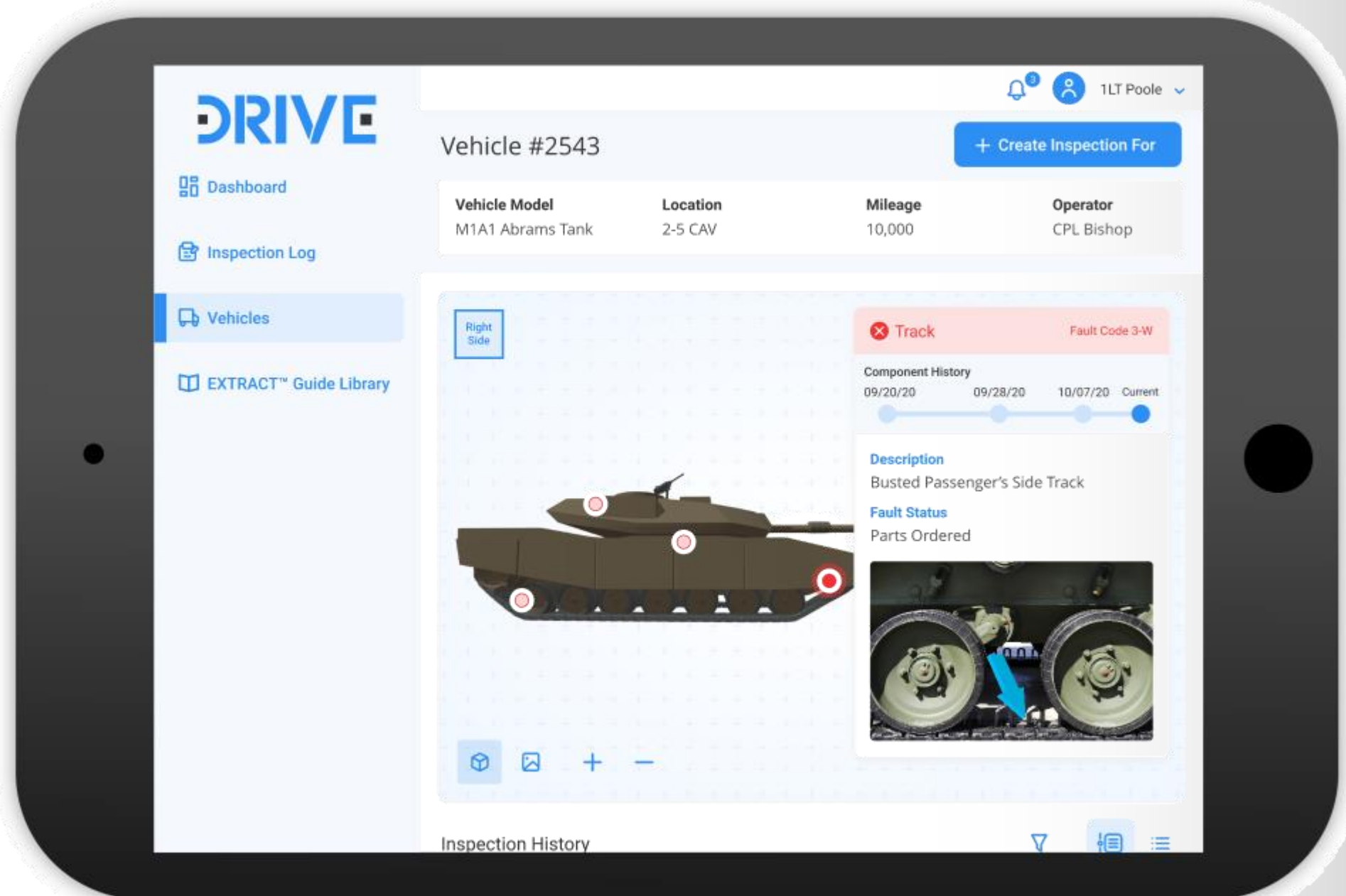
VERIFY Faults



VALIDATE Faults



SAVE & LOG History



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Applications, Limitations, and Future Work

- Applications
 - Army vehicle maintenance - PMCS
 - Commercial vehicle maintenance
 - Any maintenance area with need for fault escalation
- Limitations
 - Requires use of tablet
 - Integration with external systems
- Future Work
 - Full system implementation and on-site evaluation



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Questions/Discussion



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Context-Sensitive Adaptive Framework for Cross-Platform Interaction

Pooja Patnaik Bovard, Ph.D.

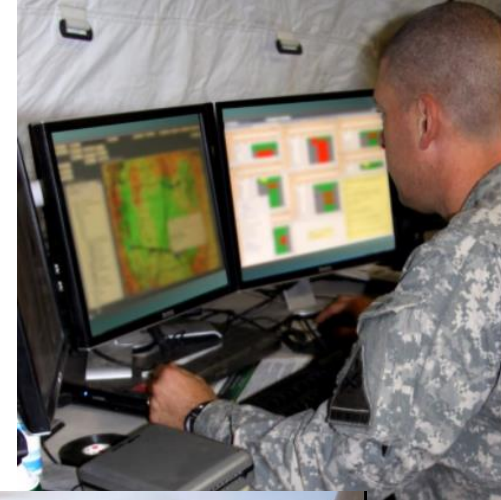
23 March 2021

NDIA Human Systems Conference 2021

DISTRIBUTION STATEMENT A: Approved for public release

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Challenge



Current State of the Art

SOA	Pros	Cons
Simulated environments	Can understand user behavior in mission-specific contexts	Low ecological validity
Suppress notifications when user is engaged in a task	Users are less stressed and more focused on important tasks	Can take attention away from critical information

Our plan	Pros	Cons
Adaptive alerts could focus on prioritized information to make proactive decisions ahead of danger	Reduced cognitive overload when faced with danger	

Use Case

Project Objective: Develop a hands-free, heads-up adaptive ATAK environment prototype that enhances SA and DM for tactical operations



Demonstrate ability to capture and translate relevant voice input in near real-time



Demonstrate ability to monitor and adapt to changing context within ATAK environment



Demonstrate ability to display ATAK content with spatial accuracy



Framework

Pacing/Timing

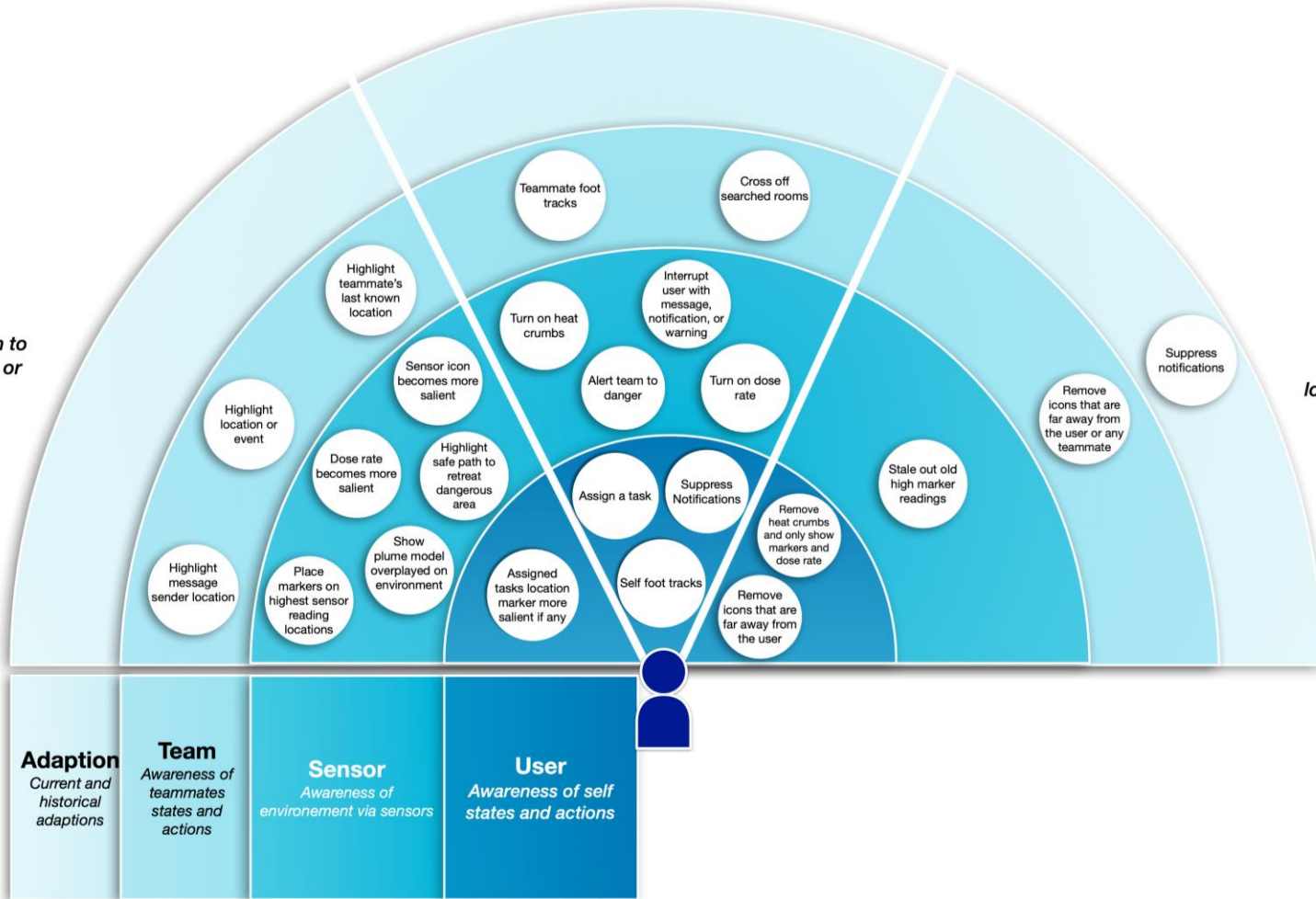
Display the information that makes sense for that specific task at a time when it will be useful

Salience

Draw the user's attention to specific UI components or information

Decluttering

Remove extraneous information that no longer applies to the user



Context

Data/information important for situation awareness in each of these contexts: what, where, when

Adaptive Context Framework

Pacing/Timing

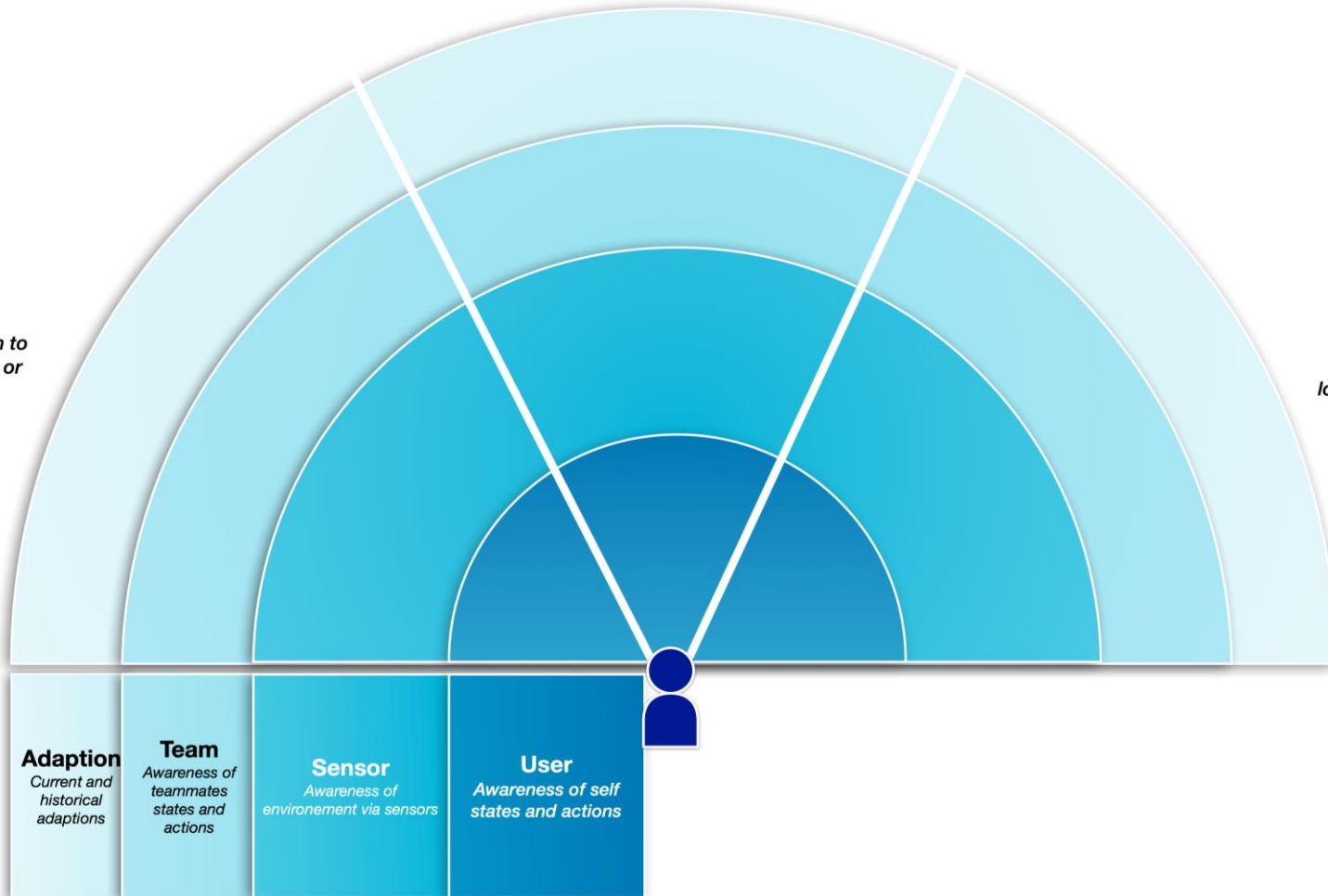
Display the information that makes sense for that specific task at a time when it will be useful

Saliency

Draw the user's attention to specific UI components or information

Decluttering

Remove extraneous information that no longer applies to the user



Adaption

Current and historical adaptations

Team

Awareness of teammates states and actions

Sensor

Awareness of environment via sensors

User

Awareness of self states and actions

Context

Data/information important for situation awareness in each of these contexts: what, where, when

Adaptive Context Framework

Pacing/Timing

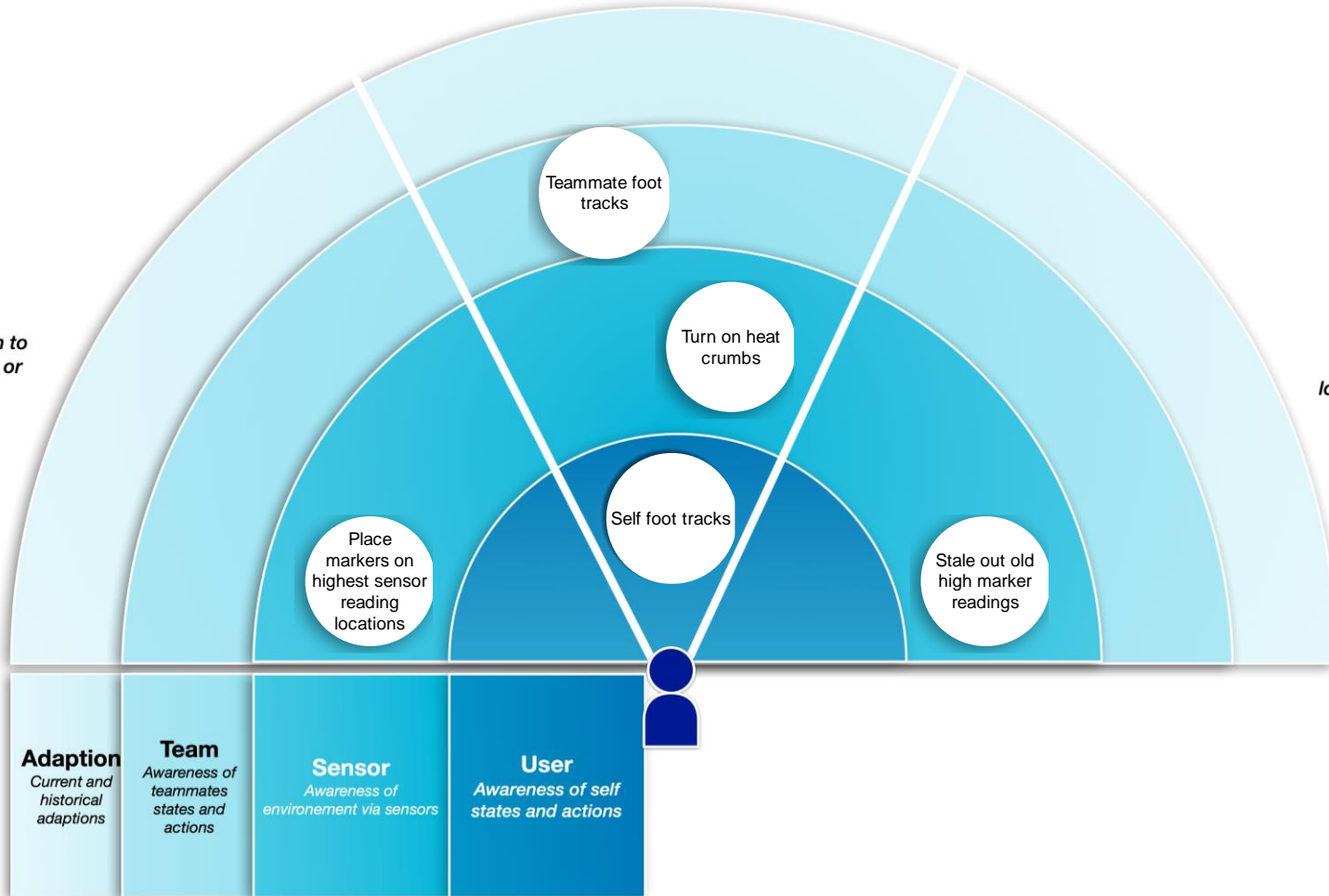
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Decluttering

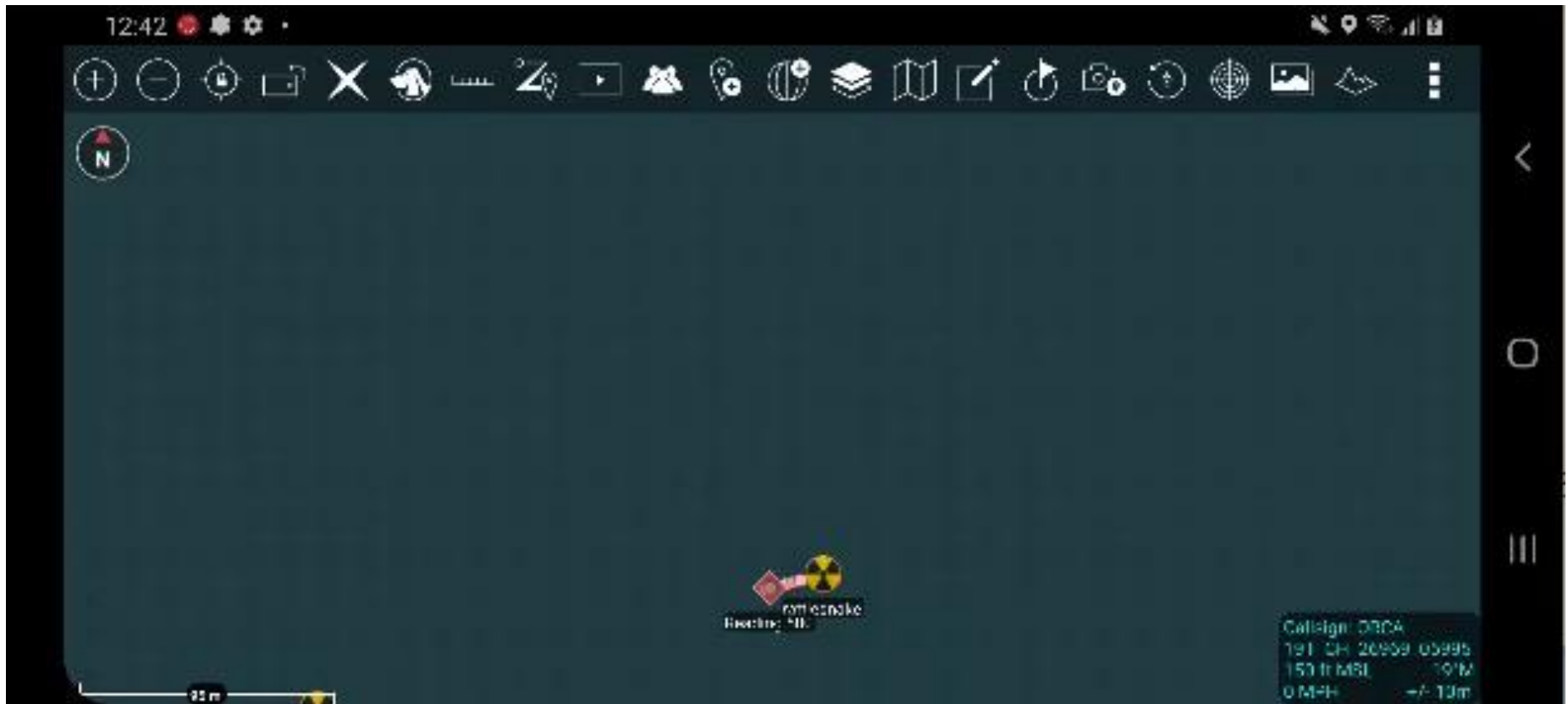
Remove extraneous information that no longer applies to the user



Context

Data/information important for situation awareness in each of these contexts: what, where, when

Demo



Ongoing & Future Work

- Cross-platform testing and validation
 - In the planning stages
- In-depth testing of more advanced adaptations
 - How much can an adaptation help users?
- In-depth testing of more advanced contextual inputs
 - What does the framework look like when we involve multiple contexts?

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- Dr. Kelly Hale
- Emily Weeden
- Eric Collins
- Alex Hamme

Questions?

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Disclaimer Statement

Any opinion, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of DTRA.

Naval Surface Warfare Center, Dahlgren Division



Performance in Noise (PiN)

2/9/2021



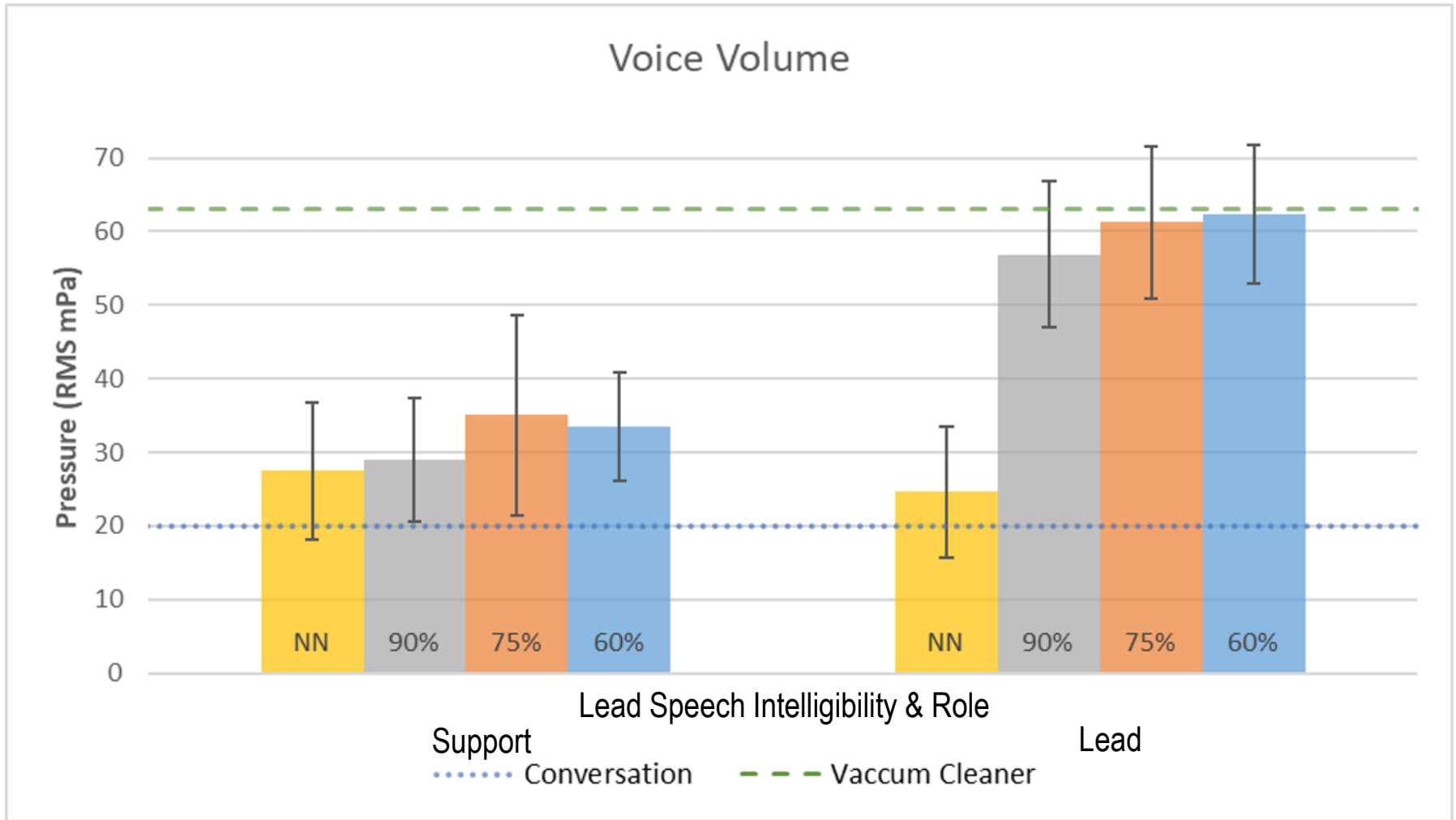
❖ Background

- Military tasks require rapid and reliable vocal communication.
- Tasks often take place in environments with continuous and unexpected noise disrupting. (CIC, flight deck, engine room, etc.)

❖ History of PiN

- Little data was available to quantify effects of noise in environment or Hearing Loss for tactical situations.
- PiN sought to quantify communication noise impact on human performance in a tactical situation.
- In noisy environments performance does suffer. Sailors speak louder, speak slower, communicate less accurately, share less information, and are less focused on visual information.

Example CIC



❖ Cause

- Noisy environments
- Loud environments
- Poor communications equipment

❖ Effect Level 1

- Reduced ability to vocally communicate
- Reduced ability to perform tasks
 - Task time, task accuracy, attention, stress, frustration, yelling, mal-adaptive behaviors, idle time, situation awareness (SA), engagement level, engagement time, alternative communication time, teammate effects, etc.
- Long term hearing damage

❖ Effect Level 2

- Risks mission
- Risks life

❖ **Wear hearing protection**

- Further reduced ability to vocally communicate and to perform tasks

❖ **Neglect hearing protection**

- Further reduces ability to vocally communicate over time

❖ **Active hearing protection**

- High cost, fear of damage, not used

❖ **Increased yelling and asking for repeats**

- Further increases environment noise amplitude, causes delays

❖ **Use text chat, switch station, or move closer to speaker**

- Reduces engagement with tactical system and does not gain full SA
- Increases idle time waiting for response
- Reduces teammate engagement with tactical system and reduces SA

❖ Promising

- Provide augmented 2 way communication aid

❖ Not promising

- Reduce environment noise
- Reduce communications noise
- Provide other modes of 2 way communication
- Provide other modes of 1 way communication

- ❖ **Develop an augmented 2 way communications aid**
 - Deciphers vocal communications for noisy environments
 - Deciphers vocal communications for Navy jargon
(abbreviations, phonetics, numbers, alternate meaning/structure/grammar)
 - Presents easily digestible communication

❖ Phase 1

- Evaluate Speech to Text (STT) Commercial off the Shelf (COTS) models

❖ Phase 2

- Train for specific real Navy jargon
- Train for specific synthetic Navy noisy environments

❖ Phase 3

- Human performance testing

❖ Phase 4

- Generalize for real Navy jargon and real Navy noisy environments

❖ Phase 5

- Transition

❖ Phase 1-2, 4: Select, train, evaluate

- Word Error Rate (WER)
- Jargon Accuracy Rate (JAR)
- F1 Score
- System resource usage

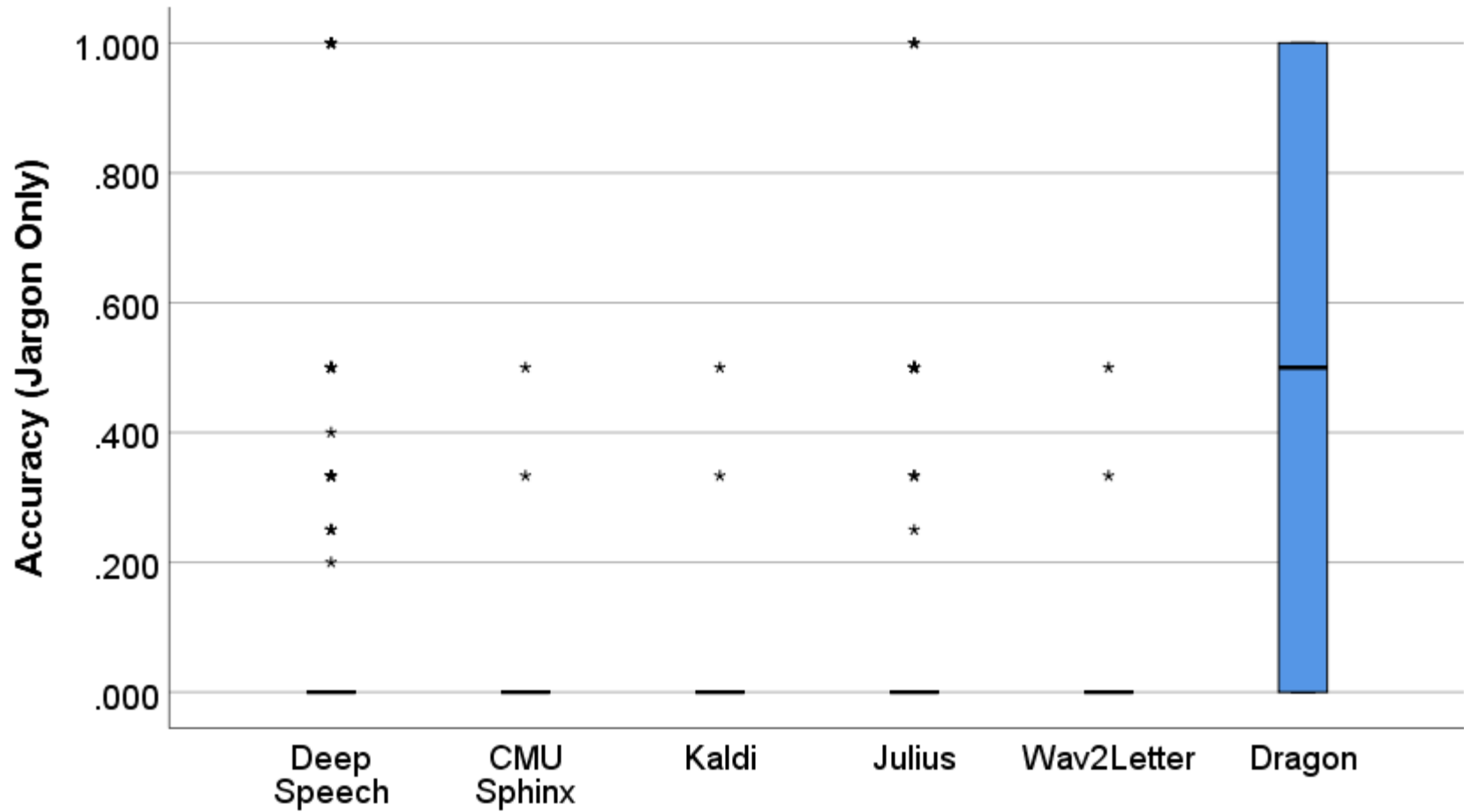
❖ Phase 3: Prototype aid usability & performance

- Task Load Index (TLX)
- Systems Usability Scale (SUS)
- Engagement
- Task time
- SA focus time
- Communications mode changes
- Teammate forced backup
- Eye movements
- Task accuracy
- Behavior changes

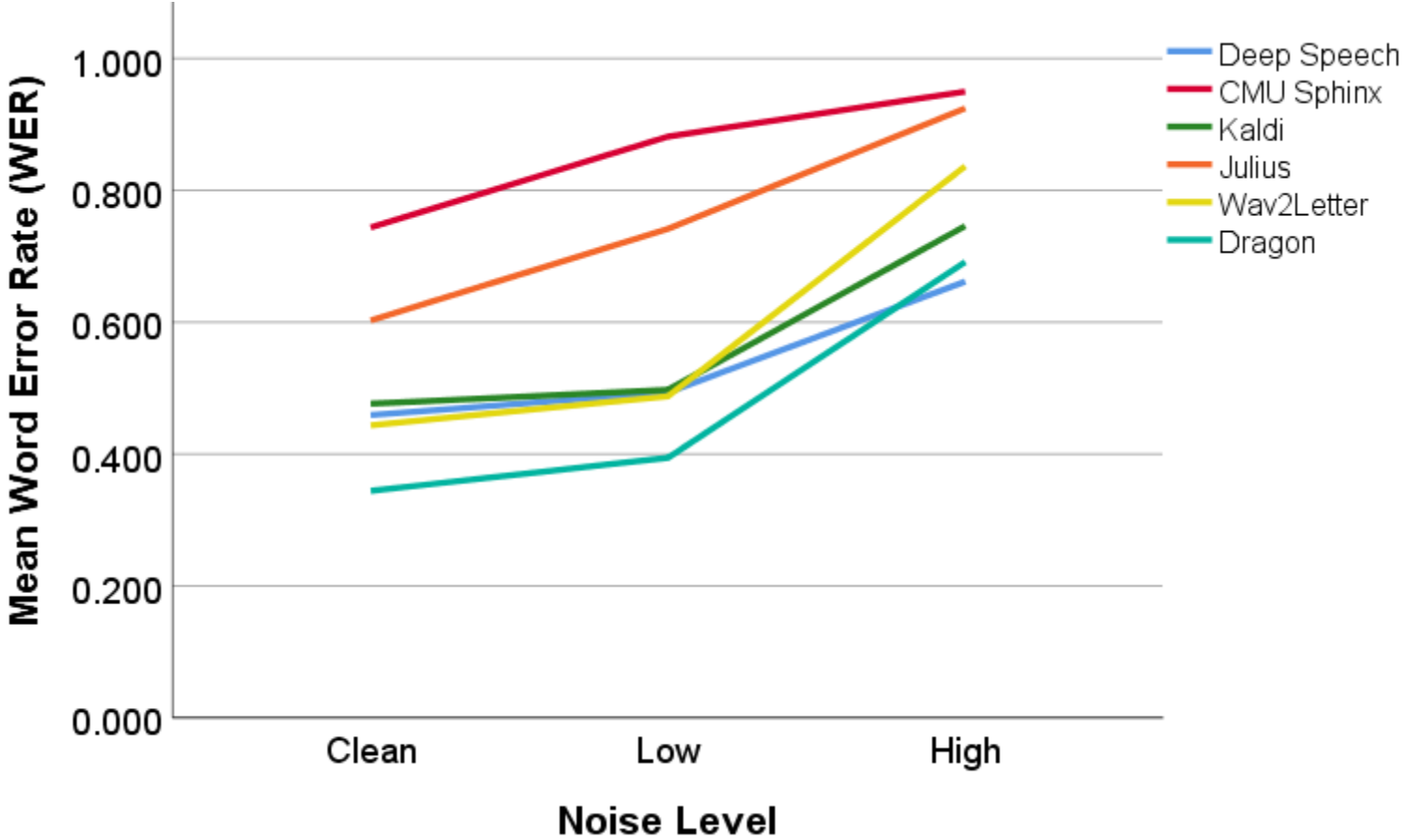
- ❖ **Gather Data** (record, transcribe, identify jargon)
- ❖ **Preprocess** (filter, sample rate, sample depth)
- ❖ **Prepare** (mix noise, slice utterances, summary stats)
- ❖ **Test** (identify metrics, batch process, analyze)

STT	X	Noise Amplitude	X	Noise Type
Deep-Speech (RNN)		None		White
CMU Sphinx (HMM)		Low		Gray
Kaldi (DNN-HMM & GMM-HMM)		High		Pink
Julius (HMM & DNN)				Engine room
Wav2letter (RNN & CNN)				
Dragon (DNN)				

Results: Jargon



Results: Noise





Overall Performance



STT Tool	Jargon Rank*	Performance Rank	Low Noise Rank	High Noise Rank	Cumulative Rank**
Dragon	1	1	1	2	5
Deep Speech	4	3	3	1	11
Wav2Letter	4	2	2	4	12
Kaldi	4	4	4	3	15
Julius	4	5	5	5	19
CMU Sphinx	4	6	6	6	22

❖ Jargon (Initialisms – letter names)

- Dragon out performed all others because it can interpret Initialisms based on letter names

❖ Jargon (Acronyms)

- All tools struggled with inconsistent results due to unique Navy acronyms

❖ Noise

- Deep Speech performed the best in the high noise conditions
- Dragon suffered to cope with intelligibility issues driven by high noise
- Deep Speech performed similarly to several others in the low noise conditions
- Different noises had varying effects at low and high intensities
- White & pink high noise had the greatest adverse effect on STT tool performance
- Machine low noise had the greatest adverse effect on STT tool performance

❖ Selected for continued development

- Dragon: Highest overall performance (all words & jargon) in clean and low noise conditions
- Deep Speech: Most resilient to noise

❖ Limited Jargon Set

- Limited use scope of words
- Initialisms with NATO phonetic alphabet were not fully examined
- Initialisms with NATO phonetic numbers were not fully examined
- Shortenings were not fully examined
- Contractions were not fully examined
- Alternate meaning/structure/grammar was not fully examined

❖ Floor Effects

❖ Ideal Microphone Performance

❖ Generic Machine Noise Profile

❖ Development

- Early results are promising and provide motivation to continue development
- Training for specific real Navy jargon
- Training for specific synthetic Navy noisy environments
- Human performance testing
- Incorporating fixes to existing limitations

❖ Impacts

- Warfighter communications improvements
- Warfighter task performance improvements

❖ Spin off

- Warfighter use of voice controlled systems



Acknowledgements



- ❖ Office of Naval Research, Code 34
- ❖ Sonalysts

**TECHNICAL MANUAL
LEADER'S/OPERATOR'S
MANUAL
FOR
HUMAN, MULTI-DOMAIN**

**BG(Ret) Pete Palmer
Dpty Chair NDIA HSD**



Value Proposition for a PMCS Approach



- Provides detailed assessment of a soldiers' operational readiness for that day's mission
- Expands a soldier's and his/her leaders understanding of Human Systems especially in the Cognitive and Belief Domains
- "One off" to "Known" Program - Known POR will provide platform for technology transition (Human Toolbox)
- Daily and sensor reporting will lead to "Big Data" analysis
- Soldier baseline and updated operating profiles can be feed into advanced STE training systems.
- Soldier baseline and updated operating profiles will provide significant enhancement of data necessary to do detailed Human System Engineering.

Soldier -10 PMCS Manual Content



Chapters

Chapter 1 – Introduction

Chapter 2 – Human/Soldier’s Operating Systems.

Chapter 3 – Soldier’s Operational Baseline (SOB), Soldier Annual Service Checks (SAS), Pre/Post Deployment Checks, Services and Procedures:

Chapter 4 – Soldier Systems Daily PMCS Checks.

Appendices

Appendix A – Human Systems Toolbox.

Appendix B – List of Abbreviations.

Appendix C – Human Systems Checklists, Reporting Forms and Records.

Appendix D – Glossary.

Appendix E – References.

Chapter 2 – Major Human Systems Categories:

SECTION III. HUMAN PHYSICAL OPERATING SYSTEMS (BODY)

- Genome
- Physical Systems
- Cognitive Systems
- Beliefs Systems

2-5 Introduction to Physical Systems (Body)

2-5.A Physiological Overview of the Human Body

2-5.A.1 Human Body: The human body is the structure of a [human being](#). It is composed of many different types of [cells](#) that together create [tissues](#) and subsequently organ systems. They ensure homeostasis and the viability of the human body. It comprises a head, neck, trunk (which includes thorax and abdomen), arms and hands, legs, and feet. The study of the human body involves [anatomy](#), [physiology](#), [histology](#) and [embryology](#). The body [varies anatomically](#) in known ways. Physiology focuses on the systems and organs of the human body and their functions. Many systems and mechanisms interact in order to maintain homeostasis, with safe levels of substances such as sugar and oxygen in the blood.

- Wiki – [List of Systems of the Human Body](#)
- Wiki – [Human Body](#)
- YouTube – National Geographic – [Human Body 101](#)

2-5.A.2 Composition of the Human Body: “Body composition may be analyzed in various ways. This can be done in terms of the [chemical elements](#) present, or by molecular type e.g., [water](#), [protein](#), [fats](#) (or [lipids](#)), hydroxyapatite (in [bones](#)), [carbohydrates](#) (such as [glycogen](#) and [glucose](#)) and [DNA](#). In terms of tissue type, the body may be analyzed into water, fat, [connective tissue](#), [muscle](#), bone, etc. In terms of cell type, the body contains hundreds of different types of cells, but notably, the largest *number* of cells contained in a human body (though not the largest mass of cells) are not human cells, but bacteria residing in the normal human gastrointestinal tract.” (Wiki – [Source](#))

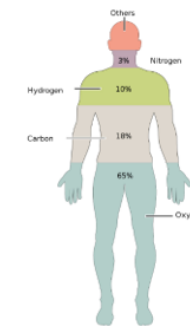


Diagram 2-5.A.3 ([Source](#))

Chapter 2 – Human Subsystems Information:

- **General description of the human subsystem**
- **Importance to Soldier’s Operational Readiness**
- **Factors Influencing the Operational Performance**
- **How to Access the human subsystem**
- **How to maintain or correct deficiencies at the Soldier level**
- **Additional References and Information Resources**

Chapter 3 – Human Baseline/Annual/Deployment



7

Assessment Areas	Characteristics for SOB/S-COP	Assessment Methods	Examination			Records (If Changed)				
		(Note: Need to determine which tests are good enough for baseline and follow on examinations)	SOB	S-AOR	S-P/P DOR	Med	SOB	S-AOR	S-P/P DOR	S-COP
Medical Health	Short Term Medical Issues	Procedures outlined in DD Form 3024 Apr 2016 Navy and Marine Corps TM NMCPHC-TM OM6260 - Medical Matrix Clinical Methods, 3rd Edition	X	X	X	X		IC	IC	IC
	Long Term Medical Issues		X	X	X	X	X	IC	IC	IC
	Medical Surveillance		X	X	X	X	X	IC	IC	IC
	NIH - Clinical Methods		X	X	X	X		IC	IC	IC
Anthropometric/ Body Type	Height	AR 600-9 Outlines checks for Body Composition, Bioelectrical Impedance Analysis FM 21-20 Chp 5 Body Composition (Old)	X	X	X	X	X	IC	IC	IC
	Weight		X	X	X	X	X	IC	IC	IC
	Girth		X	X	X	X	X	IC	IC	IC
	Bone Density		X	X	X	X	X	IC	IC	IC
	Body Fat		X	X	X	X	X	IC	IC	IC
	Body Circumferences		X	X	X	X	X	IC	IC	IC
Skin and Appendages	Skin & Appendages Overview	Clinical Methods - Skin and Appendages Exam - Fitzpatrick Scale	X	X	X	X	X	IC	IC	IC
	Type: normal, <u>dry</u> , oily, combination, sensitive		X	X	X	X	X	IC	IC	IC
	Burn Risk Type		X	X	X	X	X	IC	IC	IC
Hydration	Total Body Water (TBW)	Blood Indices, Urine Indices, Bioelectrical Impedance Analysis	X	X	X	X	X	IC	IC	IC
	Fat-Free (FMW)		X	X	X	X	X	IC	IC	IC
	Pulmonary System	Clinical Methods - Overview	X	X	X	X	X	IC	IC	IC

Chapter 4 – PMCS

1. Self Assessment Done Daily 20-30 Min
 - a. Before Checks
 - b. During Checks
 - c. After Checks
2. Soldier must think through all his human systems and subsystems to ID issues that might affect that day's mission
3. The Soldier must then Rate himself/herself as:
 - a. Fully Mission Capable (FMC)
 - b. Limited Mission Capable (LMC) and Why
 - c. Non-Mission Capable (NMC) and Why
4. Report – Ideally by App and/or direct sensor feed

NOTE: This is an initial draft will need assistance from experts and operators on what is reasonable to check and how to assess their status

SOLDIER/LEADER CHECKS - COGNITIVE HUMAN SYSTEM TM PMCS						
Item No	Interval			Functions to be Inspected	Procedures Check for & have repaired or adjust as necessary	Not Mission Ready
	B	D	A			
NOTE - the term "Mission" includes: Operations, Training, Education, Personal Maintenance or that <u>days</u> activities. Assessments needs to consider impact of Cognitive faults and Below Baseline Normal Performance for that day's Mission(s)						
NOTE - Annotate all faults, readiness ratings, and corrective actions on digital tablet DA <u>Form</u> 4988-H or manual DA Form 2404-H						
NOTE - Cognitive Checks are critical for Leaders and Commanders who must make operational decisions at all level. For those leaders who are assessed at LMC they will need to look for decision making support assistance to reduce risks. For those leaders who are assessed to be NMC they or their superiors will need to determine if they should or should not participate in that <u>days</u> mission(s) or has support assistance to reduce operational risks. In either case the leader him/herself needs to understand their limitations for that <u>days</u> mission.						
C1	X	X	X	General Behavior	Check to see if the soldier is exhibiting behavior/actions that are not in line with his/her normal behavior - if <u>so</u> then go to detailed checks in the area you identify as the potential issue/problem and/or refer to appropriate medical/psychological support. For leaders and commanders check to see if their decision making actions our outside his/her norms (irrational, slow, not in line with normal behavior)	FMC - if no impact on mission LMC - if behavior issue(s) could <u>degrade</u> mission success NMC - If behavior threatens Mission Success or personal safety
C2	X			<u>Executive Functions (EF)</u> Attention Control Cognitive Inhibition Inhibitory Control Working memory Cognitive Flexibility Spatial Reasoning Planning Fluid Intelligence	Check to see if the soldier is below or above his EF S-COP using either a short Q&A or ideally a EF App test (e.g. Stroop's Test) - <i>Note make list of EF Tool Box Tools that could be used for this assessment.</i> Determine potential cause (e.g., Sleep deprivation, other). Based on the degree beyond normal determine impact on mission and personal safety. If there is	FMC - if no impact on mission LMC - if behavior issue(s) could <u>degrade</u> mission success NMC - If EF test is well below <u>soldiers</u> norm and it will <u>effect</u> the success of the mission or learning abilities or personal safety

PMCS Checks – 4 Basic Questions:



- 1. Using the PMCS checklist are any of your systems working below normal or has an issue?**
- 2. Based on any identified issues how will they impact today's mission? Can these issues be mitigated?**
- 3. If you are opposing someone during this day's mission can the opposition use any of my issues or biases to gain an advantage? Can I mitigate that advantage?**
- 4. If you are a leader/commander how will your subordinate unit's operational readiness reports affect today's operational mission?**

Questions



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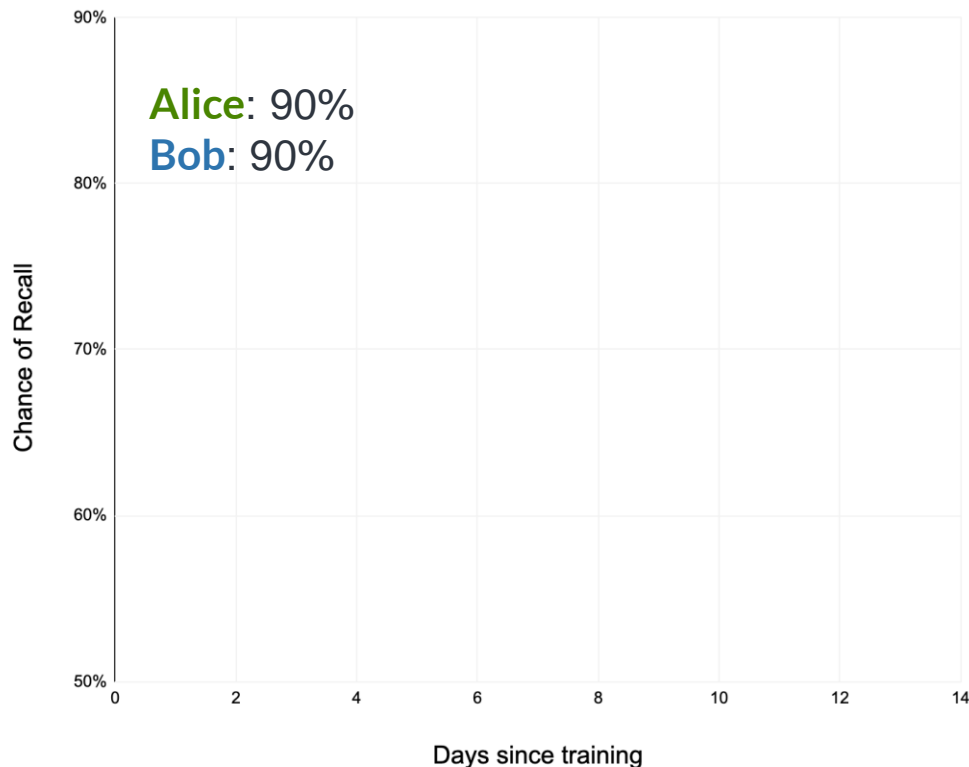
Readiness in Real-Time

Using cognitive science and AI to predict human capability

Forgetting is the key to learning.

Alice & **Bob** both take an exam after training, and both score 90%.

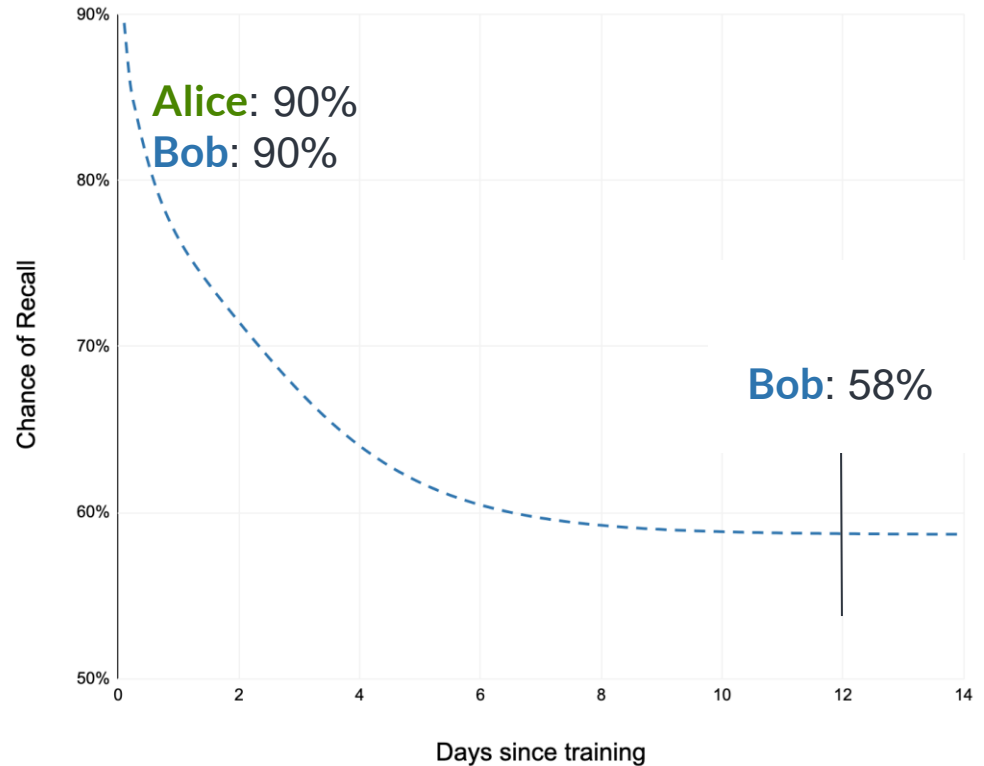
The Forgetting Curve



The more time passed since training, the less fresh it is.

Bob shows a typical forgetting curve, his memory for the material fades without reinforcement.

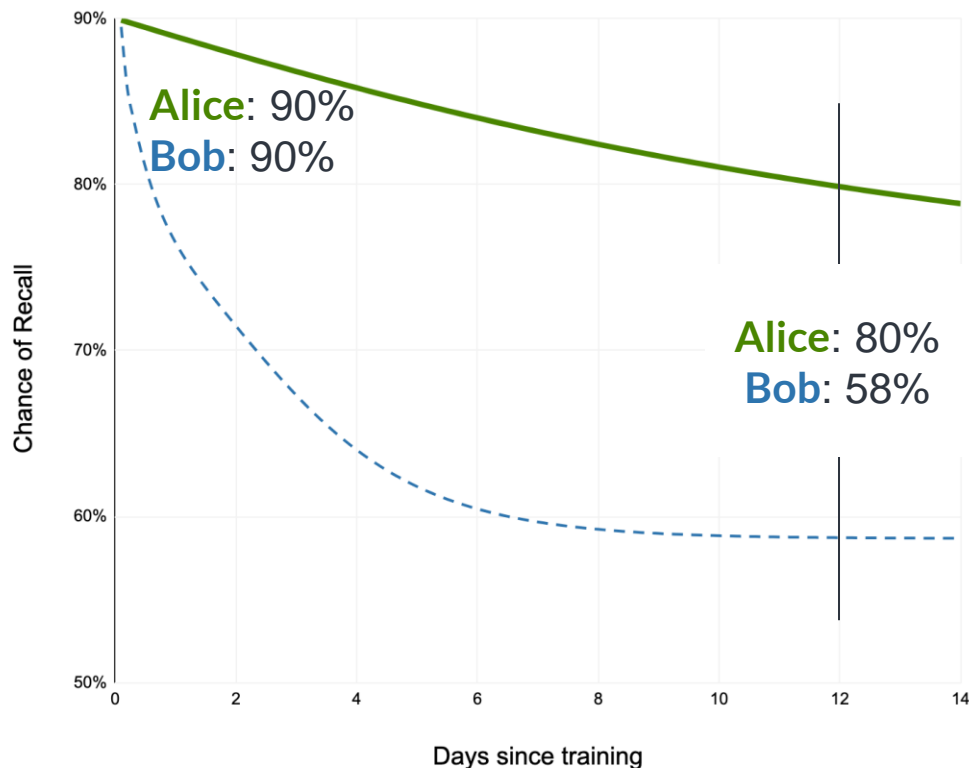
The Forgetting Curve



In contrast, **Alice** built strong retention for the material, and can recall far more two weeks later.

We can't test people daily, so knowing this trajectory is crucial.

The Forgetting Curve



Readiness

A Virtual Test Score

What does Cerego's Readiness score actually measure?

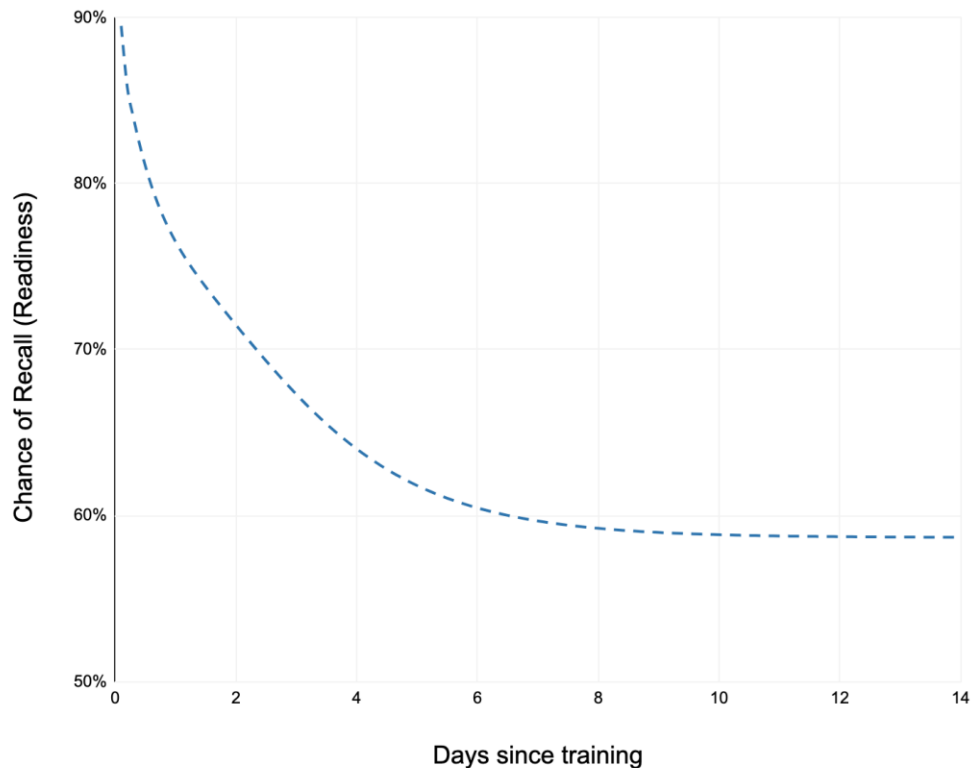
The chance you will be able to remember a specific concept at a specific moment in time.

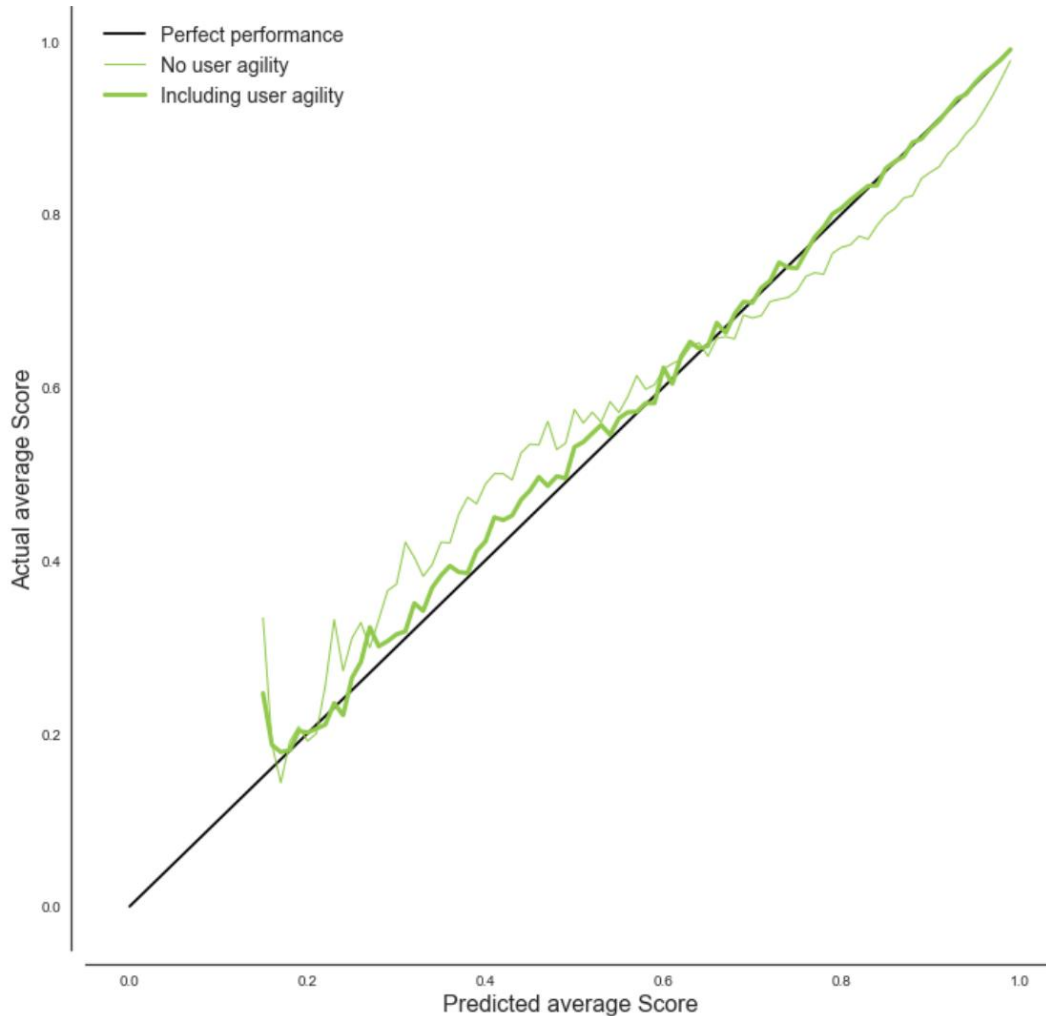
Think of it as being able to give anyone a **virtual test on any concept at any time.**

Cerego predicts this readiness curve into the future for each individual memory.

Closely resembles a power decay function.

The Forgetting Curve (Readiness across time)





Readiness model is trained on 1bn+ outcomes over 5+ years, and is well calibrated.

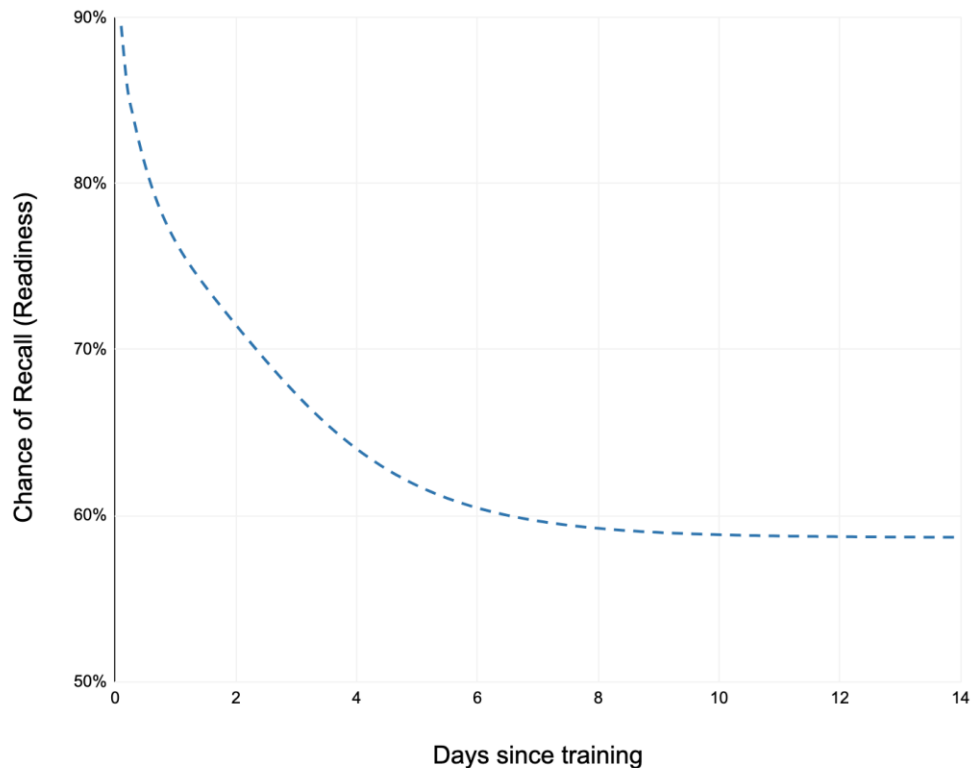
Expected calibration error (ECE) = 0.52%

Taken from Cerego Insights: Measuring Learning and Potential. Available at: <https://www.cerego.com/resources/cerego-for-admins>

Determined by:

- Quiz Difficulty
- Concept Difficulty
- Learning history
- Memory **Retention**
- Learner **Agility**

The Forgetting Curve (Readiness across time)



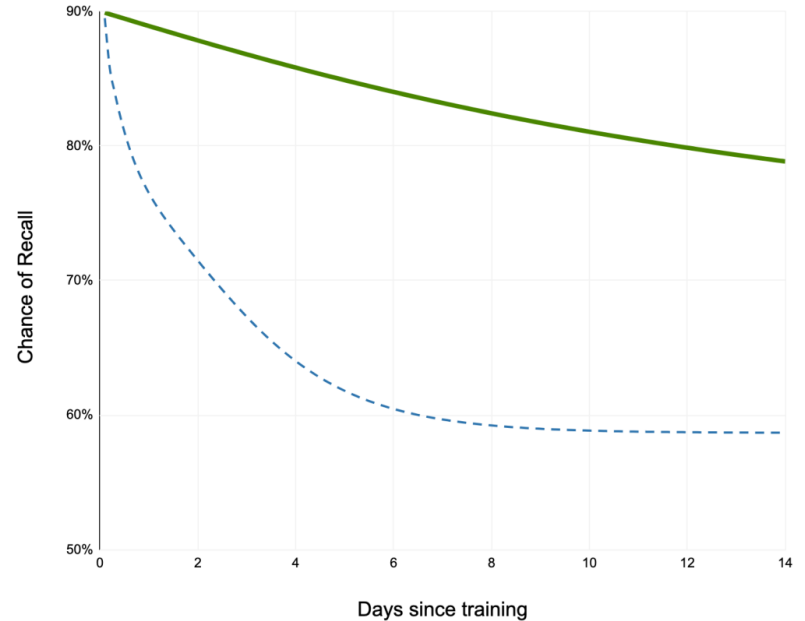
Retention

The rate of decay of an individual memory

Alice: High retention

Bob: Low retention

The Forgetting Curve



Agility

How quickly an individual learns new information, and how slowly that decays

Learners with high agility tend to build strong retention from fewer interactions.

Statistically significant but consistent across content. A high agility learner will tend to outperform the predictions of our readiness model if it does not take their agility into account.

Readiness

Who can recall their training right now, or on some future date?

Retention

How well learned is this content, and how long will it actually last?

Agility

Who are the sharpest, most adaptive learners in my organization?

Case Studies

(All available on request:
iharlow@cerego.com)

Consistent picture:

Agility & **Retention** predict future outcomes more accurately than post-tests do.

Retention is more predictive the further into the future the outcome is measured.

Case Study 1:

African Leadership University Admissions

Agility & **Retention** measured in the first, online screening stage of admissions significantly predicted success at the in-person finalist day.

Applicants scoring above-average on **Agility** and **Retention** were accepted at a 2.7x higher rate than those scoring below-average.

Case Study 2:

DAU Cybersecurity Training Pilot

Agility & **Retention** measured during training significantly predicted which learners actually retained their training 80 days later.

Almost all students achieved a passing grade at the end of the course, but only **29%** of controls scored above a passing grade 80 days later (vs **100%** of high **Agility** / **Retention** learners).

Case Study 3:

Global Threat Mitigation
Program (joint Cerego/BAH)

Agility & **Retention** during training significantly predicted performance 5 weeks later.

Agility & **Retention** predicted later performance (adj. $R^2=.621$) better than a post-test (adj. $R^2=.529$) *despite the fact the post-test and follow-up performance test used the same questions.*

It is possible, today, to accurately predict readiness from an individual's learning history.

The Forgetting Curve

