Amendment 0003
BAA12-011 entitled “Unmanned Aerial Systems Interface, Selection & Training Technologies (U-ASISTT)”
Date 06 SEP 2012

The purpose of Amendment 0003 to this BAA is to provide the 1st set of U-ASISTT Industry Day Slides as an attachment.

All else remain in effect as described in Amendment 0002 to this BAA.

Note

These are the first portion of the slides briefed at the UASISTT Industry Day

INDUSTRY DAY:
Unmanned Aerial Systems Interface, Selection, & Training Technologies (U-ASISTT)

Developing technologies to assure Navy dominance in the unmanned aerial future through better selection, training, and equipping of UAS operators

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Code 341

ONR
Revolutionary Research . . . Relevant Results

OFFICE OF NAVAL RESEARCH

Unmanned Aerial Systems

Evolving Role of Human in Aviation Systems

Abstract

Human Role in Flight Environment

Concrete

Aeromedical Physical
- Visual Acuity
- Muscle Balance

Direct interaction

Aeronautical Ability
- Intelligence
- Psychomotor
- Spatial Reasoning

Blend direct and indirect interaction

Aviation Selection Test Battery
- Psychomotor
- Technical Acumen
- Personality

Human gets a vote

UAS
- Shift towards cognitive / perceptual tasks
- Information-rich, distributed, lengthy, collaborative missions
- Increasing reliance on Automation & Multitasking

<WW I | WW II | 1990s – 2000s | Today

Time

What are the implications for selecting, training and equipping these Air Warriors?

Some Important Questions

✓<u>Common Control Station (CCS) POR Memo:</u> **Multiple UAS platforms will integrate into CCS ~ FY18 –** ***How to enable effective information display for safe and effective UAS operations?***

✓<u>SECNAV Unmanned Systems Goal:</u> **Supporting a "Human Capital &Training Strategy for UxS" –** ***How to provide optimally selected, effectively trained cadre of UAS operators?***

✓ <u>N2/N6 Information Dominance Roadmap for UxS:</u> ***How to optimize UAS DOTMLPF-P, supporting Mid- ('17) & Far- ('20) Term Goals?***

✓<u>*Navy Aviation Simulation Master Plan:*</u> **"Almost all UAS training must be conducted in simulated environments…training will link into larger training scenarios…"** ***How to provide the agent-technologies to for effective training?***

Answers require an integrated human - system solution

The Payoff of a Human Systems View

Done in parallel

What makes an effective, safe UAS Operator?

Operational Safety & Effectiveness

SELECTION

1. Select based on KSAs vs designator
2. Up front costs (600 operators, FY20)
   a. <u>Military Aviators:</u> Basic + Platform-specific training >$1M
   b. <u>Non Military Aviators:</u> $392M avoided by NOT paying for manned flight training

DESIGN

1. Common Control System SDD calls for controlling:

Multiple UAS; Dissimilar type; 1 operator

2. Enabling fewer operators to safely and effectively control multiple UASs by understanding how to support KSAs through display technologies

TRAINING

1. Target relevant KSAs
2. Reduce time to develop new entity behavior
3. Enable access & availability of training on CCS

Selection – Operational Challenge

How we select today

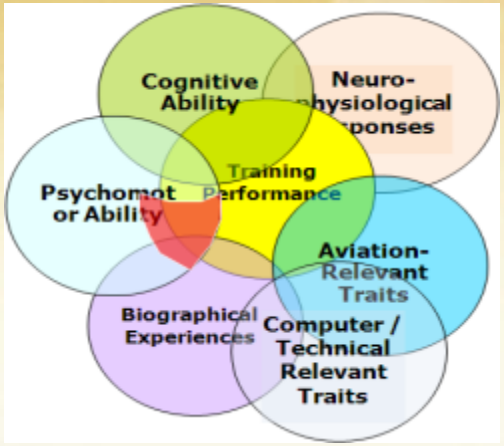
Works for Manned Aviation

Wide range of UAS missions

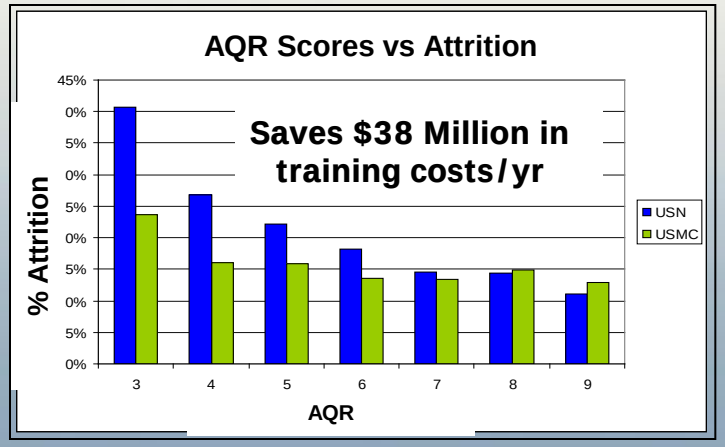
Communications/Data Relay	Reconnaissance
Information Warfare	Signals Intel
Digital Mapping	Mine Detection/CM
Littoral Undersea Warfare	Precision Target Location and Designation
SOF Team Resupply	Battle Management
Weaponization/Strike	Chem/Bio Reconnaissance
GPS Psuedolite	Counter Cam/Con/Deception
Covert Sensor Insertion	Electronic Warfare
Decoy/Pathfinder	Combat SAR

Not Manned Aviation

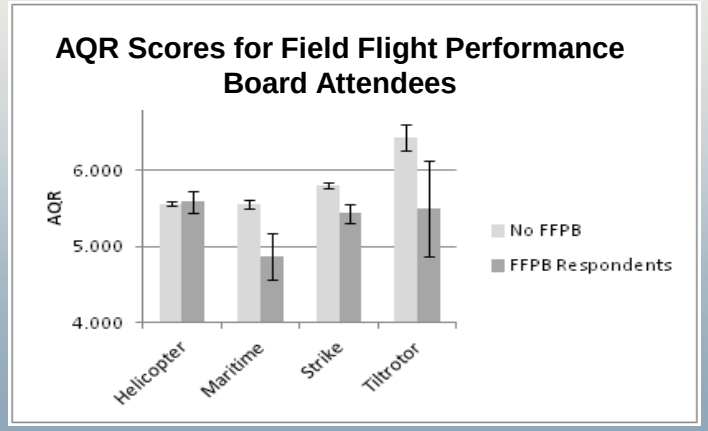
What are UAS KSAs?



Proper selection saves training $$...



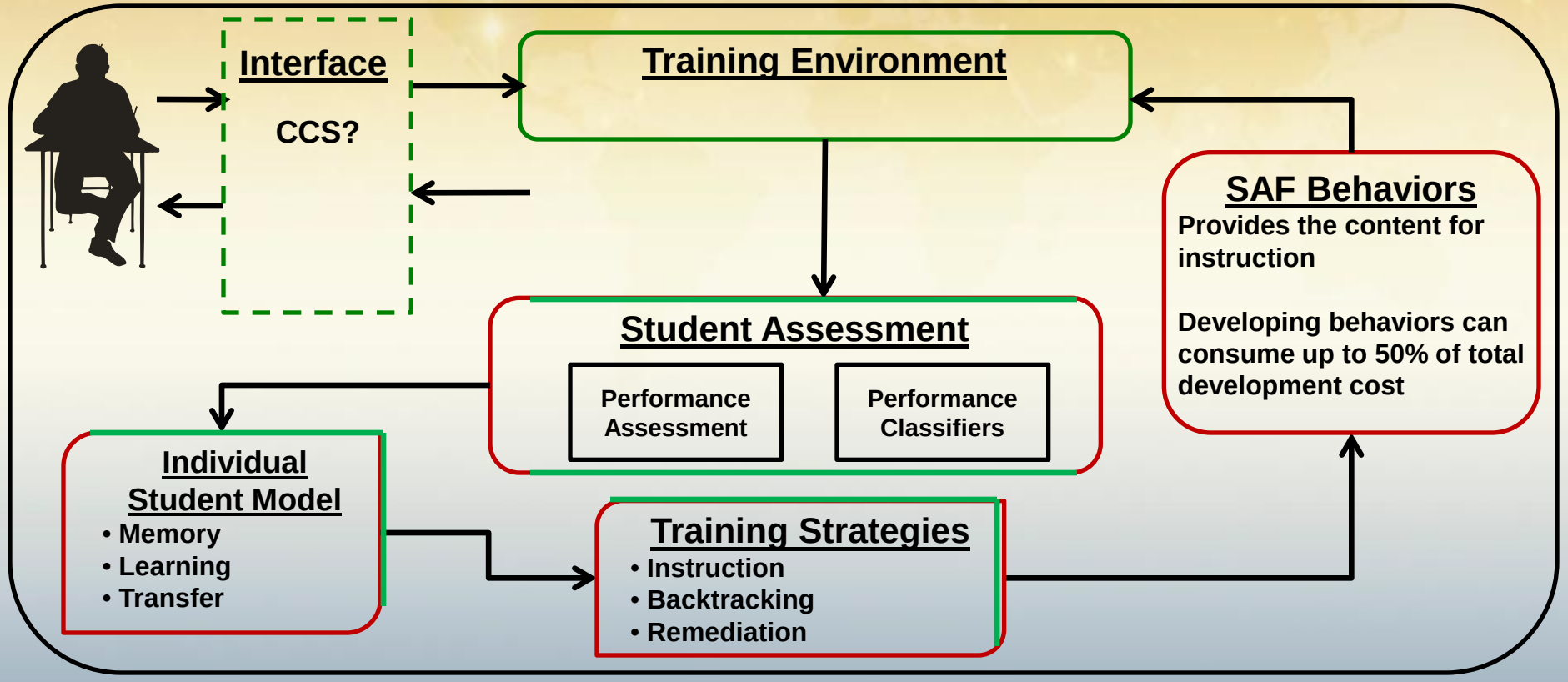
...and should reduce mishap rates too.



Select for the right UAS personnel to save on training…and mishaps.

Training – Operational Challenge

Need a new approach to developing 'content' of simulation based training



Aspects of Simulation Based Training Addressed by Current or Past Efforts

Aspects of Simulation Based Training Addressed by UASISTT

Reduce the cost of generating synthetic agents – a core of UAS training

Interface – Operational Challenge

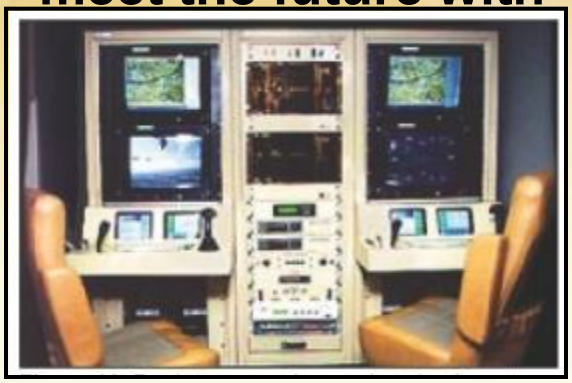
What the future holds for UAS control…well known

- Less focus on 'hands on'
- More focus on management
- Multi Vehicle Control
- Autonomy

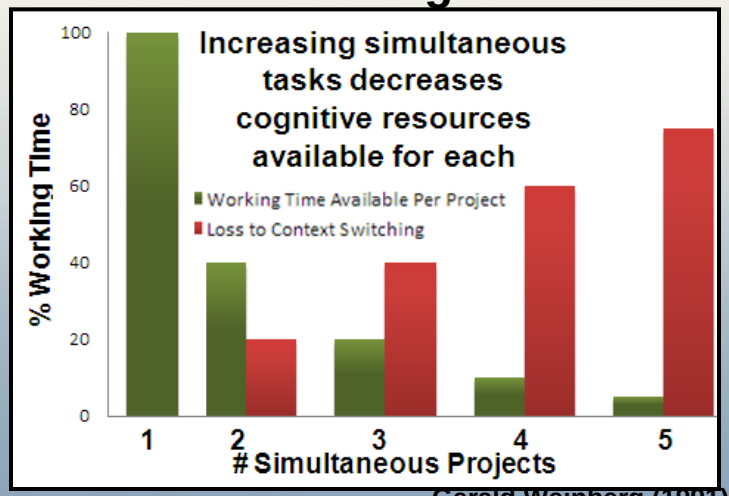
  - Information Dominance Roadmap
  - DoD UxS 2011

VS

What we (still) have to meet the future with

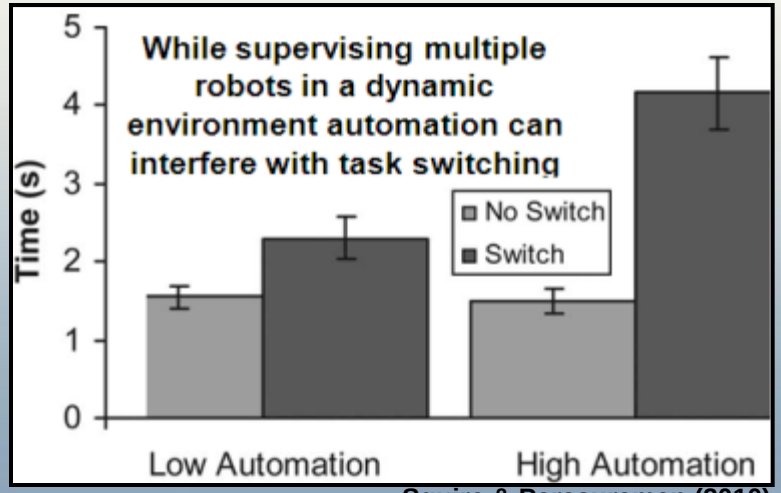


Workload Management



- Gerald Weinberg (1991)

Automation Alone is Not the Solution



- Squire & Parasuraman (2010)

Information must be presented synergistically to meet users' needs.

Addressing the Challenges: UASISTT's 3 Technology Products

UAS Operator Selection
UAS Groups 3-5

UAS Air Vehicle Operator test selection battery integrated into the Department of the Navy's existing Automated Pilot Exam framework

- Identify the knowledge skills and abilities needed to operate Navy/USMC UAS
- Identify & develop the specific UAS selection tests, and data collection instruments
- Identify the costs/benefits of using different candidate AVO populations

UAS Operator Training
UAS Groups 4-5

Tools, standards & guidelines to generate large numbers of realistic SAF behaviors integrated into the Navy's SAF generation technology

- Develop the knowledge structures needed to capture source data
- Define boundaries of behavior patterns of interest.
- Develop representative cognitive models from behavior data
- Generate novel, doctrinally accurate, SAF behaviors

UAS Operator Interface
UAS Groups 4-5

Validated interface design concepts, prototypes, and guidelines for the CCS enabling AVOs to manage cognitive workload, improve cognitive performance, and operate multiple / different UAS

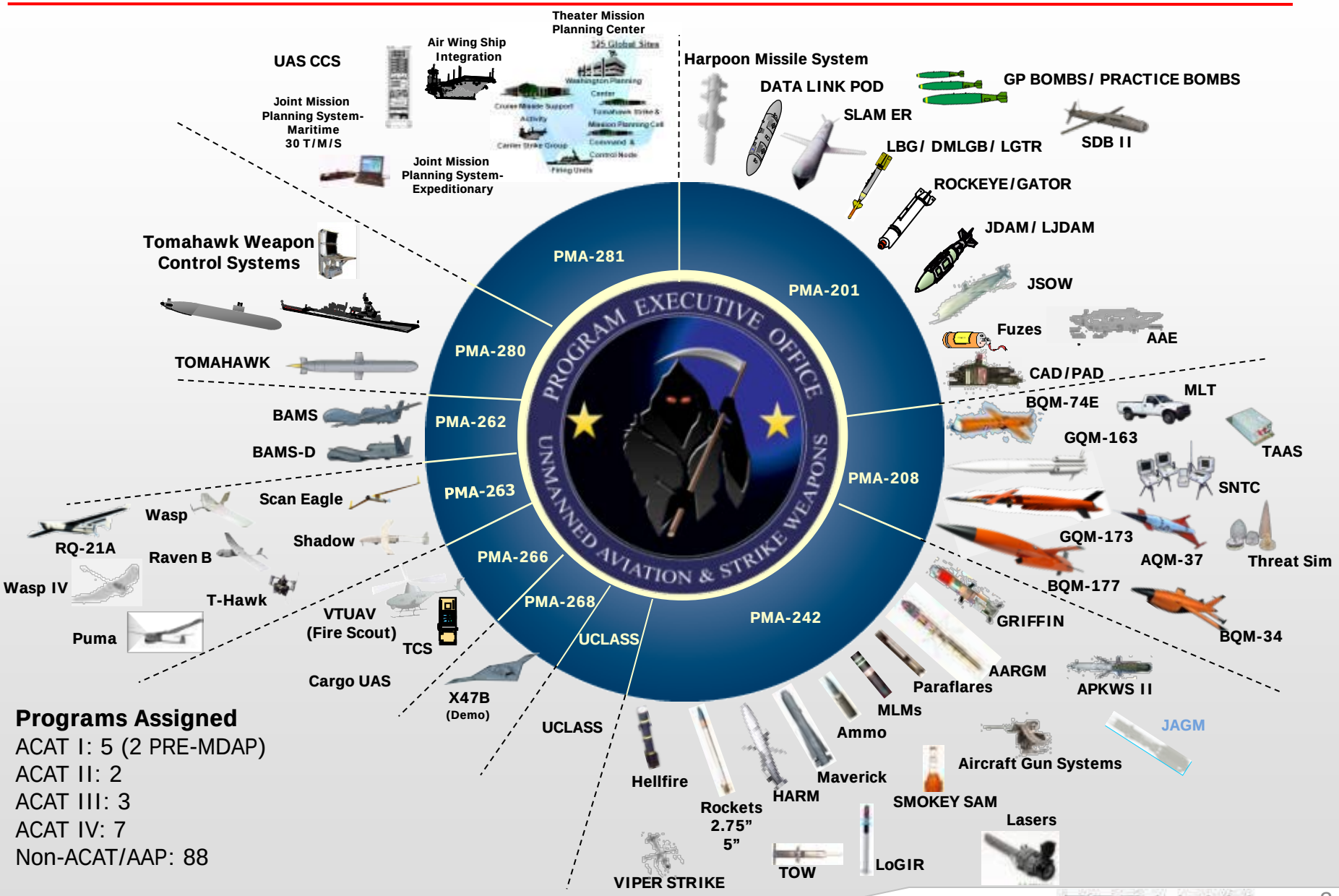
- Identify information requirement for successful operations
- Apply human factors and cognitive engineering principles to display design options
- Assess key performance characteristics including: situational awareness, workload, vigilance and related indicators of cognitive and psychomotor performance

Navy Transition Assistance Program
2012 Kickoff Meeting

Mr. Michael Erk, SES
Deputy Program Executive Officer
Unmanned Aviation and Strike Weapons

11 July 2012

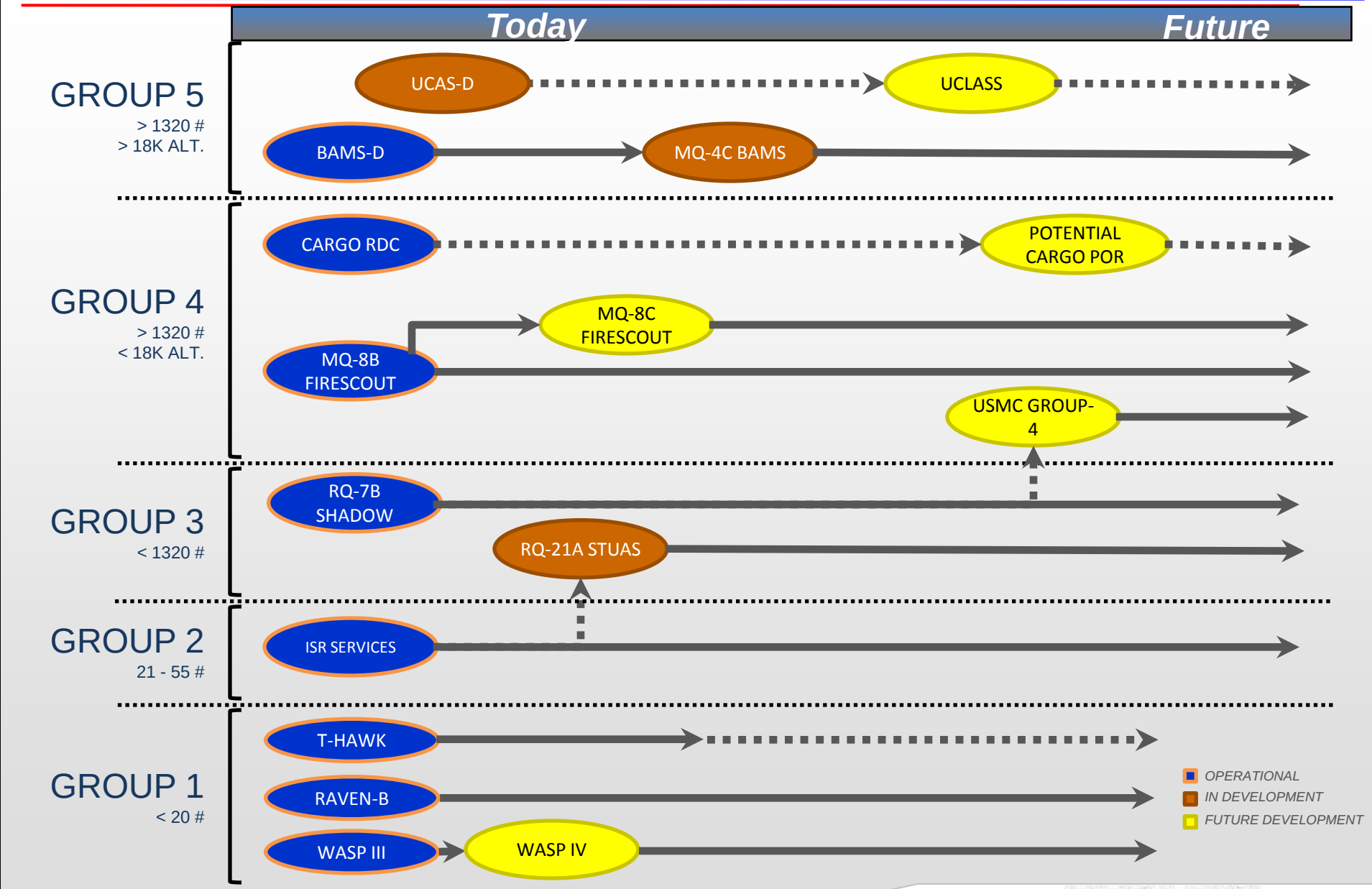
PEO(U&W) OVERALL PORTFOLIO



Programs Assigned

ACAT I: 5 (2 PRE-MDAP)
ACAT II: 2
ACAT III: 3
ACAT IV: 7
Non-ACAT/AAP: 88

Naval UAS Family of Systems



Strike Planning, Control, and Execution Systems

Updated 6/22/12

2012 Independent Framework and Services	2015 Framework Convergence and Common Services Demonstration	Future Common Framework and Common Services

Planning and Control Across All Naval Platforms

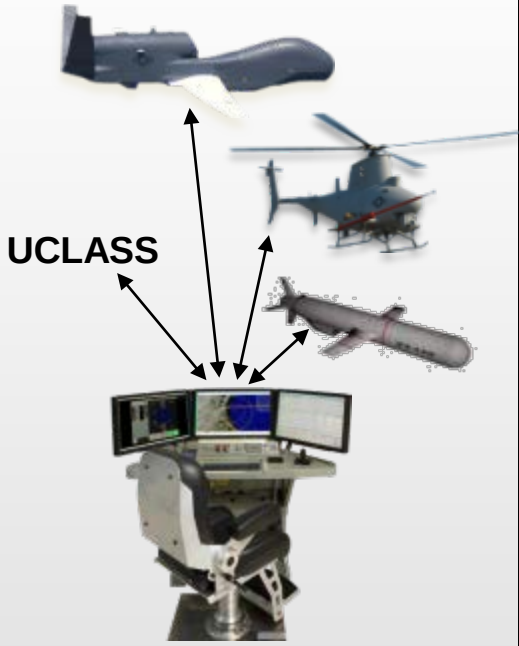
TC2S
Tomahawk Command and Control System

CCS
Common Control System

JMPS
Joint Mission Planning System

AWSI
Air Wing Ship Integration

- TC2S in Theater Mission Planning Center (TMPC)
- UxS Common Control System (CCS)
- Joint Mission Planning System (JMPS)
- JMPS Expeditionary
- JMPS Federated Applications
- Integrated Strike Planning & Execution
- Digital Camera Receiving Station (DCRS) For FMV



Increasing Commonality and Centralized Governance for Maximized Efficiencies

UAS S&T Priorities

- Ability to File and Fly in the NAS – Provide Flight Path SA for Operations in Theater
  - Comprehensive Sense And Avoid (SAA) solutions
- Migrate to a Common Control System for UASs
  - Including Human Machine Interface (HMI)
  - UCS Architecture
- Applied Autonomy Focus
  - Common architecture adopted to enable reduce cost and enhanced autonomous functions
    - App model/ Service Oriented Architecture (SOA) standardization
- Innovations/Improvements for Shipboard Launch and Recovery
  - Airframe size/configuration limits bounded by naval ability to launch and recover at sea/littorals
- Robust Datalinks and Increased Bandwidth
- Manned Unmanned Teaming Tied to Mission Capability(ies)

Engagement Guidelines

DO:

- Align with a receptive acquisition program
  - Timing with Program Of Record (POR) plan is critical
  - PMA can leverage various technology maturation funding opportunities to transition SBIRs including RTT, TIPS, RIF and JCTD.
- Align with the system integrator for transition path into a specific POR
  - Prime contractor (most cases)
  - Government organization
- Align with NAVAIR competency for knowledge products
  - Products which enable competency to increase performance.
- Know that PEO(U&W) acquires major end item systems.
  - TRL is assessed on the basis of the system not on the component.
  - We buy your products as part of a complete system from a prime.

DON'T:

- Wait for programs and platforms to be pro-active in discovering new technologies
  - PMAs are typically focused on satisfying funded requirements on time and within budget
- Bypass Prime System Integrators
- Bypass PMA point of entry
  - Start with PMA Advanced Development (AD), PEO AT, or CTO reps to evaluate product-program alignment
- Inflate TRL/MRL numbers
  - Overestimation can lead to underestimation of integration/transition costs.

Unmanned Aerial System Interface, Selection, and Training Technologies (UASISTT) Baseline Assessment

Industry Day

17 August 2012

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UASISTT Support Contractor: Lisa Thier – thier_lisa@bah.com

Agenda

- Introduction
- Data Collection Process
- Selection Findings
- Training Findings
- Interface Findings
- Summary of Baseline Assessment Findings
- Next Steps
- Questions

Introduction

Study Purpose

- **To understand, document, and validate the current-state of Unmanned Aerial Systems (UAS) selection, training, and interface design in order to establish the baseline of the processes/capabilities/constraints for these domains.**

Three-phased approach

- **Phase I: Baseline Assessment**
- **Phase II: Optimal Capabilities Development**
- **Phase III: Derived Requirements, Roadmap Documentation, and Technology Transition Agreement (TTA)**

Data Collection Process

Approach and Methodology

- Analysis of current UAS Selection, Training, and Interface was conducted by gathering relevant documentation and through interviews with Subject Matter Experts (SMEs) and Stakeholders
- Documents for the Baseline Report Included:
  - General Guidance and Policy
  - Humans Systems Interface
  - Selection, Training, and Interface Design
  - Platform Documents (e.g. Fire Scout, Shadow, BAMS/Trition, UCLASS/UCAS-D)
  - Common Control Station (CCS)
- Interview-style data collection process
  - Informants – UAS Stakeholders and SMEs
  - Interview Structure – Individual and Group Face-to-face interviews using a standardized set of questions to guide the discussion

Selection Findings

UAS Operator Basic Qualifications

- Manpower and personnel decisions based on either manpower-based limitations or previously established manned aviation requirements
  - Air Vehicle Operator (AVO) requirements defined according to aviator/aircrew requirements, UAS related Navy Enlisted Classification (NEC) Codes, and Marine Corps Military Occupational Specialty (MOS) qualifications
  - UAS-specific billets, NECs, and MOSs served as a quick-turn solution to fill critically needed positions

UAS Operator Selection Process

- No tools in place to select and classify candidate UAS operators
- Medical Examination
  - Class (I, II, III) depending on position
- Basic Aptitude Assessment
  - Armed Services Vocational Aptitude Battery (ASVAB)
  - Aviation Selection Test Battery (ASTB)

Training Findings

Joint Chiefs of Staff Instruction (CJCSI) 3255.01 Basic UAS Qualifications (BUQ)

- Joint-level minimum training standards
- Levels 1-4

Training Systems

- No requirement for commonality in training systems across UAS platforms and positions
- Interactive training events focused on procedural-based concepts vs. complex simulation environments

Simulation Laboratories

- NAVAIR's Integrated Battlespace Simulation and Test (IBST) Department
  - Joint Integrated Mission Model (JIMM)
  - Next Generation Threat System (NGTS)
  - Joint Semi-Automated Forces (JSAF)
- Existing simulators are designed around host platforms
- No standards for Synthetic Entities and Semi-Automated Forces simulated events

Interface Findings

Ground Control Station (GCS) Design Policies, Standards, and Regulations

- NATO-level Standard Agreement 4586
- MIL-STD 1472G, 2525C, and 411F
- CCS currently focused on system software and middleware performance specifications
- CCS has not developed presentation layer requirements
- CCS will align with the UAS Control Segment (UCS) Architecture, currently being developed under direction from USD AT&L

UAS GCS Human Machine Interface Department and Standardization Guide

- Contains "guidance on the functionality, content, and presentation of the Human-Machine interface of Ground Control Stations in the Unmanned Aircraft Stations"
- Will guide the development of the GCS and provide considerations for the design of a presentation layer

Summary of Baseline Assessment

Selection

- No specific criteria, no specific test for UAS operators
  - Manpower Focused
  - Platform Needs Driven
  - 'Ad hoc' satisfied by ASVAB or ASTB

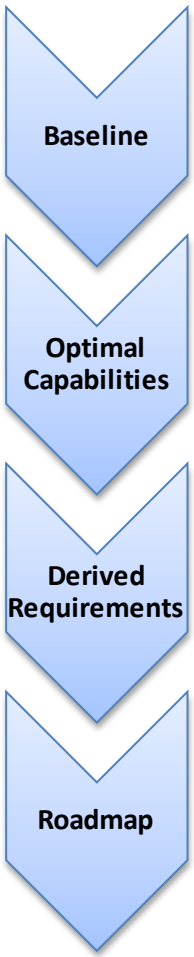
Training

- Platform driven
- NGTS and JSAF
  - Manually scripted
  - TACAIR driven
  - Naval Aviation driven
  - USMC not involved

Interface

- Platform Specific
- Each operator has own workstation
- No standard interface presentation layer requirements across platforms/positions

Next Steps



- "Here's Where we Are"
- "Here's Where we Want to Be"
- "What we Need to Do"
- "How We Get There"

TTA
Jun 2013

- Signed Level C TTA Needed to Release funds

Questions

Cross-Platform UAS Task Analysis

Dr. Richard D. Arnold
Naval Medical Research Unit – Dayton

17 August 2012

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Distribution

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Disclaimer

The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.

Acknowledgements

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Overview

- Objective
- Methodology
  - Task Analysis, SME's interviewed and Sites visited
- JTA Questionnaire
  - Content, construction and implementation
- Results
  - Prototype task and KSAO profiles
  - Position similarity matrices
- Conclusion/implications

Background

- Many UAS platforms have similar missions, but each one has different capabilities.
- Existing task lists are hard to find, and if available, they are usually outdated.
- Most systems have similar tasking but different control stations.
- Systems are “stove piped” – UASs and their training systems are developed completely independent of one another with no considerations for commonalities amongst platforms, ground control stations, training curricula, or training systems.

Objective

- Cross-platform analyses are limited or non-existent
- No single effort to date has addressed
  - all extant Navy and Marine Corps UAS platforms
  - common and unique operator task and KSAO requirements
  - Similarities and differences by crew position
- Comprehensive, detailed analysis of UAS work, tasking, and worker requirements is needed

Tasking Identified

- Obtain or build individual task lists for each platform being considered
- Seek out and work with platform specific SMEs to develop task lists
- Combine/group tasking across platforms to develop JTA for distribution and data collection

Target Platforms and Positions

- Platforms
  - RQ-11 Raven
  - ScanEagle
  - RQ-7 Shadow
  - MQ-8 Fire Scout
  - RQ-4A BAMS-D
  - MQ-4C BAMS
  - X-47 UCAS

Target Platforms and Positions

- Positions
  - Pilot / Air Vehicle Operator (AVO)
  - Sensor/Mission Payload Operator (MPO)
  - Mission Commander (MC)
  - TOPS (Tactical OPerationS officer)
  - TACCO (TACtical COordinator)

Sites/SMEs Contacted/Visited

- Numerous meetings / phone calls / telecons
- Marine Detachment, Ft Huachuca
- NSW, Coronado
- NAWCAD, Patuxent River, MD
- Webster Field Annex, St. Inigoes, MD

Survey Development

- Contacted senior platform POC's
- Presented project-overview brief
- Requested help in developing platform specific items for questionnaire
- Platforms provided operating manuals, training materials, SOPs, etc.
- Drafted survey items
- Worked with SMEs to edit items and finalize platform-specific list – iterative reviews

Survey Development *(cont'd)*

- Combined items from all platforms
  - Merged similar items
    - *"Perform pre-flight/takeoff checks and complete checklists"*
  - Retained unique items
    - *"Evaluate shipboard environmental conditions (e.g., ship pitch & roll, deck winds) for launch*
- Final survey review with senior UAS SME
  - End product: 256 task item survey, with 4 rating scales per item, plus 67 Rated KSAs.

Survey Development *(cont'd)*

- Comprehensive, detailed questionnaire
  - Tasks
    - 20 clusters, 256 items
  - KSAO's
    - 17 categories, 67 items
- Hierarchically organized task clusters
- Survey branching

Task Clusters

1. Preflight tasks
2. Mission planning
3. System config/start-up
4. Air vehicle launch/takeoff
5. In-flight ops – General
6. In-flight ops – Safety and checks
7. Communications
8. Navigation
9. Airspace area management
10. Crew task management
11. Fuel/power management
12. Payload ops
13. ISR
14. Flight maneuvers
15. Mission execution
16. Missions – Target management
17. Emergency tasks
18. Air vehicle approach/landing
19. Postflight tasks
20. Shipboard tasks

Task Rating Scales

Naval Medical Research Unit – Dayton

Dimension	Definition	Rating scale response options
Importance	Degree to which incorrect performance of the task would result in negative consequences (for example, potential injury to self or others, damage to aircraft or equipment, increased time to complete a mission task).	1= Not important 2 = Slightly important 3 = Moderately important 4 = Highly important 5 = Extremely important
Difficulty to Learn	Degree of difficulty in learning to perform the task successfully and independently, relative to all other tasks performed in training.	1 = One of the easiest tasks to learn 2 = Easier to learn than most other tasks 3 = Approximately half of the tasks are easier to learn and half are more difficult to learn 4 = Harder to learn than most other tasks 5 = One of the most difficult to learn of all tasks
Frequency	How frequently a task is performed over the course of an event with a relatively fixed time period, such as a mission.	1 = Less than once per mission 2 = At least once per mission 3 = 2 – 5 times per mission 4 = 6 – 10 times per mission 5 = More than 10 times per mission C = Almost continuously
Level of Mastery - Qualified Operator	For a **QUALIFIED OPERATOR**, the percentage of time a task must be performed at a high level of mastery, without errors or excessive delays, and without assistance or coaching from others.	Mastery-level performance must be demonstrated: 1 = 0 – 20% of the time 2 = 21 – 40% of the time 3 = 41 – 60% of the time 4 = 61 – 80% of the time 5 = 81 – 100% of the time

KSAO Categories

1. Communication Skills
2. Conscientiousness
3. Coping with Stress and Emergencies
4. Development Skills
5. Learning and Memory Skills
6. Mathematical Ability
7. Mechanical Abilities
8. Motivation
9. Multitasking and Attentional Skills
10. Perceptual and Psychomotor Abilities
11. Physical and Psychomotor Abilities
12. Planning and Organizing Skills
13. Problem Solving/Reasoning Skills
14. Sensation Seeking
15. Sensory Perceptual Abilities
16. Social/Interpersonal Skills
17. Spatial and Navigation Skills

Data Collection

- Each platform identified SMEs to complete survey
- Kronos Inc. hosted survey on its server
  - Unique link provided to each respondent
- Survey administered: March – June 2011

Results – Participation

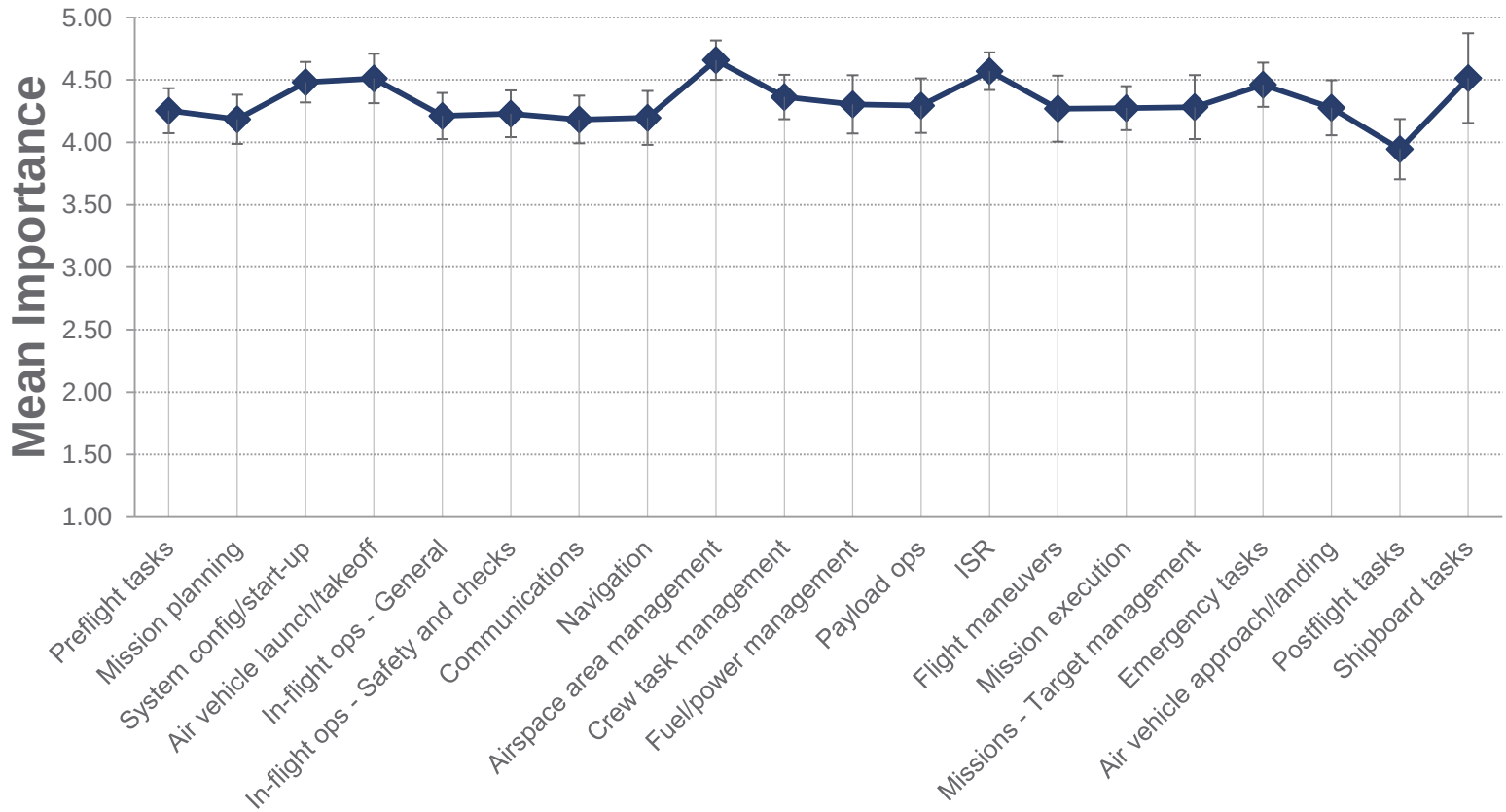
Naval Medical Research Unit – Dayton

		Platform							Total
		MQ-8 Fire Scout	RQ-11 Raven	Scan Eagle	RQ-7 Shadow	MQ-4 BAMS	RQ-4A BAMS-D	Other	
Air Vehicle Operator/ Pilot	Count	5	4	0	29	1	6	1	**46**
	% of Total	6.3%	5.1%	.0%	36.7%	1.3%	7.6%	1.3%	58.2%
Sensor/ Payload Operator	Count	0	1	0	4	6	5	1	**17**
	% of Total	.0%	1.3%	.0%	5.1%	7.6%	6.3%	1.3%	21.5%
Mission Commander	Count	0	0	2	0	2	6	0	**10**
	% of Total	.0%	.0%	2.5%	.0%	2.5%	7.6%	.0%	12.7%
TOPS	Count	0	0	0	0	0	2	0	**2**
	% of Total	.0%	.0%	.0%	.0%	.0%	2.5%	.0%	2.5%
TACCO	Count	0	0	0	0	1	2	0	**3**
	% of Total	.0%	.0%	.0%	.0%	1.3%	2.5%	.0%	3.8%
Other	Count	0	0	0	0	0	1	0	**1**
	% of Total	.0%	.0%	.0%	.0%	.0%	1.3%	.0%	1.3%
Total	Count	**5**	**5**	**2**	**33**	**10**	**22**	**2**	**79**
	% within Position	6.3%	6.3%	2.5%	41.8%	12.7%	27.8%	2.5%	100.0%
	% within Platform	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	6.3%	6.3%	2.5%	41.8%	12.7%	27.8%	2.5%	100.0%

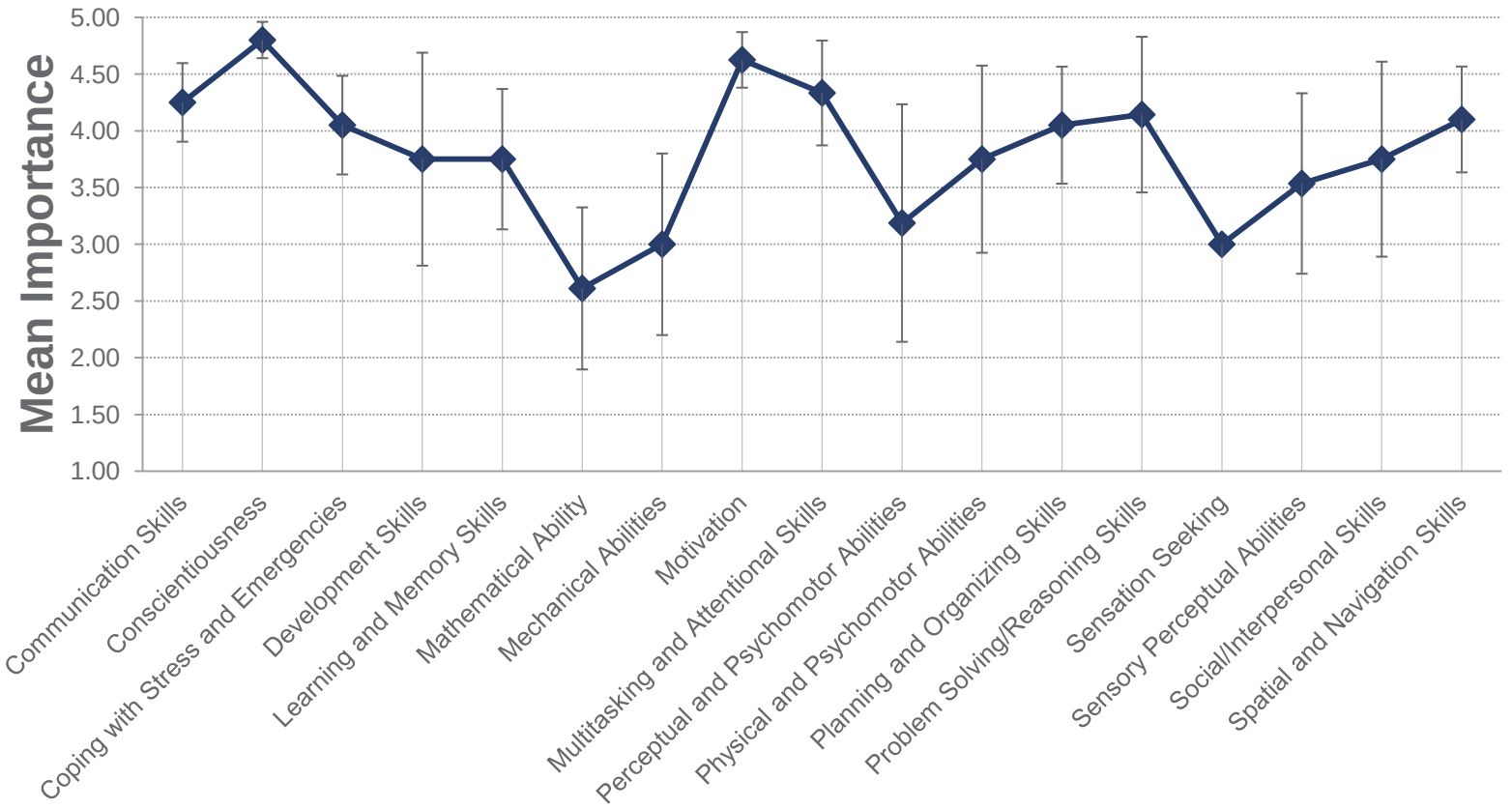
Results – Interrater Agreement

- Statistics: r_{wg} and a_{wg}
- Best agreement for $>$ 3 raters
- Clusters with highest agreement
  - Airspace and operating area management
  - Flight maneuvers
  - Intelligence, Surveillance, and Reconnaissance
  - Shipboard tasks
- Lowest agreement
  - Mission planning

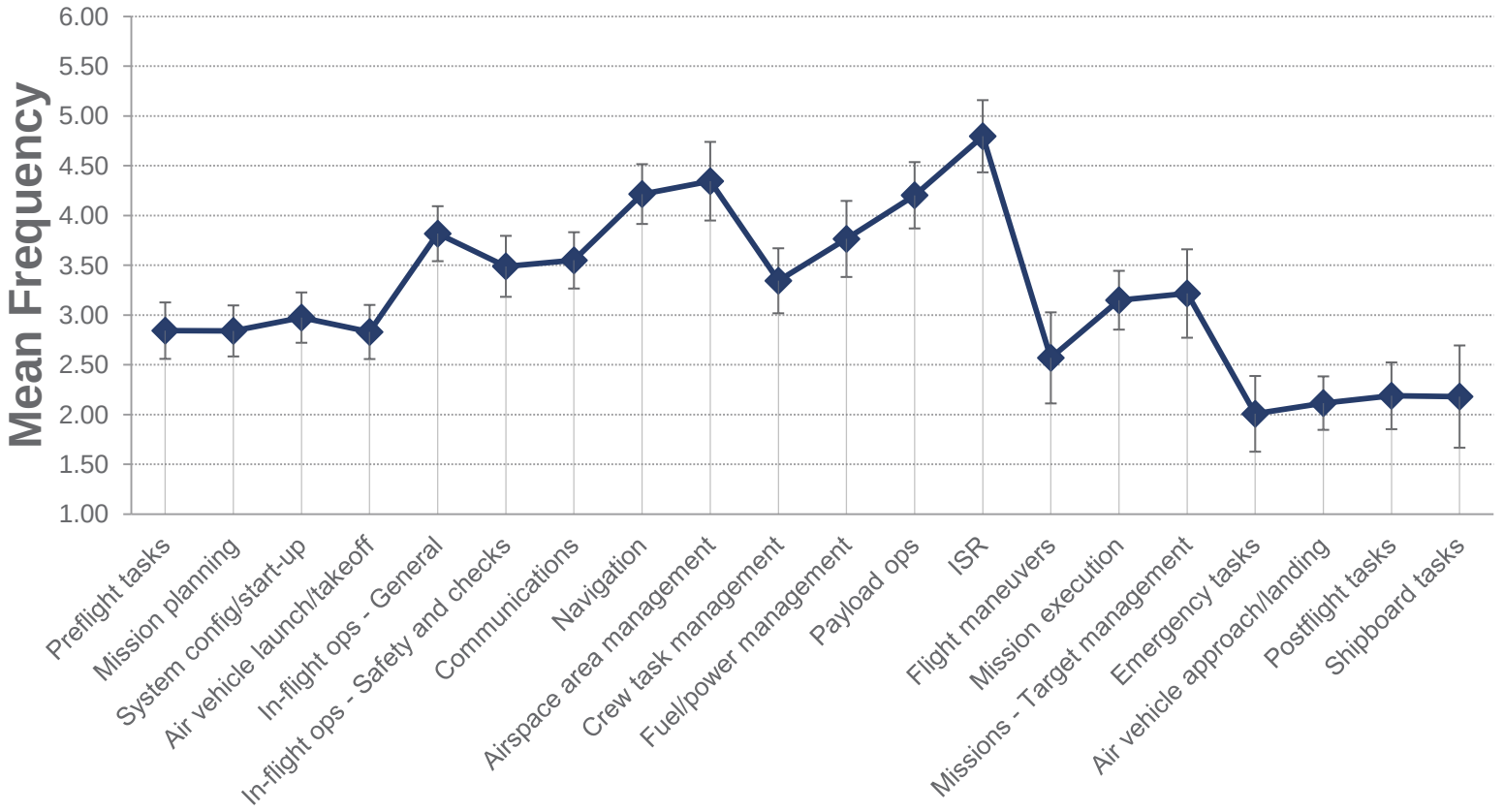
All platforms - Air Vehicle Operator/Pilot



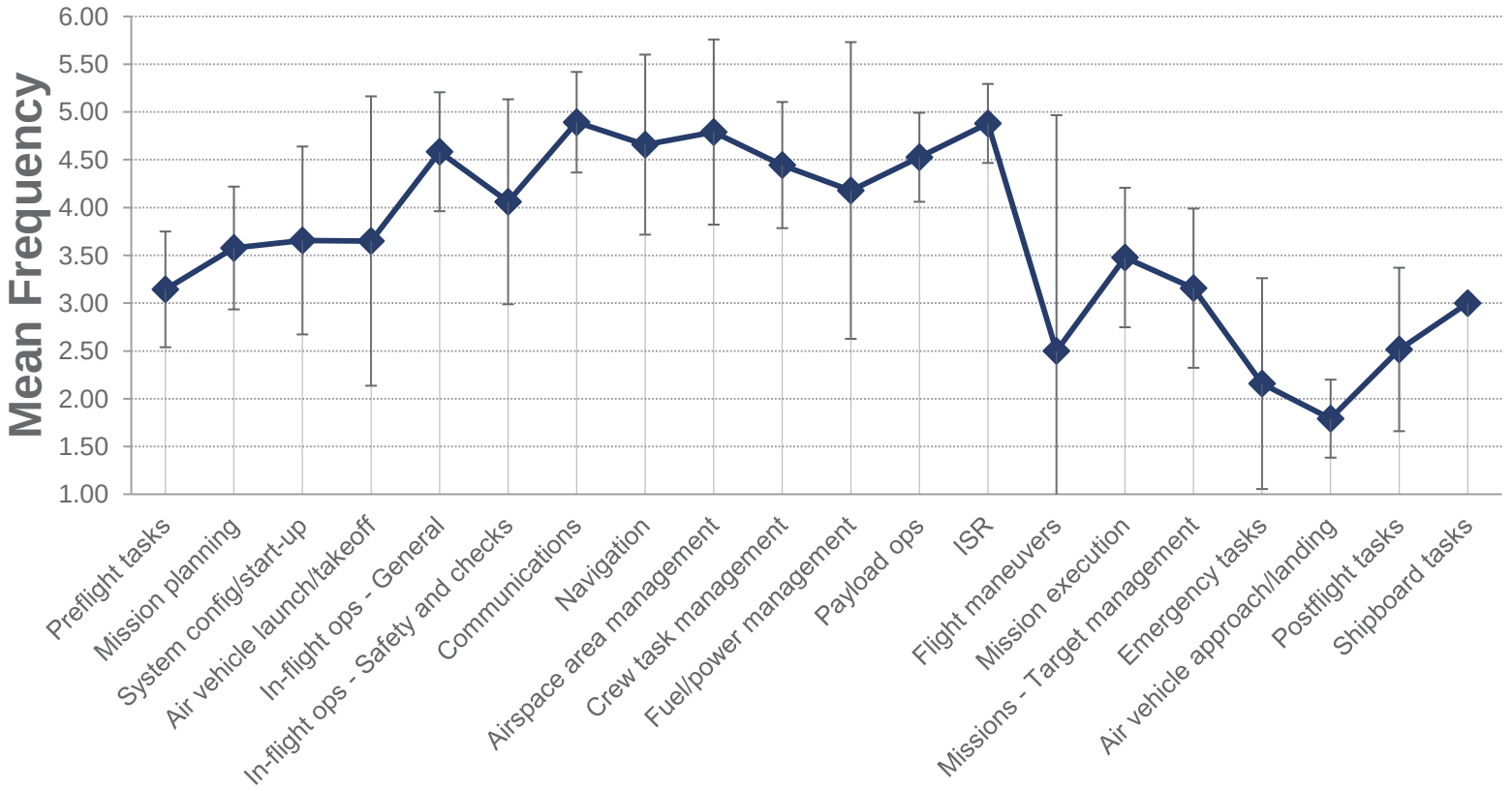
Raven - Air Vehicle Operator/Pilot



All platforms - Air Vehicle Operator/Pilot



All platforms - Sensor/Payload Operator



Key Cross-Platform Tasks…

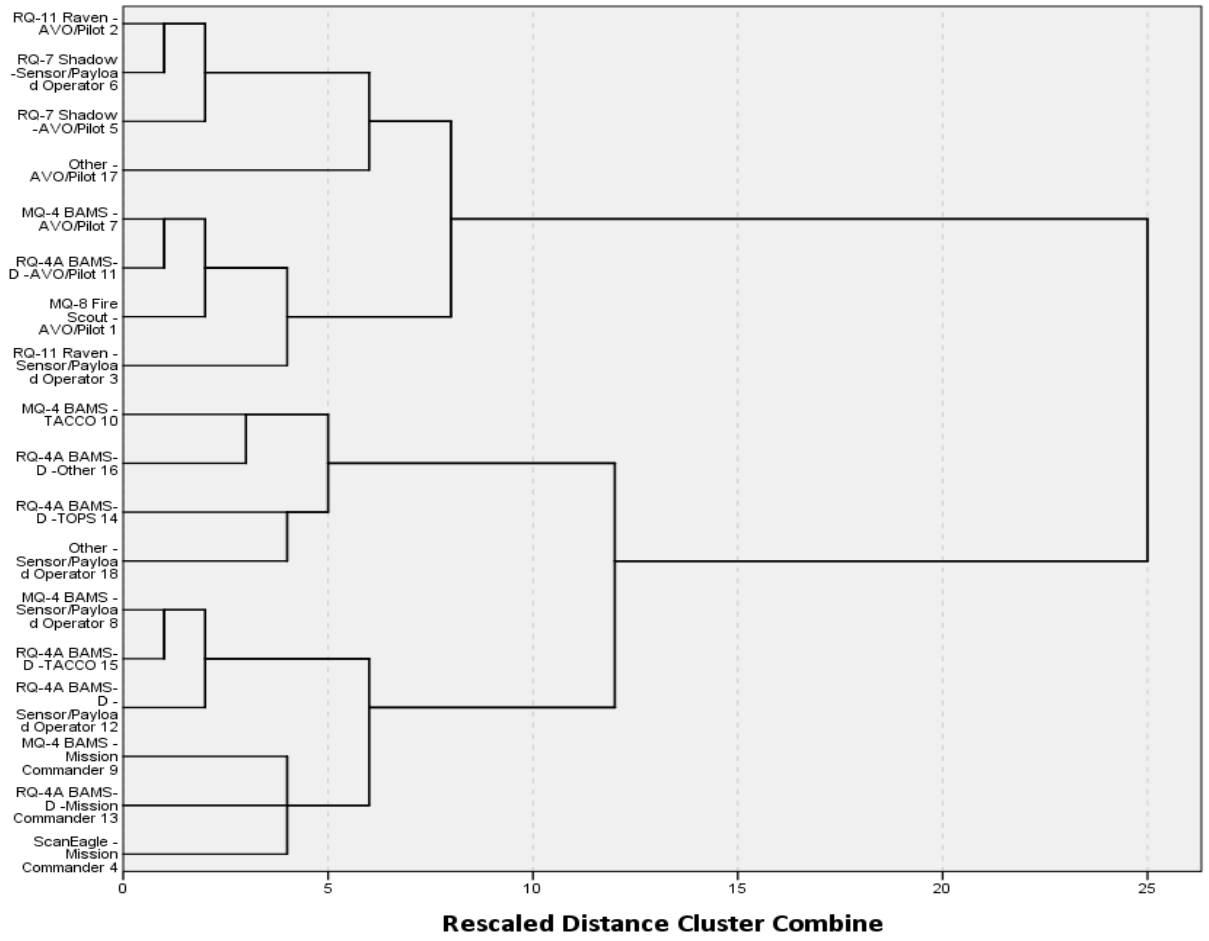
- Perform shipboard takeoff or landing.
- Perform intelligence, surveillance, and reconnaissance tasks, including collecting, reporting, and disseminating intelligence information.
- Maintain awareness of other air traffic and deconflict as necessary.
- Read, understand, and analyze warning or emergency messages.

…And KSAOs

- Oral comprehension
- Dependability
- Adaptability
- Critical thinking
- Deliberation/concentration
- Accountability
- Task prioritization
- Assertiveness
- Teamwork skills

Naval Medical Research Unit – Dayton

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. MQ-8 Fire Scout - AVO/Pilot	-																	
2. RQ-11 Raven -AVO/Pilot	64.87	-																
3. RQ-11 Raven - Sensor/Payload Operator	76.92	121.25	-															
4. ScanEagle -Mission Commander	96.03	85.20	151.11	-														
5. RQ-7 Shadow -AVO/Pilot	41.65	19.67	130.54	97.21	-													
6. RQ-7 Shadow - Sensor/Payload Operator	69.23	1.03	131.00	90.00	20.58	-												
7. MQ-4 BAMS -AVO/Pilot	38.93	42.05	71.61	53.73	51.43	47.66	-											
8. MQ-4 BAMS - Sensor/Payload Operator	114.71	89.47	146.69	91.19	100.62	97.21	81.66	-										
9. MQ-4 BAMS -Mission Commander	92.14	54.93	94.53	84.46	65.41	59.58	64.35	76.20	-									
10. MQ-4 BAMS -TACCO	166.50	161.63	139.83	131.19	163.85	170.21	121.50	59.40	70.74	-								
11. RQ-4A BAMS-D - AVO/Pilot	22.18	46.75	54.37	81.38	59.40	50.71	18.26	100.79	70.92	151.38	-							
12. RQ-4A BAMS-D - Sensor/Payload Operator	132.29	115.56	117.22	118.36	125.18	122.20	107.96	30.63	57.78	45.89	118.47	-						
13. RQ-4A BAMS-D -Mission Commander	131.34	88.79	160.61	89.74	100.96	94.15	87.66	45.71	77.89	98.52	113.25	78.62	-					
14. RQ-4A BAMS-D -TOPS	193.15	233.70	175.54	165.29	231.51	246.91	120.86	119.37	173.29	101.46	173.20	156.46	143.58	-				
15. RQ-4A BAMS-D -TACCO	109.37	92.57	138.64	96.51	104.14	100.79	84.70	4.68	74.85	67.77	95.27	26.36	58.33	145.64	-			
16. RQ-4A BAMS-D -Other	146.60	187.30	103.73	121.45	187.99	199.74	100.77	83.05	102.72	47.93	128.87	61.90	138.77	70.74	88.49	-		
17. Other -AVO/Pilot	69.83	94.56	167.70	148.11	61.98	93.97	92.01	142.48	141.92	222.88	88.99	172.10	196.98	264.32	139.31	208.75	-	
18. Other -Sensor/Payload Operator	166.52	193.96	217.62	163.27	157.14	203.86	145.28	87.38	146.30	67.08	191.03	123.91	100.73	86.82	116.69	99.71	209.27	-



Conclusion

- UAS taskwork uniformly important
- Significant variability in difficulty, frequency, and mastery requirements
- Meaningful cluster results useful for job family development
- Data will be useful for future UAS HF/H SI work, for example:
  - KSAO data can inform identification or development of potentially effective UAS operator selection tests
  - Task rating data (difficulty to learn, level of mastery required) will be useful for UAS training curriculum development
  - Task rating data (importance, frequency) may prove useful for future UAS interface/display design(common or specific)

Navy UAS Training Challenges

Problem:

- UAS training will be conducted via simulators
- Must have realistic environment and entity behaviors
- Limited access to experienced UAS Operators
- Software and SME collaboration is expensive
- Fleet still learning to use UAS. Utilization likely to change as capability realized (refined tactics and new missions)

Solution:

- Content generation tool that creates real entity behavior and scenario features based on sensor data captured from past missions
  - Scenario features: proper look and feel of the mission environment. Appropriate density and type of friend, foe, and neutral entities.

- Content must work with CCS software architecture
  - Using a Navy System (i.e., NGTS)

Unmanned Air Systems Interface, Selection & Training Technologies (UASISTT) UAS Human Machine Interface Common Control System (CCS) Design Challenges

Aug 17, 2012

Michael Spillman
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Introduction

- UASISTT UAS Human Machine Interface Design Objective: Develop Interface design concepts, prototypes, and guidelines *for the Common Control System (CCS)* …

- CCS is referenced at least 7 times in BAA 12-011.

- CCS Mission Statement:
  - –Achieve UAS common control across PEO(U&W) UAS platforms to eliminate redundant efforts, encourage innovation, and improve cost control of unmanned aviation.

Common Control System Approach

- **The Common Control System (CCS) is:**
  1) A software solution with instantiations for Fixed, Mobile, and Dismounted hardware configurations
  2) OSD UAS Control Segment (UCS) Architecture Compliant
  3) Built on a Government managed Open COTS Framework
  4) Common Services and Applications provided by multiple vendors
  5) Unique Services and Applications provided by the UAS Platforms
  6) A Presentation Layer decoupled from underlying functionality
  7) Integrated and Tested by a Government Lead Systems Integration team

CCS will be GFE for UCLASS

Fixed / Mobile / Dismounted

- The Government utilizes many different mediums for display of information from large wall-mounted displays to smart phone displays.

Fixed Shore Based

Mobile: Ship/Truck/Aircraft/Submarine Based

Dismouned Ruggedized Laptop

Dismouned Tablet Computer

CCS Design Challenges/Opportunities

- Enabling a single operator to manage up to 3 UAS of no more than 2 different types showing at least a 25% improvement in performance during a 'Patterns of Life' scenario

- Support for various mission types (surveillance, patrol, strike)

- User Performance
  - User Situational Awareness
  - User Workload
  - User vigilance during long periods of inactivity
  - User effectiveness during sudden and critical dynamic events

- Varying levels of autonomy and levels of interoperability

CCS Design Challenges/Opportunities

BAA Goal: Developing technology solutions addressing critical deficiencies in selecting, training and equipping the Air Vehicle Operator (AVO) position

- Design Challenge 1: User effectiveness during sudden and critical dynamic events.
  - Risks:
    - –Multiple vehicles have simultaneous alerts, and require immediate operator action from a single operator to meet safety requirements.
    - –Multiple vehicles and/or payloads require simultaneous operator action from a single operator to provide mission effectiveness.
- Design Challenge 2: User vigilance during long periods of inactivity.
  - Risks :
    - –Repetitive and/or extended periods of zero tasking results in inattention when high alertness is required for mission effectiveness.
    - –Limited operational staff and long operational hours result in operator fatigue which degrades operator effectiveness.

CCS Design Challenges/Opportunities

- Design Challenge 3: Varying levels of autonomy
  - Risks:
    - –Automation does not provide clear feedback to the operator.
    - –Automation performs actions which the operator did not intend, or which the operator could not resume control when desired.

- Design Challenges 4 and 5: Enabling a single operator to manage up to 3 UAS of no more than 2 different types showing at least a 25% improvement in performance during a 'Patterns of Life' scenario and Support for various mission types (surveillance, patrol, strike)[1].
  - Risks:
    - –User interface clutter and complexity due to supporting many different vehicle types and payload types. The user interface includes items which are not relevant to the current mission.
    - –The user mistakenly selects the incorrect vehicle or payload for interaction, resulting in errors.

1. Reference BAA 12-011

OSD UCS

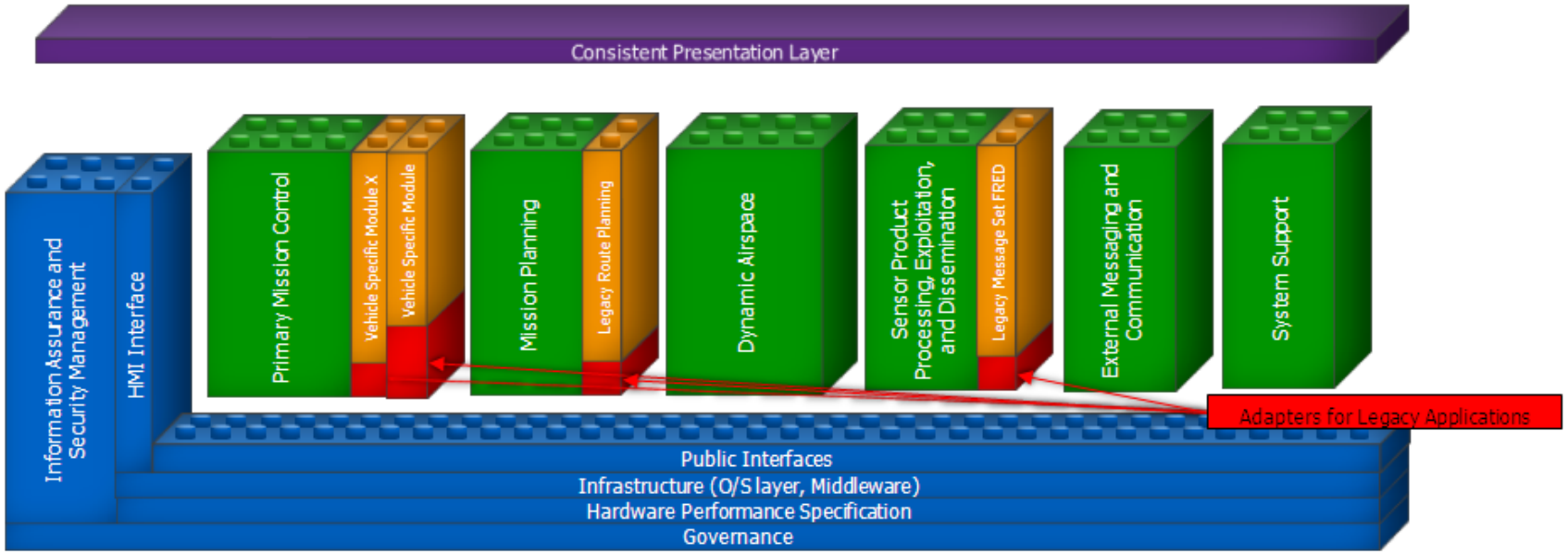
- CCS is aligning with the OSD UCS Architecture

- Overview: "The UAS Control Segment (UCS) Architecture is a framework representing the software-intensive capabilities of current and emerging UAS programs in the U.S. Army, Navy, and Air Force inventories. The goal is to develop an architecture, based upon *Service Oriented Architecture (SOA)* principles, that will be adopted by each of the Services as a common basis for acquiring, integrating, and extending the capabilities of the control systems for UAS." [1]

- Additional information available on the UCS web site[1]:
  - –UAS Ground Control Station HMI Development and Standardization Guide (UASISTT Human Machine Interface research should build on this baseline document).
  - –Video: UCS Overview
  - –Video: Navy CCS

CCS Architecture Based on OSD UCS

The CONSISTENT UI (PRESENTATION LAYER) –
Built through Human Computer Interface (HCI) Style Guide and common task execution, maximizes benefits in training, allows for synergy in usability initiatives, reduces development costs



The FRAMEWORK –
Maximize Commercial Off The Shelf (COTS) and H/W independence, minimize size, leverage JMPS model for Bus./Tech. Rules. Must include Information Assurance Boundary

The UNIQUE Applications/Services –
Program of Record (POR) requirements unique to an individual platform, POR responsible for development, CCS responsible for specifications to work in FRAMEWORK and support consistent presentation layer

The COMMON Applications/Services –
Services or Applications that are shared/reused by Unmanned vehicles (UxV's), CCS responsible for specifications to work in FRAMEWORK and support consistent presentation layer

Presentation Layer

- CCS Presentation Layer intentionally decoupled from underlying functionality. Allows for maintenance of a consistent HMI to the operator.

  –For future integration with CCS, services will provide user interface data, but the actual display of that data could be implemented by a separate entity responsible for the “presentation layer”.

  –Example: CCS is based on an open architecture and open and publishable interfaces. Service interfaces can be tailored as necessary to provide data to the presentation layer (vendor independent).

UxV

OSD UCS and BAA 12-011 are focused on UAS. Future CCS goals include UxV (UAV, UGV, USV, and UUV).

How to do Business with ONR

Unmanned Aerial Systems Interface, Selection & Training Technologies (U-ASISTT) FNC Industry Day

Brian Bradley
Contracting Officer

Distribution Statement A

Doing Business with ONR

- **Team Approach**
  - Program Office
  - Contracts Department
  - Contractor

Contract Type

- Cost Plus Fixed Fee (CPFF) Completion Type Contracts

Be Prepared

- **Approved Accounting System**

  (required for cost type contracts)
- **Current Online Representations and Certifications (ORCA) to include DFARS Clauses**

Be Prepared Continued

- **Complete ONR Specific Representations and Certifications**
- **Assertion of Data Rights**
  - Consult DFARS for Proper Format
    - DFARS 252.227-7013
    - DFARS 252.227-7014

READ THE BAA

Proposal Due Date

Full Proposals are due 3PM (EDT)
7 DEC 2012

Proposal Submission

- Proposals are to be submitted in accordance with the Broad Agency Announcement (BAA)
- In accordance with FY12 BAA's, Offerors must complete and submit the Cost Proposal Spreadsheet, Technical Proposal Template, and Technical Content Document located at:

  http://www.onr.navy.mil/Contracts-Grants/submit-proposal/contracts-proposal/cost-proposal.aspx

Benefits of Technical and Cost Proposal Documents

- Developed to streamline the submission and review of proposal packets
- Eliminates extraneous time and manpower previously spent on free-form proposals
- Cost proposals are submitted in a uniform format

How to Use Templates

- Imbedded Instructions provide assistance on how to complete templates
- Templates must be completed and submitted to constitute a valid proposal package
- Subcontractors are required to provide a separate cost proposal spreadsheet
  - Subcontractors must use ONR's Cost Proposal Template and may submit detailed (unburdened) cost proposal(s) directly to the Government

Proposed Costs

- **Proposed costs must be separated by base and options(s)**
- **Be sure to Provide Consulting Agreements**
  - Name
  - Description of effort to be performed
  - Number of Hours
  - Hourly Rate
  - Travel Costs

Proposed Costs Continued

- **Offerors must be able to support proposed Other Direct Costs (ODC's); such as travel, equipment, materials and supplies by providing:**
  - Invoices
  - Quotes
  - Purchase Orders
  - Historical Cost Information

What Else Can You Do?

- **Be responsive to requests from the Contract Specialist(s) and Program Officer regarding requests for additional information and documentation**
  - Remember we are a team