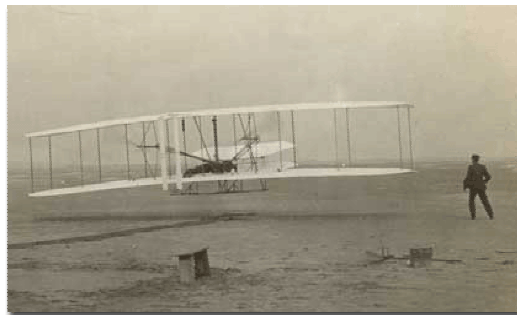


High Fidelity Training for UAS Aircrew



1903

~30 years

1934

From the Wright Flyer to the "Blue Box"



1975

From Mastiff to PMATS
~30 years

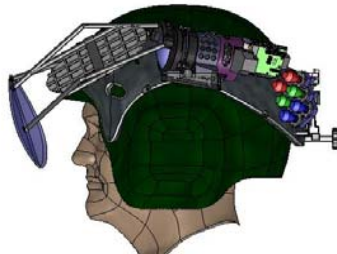
2005



CERI UAV Human Factors Workshop
21 May 2007

Outline

- Corporate Introduction
- UAS Training Context
- Predator Mission Aircrew Training System (PMATS)
 - Background
 - Program Specifics
- UAS Community Signposts



We Know
Training
From The
Ground Up

CY06E Sales By Segment - Preliminary

L-3 Consolidated (CY06E)

\$12.4B



34% Specialized Products

\$4.2B

24%

C³ISR

\$3.0B

23%

Government Services

\$2.9B

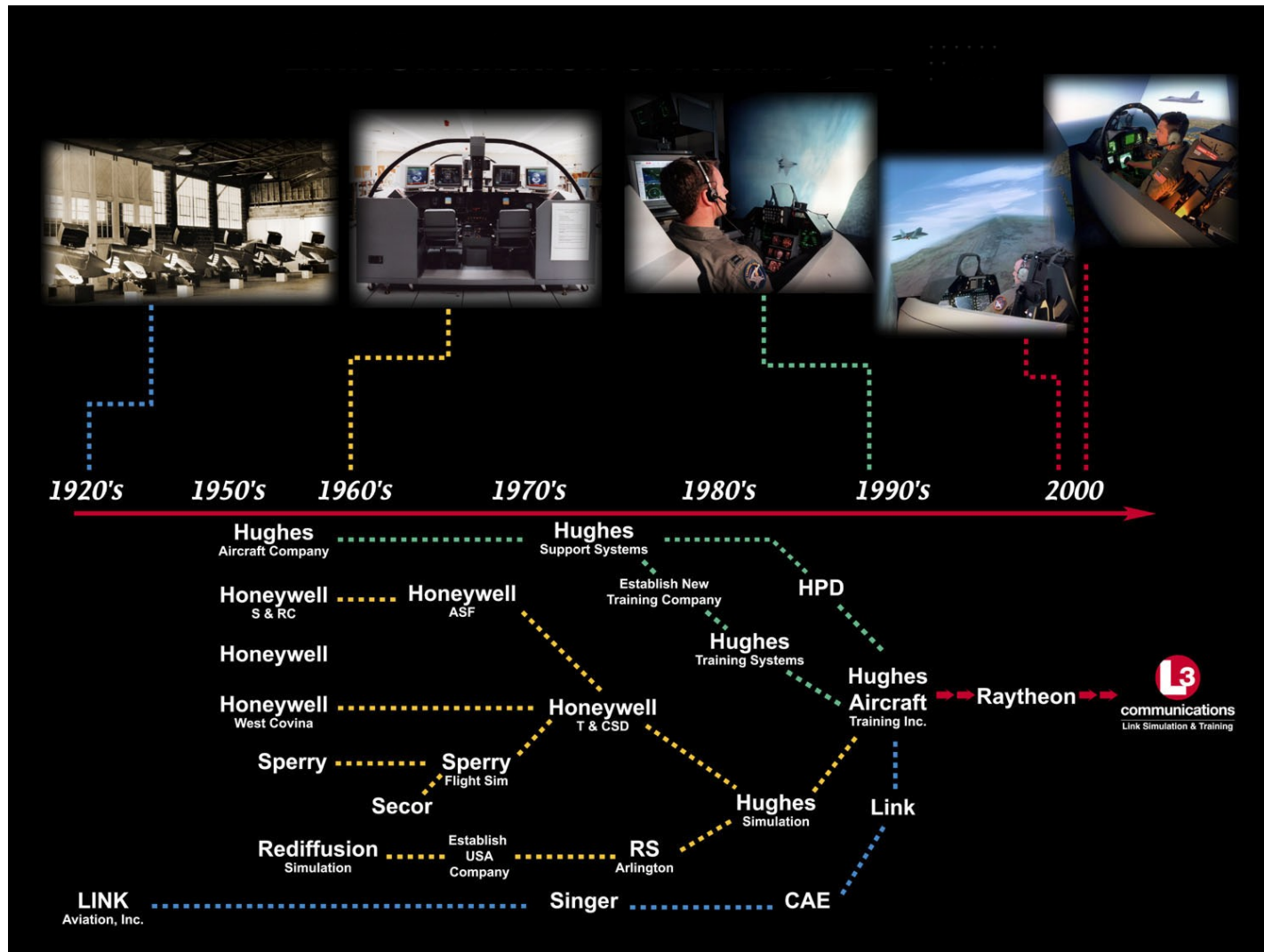
19%

Aircraft Modernization, and Maintenance

\$2.4B



Link Simulation & Training Legacy



Industry Leader ... Fixed and RW Training Solutions

PRODUCTS

Distributed Mission Operations (DMO)
 Collective Training Systems - AVCATT
 Tactical Operational Flight Trainer
 Operational Flight Trainers
 Weapon System Trainers
 Weapon Tactics Trainers
 Part Task Trainers
 Deployable Training Devices
 Aircrew Systems Trainers
 Computer-Based Training
 Maintenance Trainers
 Front End Analysis
 Instruction
 Training Management
 CLS / CTSS

AIRCRAFT

A-4	F-15	AH-1S
A-5	F-16	AH-1W
A-6	FA-18	AH-64
A-7	EA-18G	CH-46
AV-8	F-22	CH-47
B-2	F-111	CH-53
B-52	F-117	UH-1H
C-130	KC-10	UH-1N
C-141	KC-135	UH-60
E-3	MQ-1	SH-60
E-6	P-3	OH-58
EA-18G	T-37	
F-4	T-38	
F-5	T-45	
F-14		

SPECIALITY

Systems Integration
 Instructional Systems
 Performance Enhancement
 Brief/Debrief/AAR
 PC Architectures
 Avionics Modeling
 Interoperability
 Aero Modeling
 Image Generation
 Visual Displays
 HMD
 Sensors
 Legacy Simulator Upgrades
 Distributed Microprocessors

Brief History of DoD UAS Training

- 80s: Israeli Mastiff & Pioneer enter DoD inventory
 - Creation of dedicated schoolhouse at Ft. Huachuca
 - Classroom theory + live flights
- 90s: The MUSE Generation
 - Initially designed solely to train Hunter crews
 - 6-DOF aircraft model + Visual Scene Generator + training scripts
 - Plug MUSE into GCS and “fly” it around
 - Additional platforms & sensors added:
 - Pioneer, Outrider, Predator, U-2, etc.
 - From operator training to staff level training
 - Original intent under utilized
 - Primarily due to operational burden on “flight-worthy” systems
 - Crew training syllabus remained heavily dependent on live flights
- 21st Century: Embedded Training
 - Difficulty with fault insertion into “flight-worthy” system
 - UAV training pipelines remain live flight dependent
 - Student throughput perennially backlogged

PMATS Overview

- Predator Mission Aircrew Training System (PMATS)
 - Requirements
 - High-fidelity, fully immersive, Predator simulation for both pilots and sensor operators
 - Maintain concurrency with fielded system
 - Front End: (Nearly) exact replica of flight-worthy system
 - OEM supplied
 - Back End:
 - 6-DOF flight model (OEM provided)
 - Virtual Environment
 - Terrain, sensor imaging, synthetic targets / forces
 - Instructional System Support
 - Instructor Operator Station (IOS)
 - Fault insertion; recording/playback; briefing / debriefing
 - Networked server backbone; distributed training (i.e., DMO)

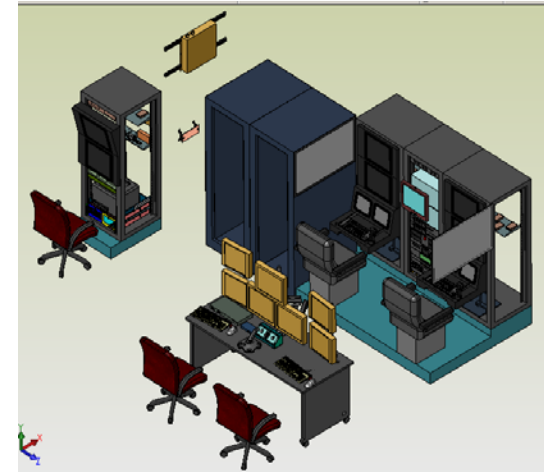
PMATS Overview

■ Program Specifics

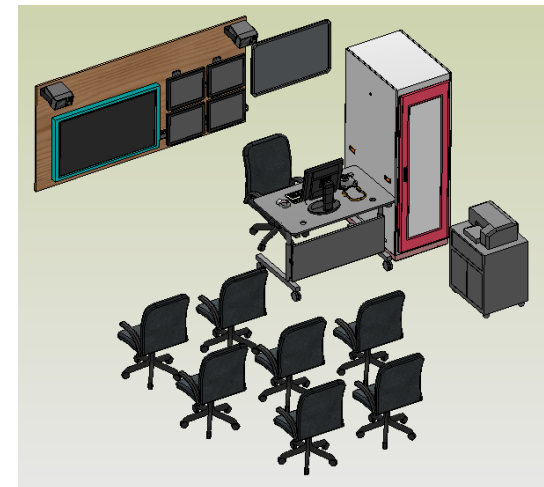
- Awarded: Jun3, 2005
- Deliver 7 systems to Creech AFB
 - System Includes:
 - Student workstation (Predator GCS)
 - Instructor Operator Station (IOS)
 - Brief / debrief workstation
 - Retain a “testbed” system at Link

■ Current Status

- Initial Delivery: Commenced Dec 2006
 - 8 PMATS
 - 3 Brief / De-brief
- April 2007: USAF Exercised Option
 - 8 more PMATS
 - 2 more Brief / De-brief



GCS & IOS



Brief / Debrief

Core Enabling Technologies

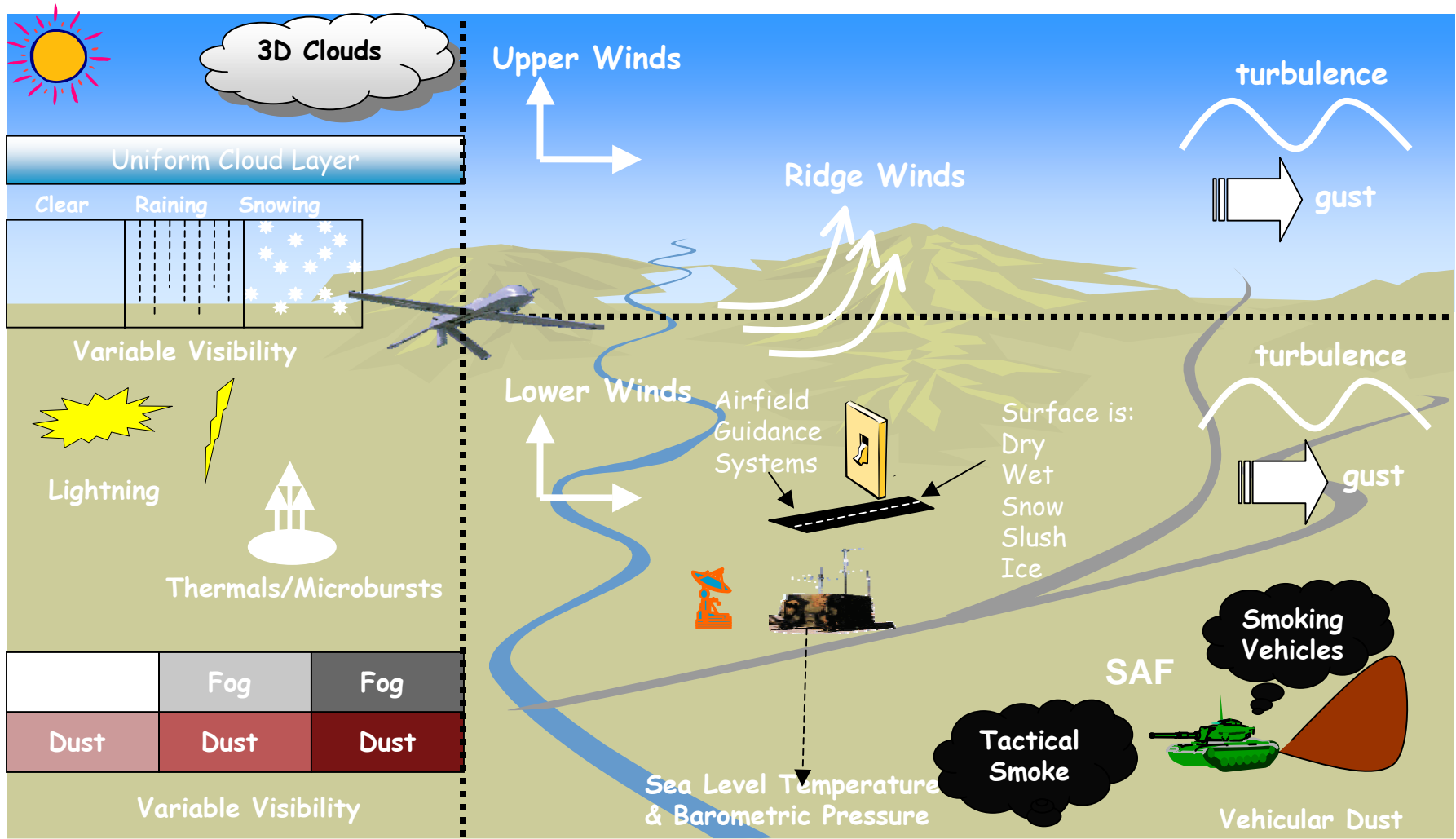
- Instructional Systems
 - IOS, Brief/Debrief, Malfunctions, Role Players
- Interoperability
 - Local and long haul networks
- Environments
 - Physics based, Natural, Battlefield, Targets, Crowds
- COTS PC Architecture
 - Host Computer, Image Generator, Instructional Systems
- Modeling
 - Aero, Sensors, Weapons, Communications

Enables Realism to the Operators
Leverages Existing DoD Investment

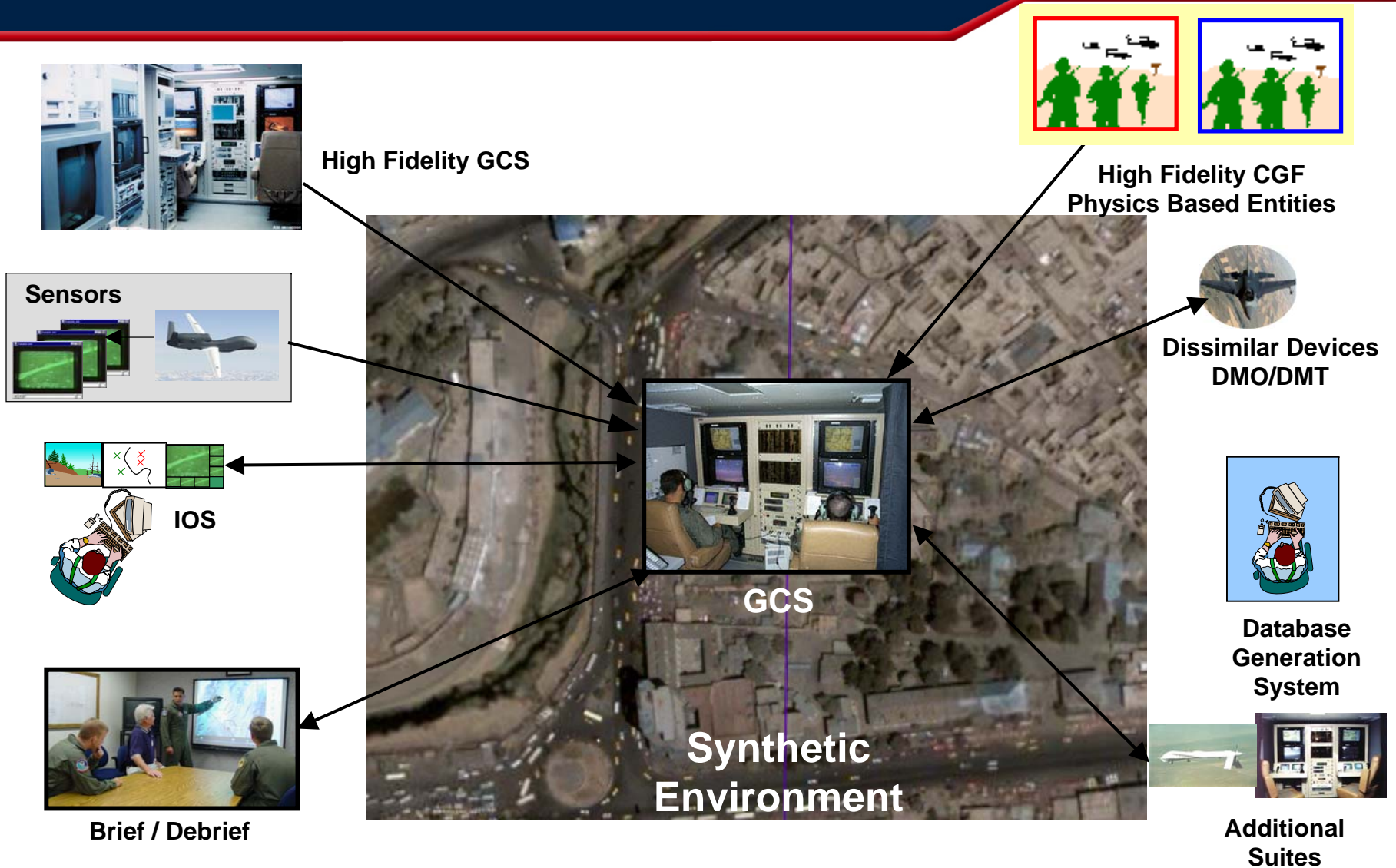
UAS-Unique Simulation Technology

- UAS Datalink Modeling
 - For accurate training of both LOS & SATCOM procedures
 - Handoffs between forward and read GCS
 - Link loss emergency procedures training
- Environmental effects on aircraft and sensors
 - Icing, winds, clouds, haze, smoke, thermal crossover
- Extendable training system matches fielded platform
 - Sensors: EO / IR, SAR, Nose camera
 - Weapons
 - Communications: ARC-210 voice comms
 - Configuration: RQ-1B, MQ-1B, MQ-9, etc.
- Emergency Procedures Training
 - Instructor console configured to inject UAS-centric faults

Environment Realism



UAS Training Systems Concept



PMATS Training Advantages

- From Taxi to Shutdown
 - Visuals precisely replicate Creech airfield and Nellis ranges
 - Potential to eliminate (some number) of live syllabus flights
- Emergency procedures training
 - Overcomes reluctance to insert complex faults into flight-worthy system
 - Some UAV emergencies cannot be simulated during a live flight
 - Examples: Engine Cut; Datalink Loss; Severe Weather (icing)
- Reconfigurable on the fly
 - Ability to replicate wide variety of fielded configurations (when available)
 - RQ-1A, RQ-1B, MQ-1, MQ-9...
 - Customized crew training (concurrency)
- Tactics Development
 - “Try before you fly”
 - Reduces live flight demos

Same advantages as
seen in manned aircraft
training systems

Positive UAS Community Signposts

- From the Wright Flyer to the Blue Box
 - Simple airplanes; small quantities; few pilots
 - Hard to justify the case for fully immersive simulators
- From Mastiff to PMATS
 - Relatively small worldwide investment in UAS (vs. manned aviation)
 - Hard to justify value of PMATS-like concept during those early years
 - UAS community “mass” in 2006 changes the equation
 - Complexity, cost, number of affected personnel
- PMATS Contract Signposts
 - Formal recognition of the value of immersive training
 - Contract awarded to a recognized training company
 - Acknowledgment that embedded training has limitations
 - Potential Return on Investment
 - Reduced live flight syllabus
 - Increased student throughput
 - Enhanced training experience; more qualified graduates

Conclusion

“Aviation Discipline / Culture One Standard for Manned / Unmanned”

- PM UAVS Pathfinder 06 presentation.

- “Moving the Army’s UAS program from MI oversight into the manned aviation world allows us to bring the same technical and safety rigor to these systems as we employ on all our other aircraft.”
 - Paraphrased from COL Hazelwood’s (PM UAVS) presentation at AAAA Symposium, Feb 2007
- We agree.
 - Especially regarding simulation and training.

For more info:

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