US Naval Aviation Training in the 21st Century

Naval Air Warfare Center Training Systems Division (NAWCTSD)

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NAWCTSD MISSION

To be the principal Navy center for research, development, test and evaluation, acquisition and product support of training systems, to provide inter-service coordination and training systems support for the Army, Marine Corps, and Air Force, and to perform such other functions and tasks as directed by higher authority.

SELECTED FOCUS AREAS

- **FLEET READINESS**
  - Maintain relevant fielded devices that support current ops

- **EXPANDED FLEET CAPABILITY**
  - Delivering integrated warfighting capability/networked training opportunities
  - Foster Live, Virtual, Constructive training solutions

- **EVALUATION OF NEW TECHNOLOGIES**
  - Rapid prototype deployment
  - Embedded assessment and data analysis tools
TEAM ORLANDO MISSION

Support the U.S. Department of Defense’s requirements by providing a consolidated inter-service military entity in the Central Florida area for Human Performance, Modeling and Simulation and Training. Facilitate research and collaboration of new technologies, programs and agile processes across the inter-agency to further advance a thriving and innovative environment to best support Service requirements and initiatives for effectiveness and efficiency.
COLLABORATIVE ALLIANCE
AVIATION TRAINING PROGRAMS

- Costs of sim vs flight
- Costs & capabilities of traditional OFTs vs new AR/VR part-task trainers
Augmented reality: User can see the real world and we overlay virtual objects into their field of view

Augmented Virtuality: Mixing real world objects into virtual/augmented reality

Virtual reality: User’s field of view is fully covered and immersed into a virtual environment

Virtual Environment: Interactive 3D models or worlds used for training (standard gaming console)
[VIRTUAL REALITY VS AUGMENTED REALITY]

VIDEO-BASED

WEARABLE

Mixed Reality

Real Environment  Augmented Reality  Augmented Virtuality  Virtual Reality
AR/VR TRAINING EFFECTIVENESS

ACTIVE QUESTIONS

Why Use AR/VR.... What are you trying to Train?
- Immersion
- Interactivity

Where does AR/VR work?
- More/As effective as PC-based?
- As Sim/OFT?

For whom does it work?
- Individual differences
- Experience level
- Skill development vs. sustainment

EXISTING BODY OF WORK

• Limited F/A-18 VR Prototype Flight sim. evaluation
• Desktop vs. VR experimental comparison for training maintenance procedures (E-28 Arresting gear system)

CURRENT EFFORTS & EVALUATIONS

• H-60R AR Tablet-based Pre-flight Checklist trainer – https://youtu.be/H5oXR2iR3EI
• H-60S VR Helmet Display Tracking System HUD Trainer
• USAF VR Pilot Training Next
• T-45 VR 4E18 trainer
  Kingsville (4)
  Meridian (4)
  Pensacola (1)
• T-45 VR Part Task Trainer evaluation
• T-45 AR PTT evaluation – Hi-Res COTS HMD
“The cost to operate present and future platforms - combined with advanced capabilities that are rapidly exceeding the capabilities of our current training ranges - demands that we innovate in combining live, virtual, and constructive training.” - The Vision of Naval Aviation 2025
[LIVE-VIRTUAL-CONSTRUCTIVE TRAINING]

[WHAT IS IT]
• Live: Pilots in live aircraft
• Virtual: Pilots in simulators
• Constructive: Artificial entities

[WHY DO WE NEED IT]
• Range limitations
• Need to keep tactics secret
• Cost of flight hours
• Lifespan of existing a/c

[TARGETED NEEDS]
• Cross-Domain Solutions
• Data interoperability
• Secure IP-based comms
• Sustainable distributed operations centers
• Training Effectiveness Framework
• Timeline

• CNO has designated FFC as EA for LVC
• NAVAIR has designated CO, NAWCTSD as the LVC for Training Lead
• Real-time data analyses
• Analyze relationships that would otherwise never be possible
• Find multi-dimensional trends and interactions
**Proficiency Model, Equation & Methodology**

\[ \text{Proficiency points} = (T \times BE \times IQ \times MF) - SD \]

- **Time**
  - Flight Time
  - TO iterations
  - # sorties
  - Time for Mental rehearsal, etc.

- **Baseline Tr’g Eff**
  - Criticality of TO for skill
  - Proportion TOs that can be accomplished for each ACTC level

- **Instr’l Quality**
  - Instructor Support
  - Debrief/ Feedback
  - Scenario
  - Teamwork
  - Admin

- **Media Fidelity**
  - Cockpit Fidelity
  - Aerodynamics
  - Field of View
  - Aural Cueing
  - Systems Fidelity

- **Skill Decay**
  - Prior learning
  - Length of hiatus
  - Task complexity
  - Nature of skill
  - Instructional support

- **Mental rehearsal, etc.**

- **T** = Practice time (or trials/ iterations)

- **BE** = TO Criticality + % TO attainable

- **IQ** = \( \frac{\text{Actual Instr’l features [i.e., capability]}}{\text{Ideal Instr’l features [i.e., criticality]}} \)
  - to support the skill

- **MF** = \( \frac{\text{Actual Media Fidelity [i.e., capability]}}{\text{Ideal Media Fidelity [i.e., criticality]}} \)
  - to support the skill

- **SD** = Rate Asymptote “Grace period”

**Proficiency Points**
- calculated for each skill, ACTC level & R+ month across FRTP.
- Proficiency points + SME estimates of learning rates produce Hypothesized Proficiency curves.

**Proficiency Points Formula**
- \( \text{Proficiency points} = (T \times BE \times IQ \times MF) - SD \)

**Legend:**
- TO = Task Option
- FRTP = Fleet Response Training Plan

**Hypothesized Proficiency Curves**
- PROFICIENCY MODEL, EQUATION & METHODOLOGY

**Note:**
-LEGEND: TO = Task Option; FRTP = Fleet Response Training Plan
BACKUP