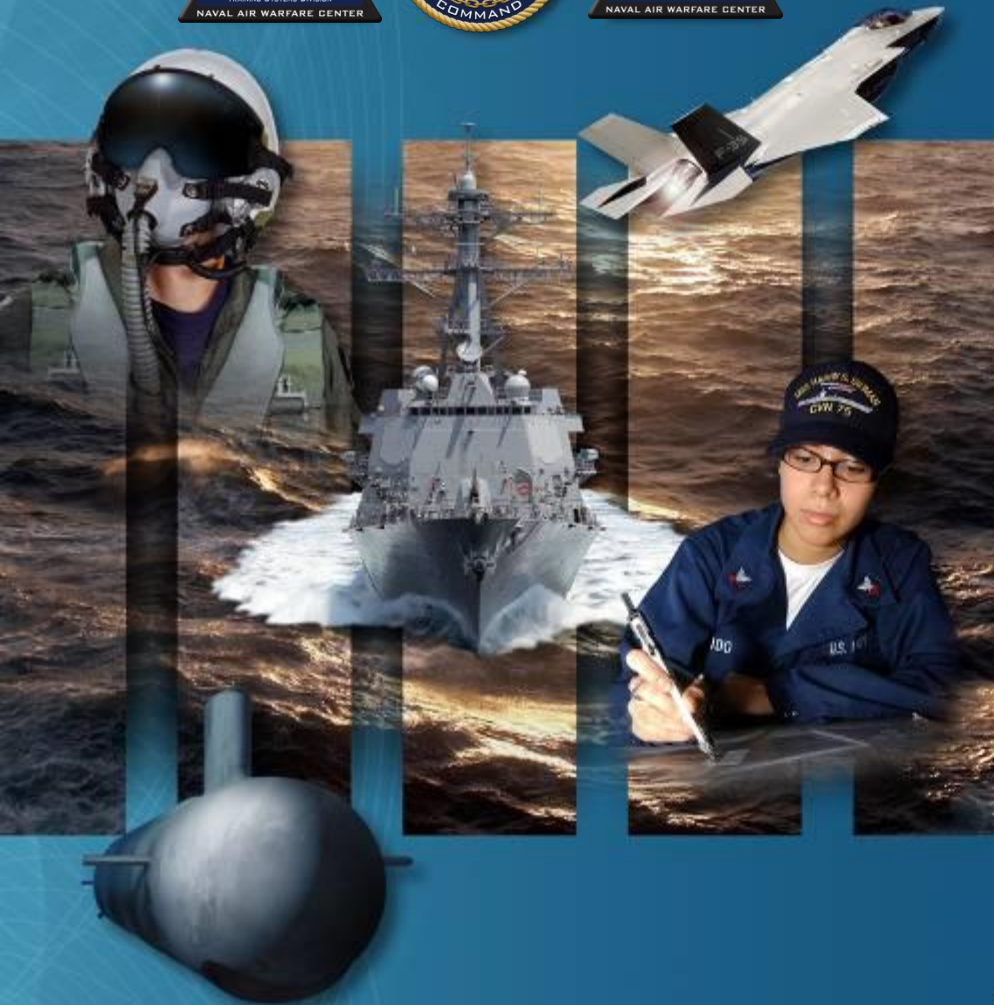


NAVAL AIR WARFARE CENTER
TRAINING SYSTEMS DIVISION
ORLANDO FLORIDA



Human Systems Technology Roadmap

John Owen and Bob Seltzer
8/23/2017



DISCLAIMER



The information about to be presented affords industry partners insight into on-going and pending acquisitions.

Significant portions of the information are planning in nature and are subject to change throughout the acquisition planning and acquisition strategy approval process, and in response to NAVAIRSYSCOM, DASN(A&LM) and DPAP peer reviews.



**“All I’m saying
is, now is the
time to develop
the technology
to deflect an
asteroid.”**



Motivation



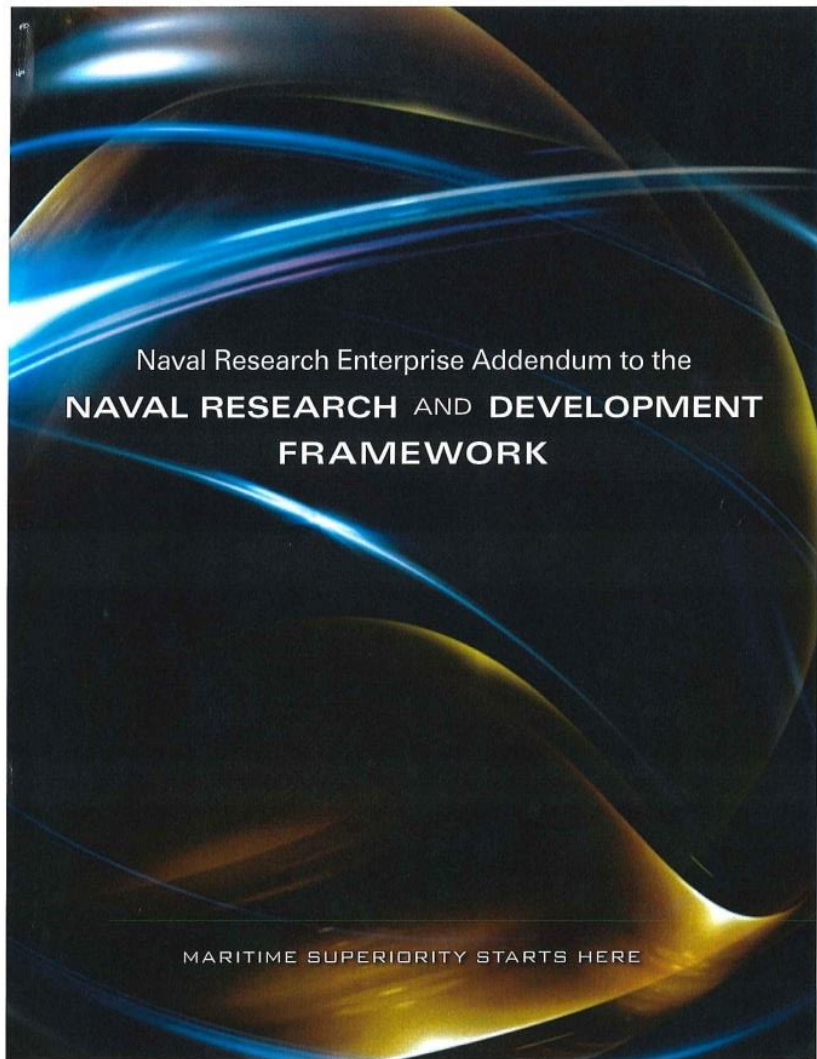
Roadmaps are Used as Decision Aids to Improve Coordination of Activities & Resources

Specific Uses Include:

- **S&T Mgt: Strategy, Planning, Execution, Reviewing & Transitioning**
- **Enhancing Communication Among Researchers, Technologists, Product Mgrs and other Stakeholders**
- **Identify Gaps & Opportunities in S&T Programs**
- **Identify Obstacles to Rapid & Low-cost Product Development**
- **Identify S&T areas that have high potential promise**
- **Accelerate/facilitate the transition of S&T to Eventual Products on programs of record**



CNR Framework for Accelerating the Navy & Marine Corps After Next



PRIORITIES

Framework Priority	Objectives	Research Sub Topics	*Future Force Attributes
Augmented Warfighter	<ul style="list-style-type: none"> Enhance decision-making speed and quality Improve human-machine interfaces and teaming Mitigate tactical-level risk to our people and command, control and communications degradation 	Algorithmic phenomenology; autonomy; artificial intelligence; machine reasoning; cognitive science; decision-making; human systems design; human-machine interaction; and training and education	Adaptive, Agile, Autonomous, Connected, Distributable, Interoperable, Lethal, Trained, Fast
Integrated & Distributed Forces	<ul style="list-style-type: none"> Enhance dynamic, synchronized actions across forces Support collaboration spanning geography, domains, platforms and joint partners; leverage satellite and Precision Navigation and Timing advancements Increase flexibility and reach of the naval force through incorporation of autonomous and disaggregate systems 	Autonomous platforms; communications and networks; networked sensors and weapons; positioning, navigation and timing; and coordinated spectrum and signature management	Adaptive, Agile, Autonomous, Connected, Distributable, Interoperable, Scalable, Fast
Operational Endurance	<ul style="list-style-type: none"> Enable maneuverability, efficiency, and resiliency for sustained operations by warfighters, systems and platforms (regardless of the threat or operating environment) Improve platform-level energy storage/efficiency for propulsion and weapons systems Develop wide-area and force wide disinformation deception and decoys 	Power generation, storage, energy efficiency; survivability, endurance and availability; security/protection; platform affordability; high-performance materials; biomedical; and logistics and sustainment	Adaptive, Agile, Defensible, Distributable, Efficient, Sustainable
Sensing & Sense-Making	<ul style="list-style-type: none"> Transform vast data into timely knowledge Enable persistent awareness and understanding, and optimized operation (regardless of the threat or operating environment) Integrate artificial intelligence into C4ISR networks scalable to theater wide 	Multi-domain and multi-spectral sensors; digital algorithms and data sciences; quantum information sciences; and modeling, simulation and forecasting of the operational environment	Adaptive, Agile, Autonomous, Connected, Distributable, Interoperable, Scalable, Fast
Scalable Lethality	<ul style="list-style-type: none"> Enable offensive and defensive actions that are multi-domain, integrated, cost-effective, and kinetic and non-kinetic Deliver directed energy and low cost, high probability of kill standoff strike 	Cyber/algorithmic effects; countermeasures and decoys; counter-weapons, threat neutralization and explosive ordnance disposal; targeting sensors; directed energy and electric weapons; energetics; and lower cost, higher performance weapons	Adaptive, Agile, Autonomous, Connected, Defensible, Distributable, Efficient, Fast, Interoperable, Lethal, Scalable, Sustainable



AIR 4.6 Core Capabilities Document



- Human Systems Department (AIR-4.6) provides expertise, world-class facilities, resources, products, and services to optimize human performance, protection, and survivability within the totality of the military weapon system.
- AIR-4.6 integrates following elements of Human Systems Integration (HSI); human engineering; manpower, personnel, and training; health hazard mitigation; safety, medical, and survivability factors; and habitability considerations into the systems design and acquisition process for all phases of the systems life cycle.
- The five top-level AIR 4.6 Core Capabilities (as defined in AIR 4.6's Core Capabilities document, dated 2016) are:
 - Human Systems Engineering, Integration, and Acquisition
 - Optimized Human Performance and Decision Support
 - Advanced Training Systems Technology
 - Human Systems Design, Analysis, and Evaluation
 - Warfighter Protection, Performance, and Survivability

AIR-4.6 will continue to develop its capabilities to meet the current and future needs of the Fleet



Technology Roadmap Taxonomy



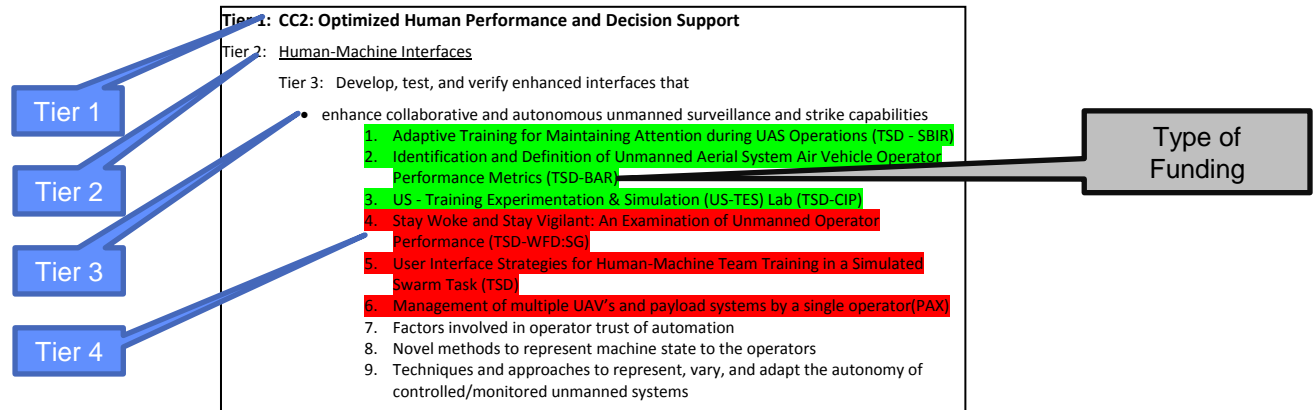
Tier 1: One of the five AIR 4.6 Core Capabilities (as defined in AIR 4.6's Core Capabilities document, dated 2016)

- Human Systems Engineering, Integration, and Acquisition
- Optimized Human Performance and Decision Support
- Advanced Training Systems Technology
- Human Systems Design, Analysis, and Evaluation
- Warfighter Protection, Performance, and Survivability

Tier 2: Current Capabilities or S&T/R&D focus areas (as defined in AIR 4.6's Core Capabilities document, dated 2016)

Tier 3: Specific Technical Sub-areas within AIR 4.6 Current Capabilities

Tier 4: Future Technical areas (areas that will mature existing or develop new capabilities baselines) **Funded**, **Unfunded**, Adv Research Or Tech Dev (Unfunded) . Funded items taken from current NAWCTSD Grey Book and existing funded NAVAIR S&T proposals.



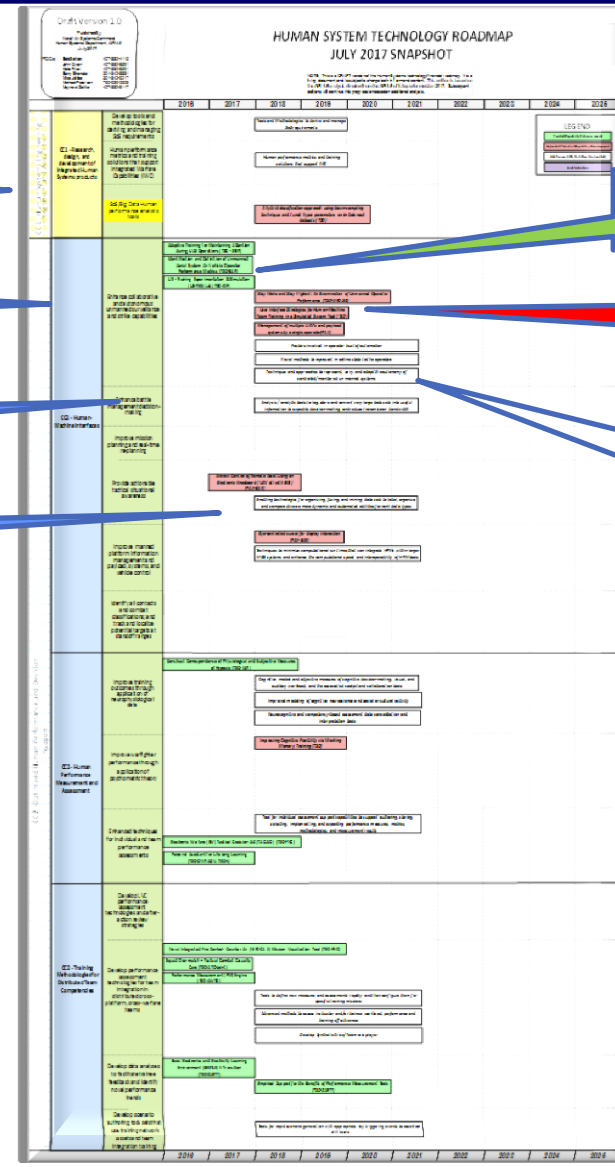
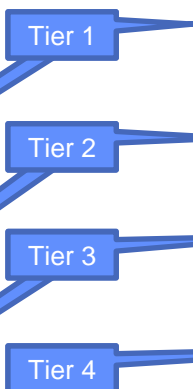
Note: As technology associated with training and crew systems evolves this Roadmap will likely include additional topics in tiers 1-4, and the timeline for maturity may be adjusted as more information is included.



Technology Roadmap



- Tier 1: CC2: Optimized Human Performance and Decision Support**
- Tier 2: Human-Machine Interfaces
- Tier 3: Develop, test, and verify enhanced interfaces that
- enhance collaborative and autonomous unmanned surveillance and strike capabilities
- Adaptive Training for Maintaining Attention during UAS Operations (TSD - SBIR)
 - Identification and Definition of Unmanned Aerial System Air Vehicle Operator Performance Metrics (TSD-BAR)
 - US - Training Experimentation & Simulation (US-TES) Lab (TSD-CIP)
 - Stay Woke and Stay Vigilant: An Examination of Unmanned Operator Performance (TSD-WFD:SG)
 - User Interface Strategies for Human-Machine Team Training in a Simulated Swarm Task (TSD)
 - Management of multiple UAV's and payload systems by a single operator(PAX)
 - Factors involved in operator trust of automation
 - Novel methods to represent machine state to the operators
 - Techniques and approaches to represent, vary, and adapt the autonomy of controlled/monitored unmanned systems



Existing Funded programs

Unfunded programs

Adv Research Or Tech Dev (Unfunded)

Adv Research Or Tech Dev (Joint Initiative)



Example Drill Down: CC #2



TIER 1: Adv. Training Systems Technology

TIER 2: High Fidelity Training Environments

TIER 3: Create software development environments to design and maintain high-fidelity trainers

TIER 3: Dev. real-time flight aerodynamic and visual simulation technologies

TIER 3: Develop speech recognition, synthesis functionality, and computational methods to recognize the difference between relevant and irrelevant speech

TIER 3: Develop multi-modal sensory simulation systems and integrate into Tactical Software training applications

TIER 3: Develop multi-touch interaction and 3D models

TIER 2: **Simulation Interoperability and Distributed LVC Technology**

TIER 3: Dev. interoperable LVC & Cyber Warfare trg simulation & technologies

TIER 3: Dev. Multi-Level Security Methods to safeguard classified information in the LVC environments

TIER 3: Develop Mission Rehearsal Enabled Database Methods for collecting and packaging authoritative data feed

TIER 3: Develop tools for Enhanced Constructive Env. to support instructor inserted dynamic changes to simulated environmental conditions

TIER 3: Dev. Information Load Management methods, technologies, and tools



Technology Roadmap Development Plans



Activity	FY17			FY18+
	Jul	Aug	Sep	
Draft Roadmap Complete	▲—————▼			
Competency Management Review		▲—————▼		
Training Industry Roadmap Workshop			★	
Industry Input Phase		▲—————▼		
Workforce Briefs and Surveys		▲—————▼		
FY17 Technology Roadmap Complete				★
Tech Roadmap Life Cycle Updates			▲—————▼	

Technology Roadmap is a living document with our first draft completed 01 Oct 2017



How can you participate



This is an evolving process of creating and implementing a roadmap and monitoring and updating it as necessary. The goal is to engage and align diverse stakeholders in a common course of action. You can participate by:

- Identifying additional Technology/Methodology areas of interest
- Identifying teaming opportunities for areas of interest
- Provide suggestions on metrics and milestones to allow regular tracking of progress

The Government strategic focus and funding will be aligned to our roadmap.