United States Air Force

The MathWorks Aerospace and Defense Conference 2006
“Innovation Across the Industry”

Washington, DC
14 June 2006

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Mark Dusenberry pilots a replica 1905 Wright Flyer III over the Huffman Prairie Wednesday during the Centennial of Practical Flight ceremony. Mr. Dusenberry of Dover, Ohio, built the aircraft himself spending nearly 10,000 hours over eight years. The celebration was held at the same location where the Wright Brothers began their quest to demonstrate practical flight 100 years ago.
What Do Air Force Engineers Do?

- Assess Emerging Technologies Through Applied Technology Demonstrations
- Create Partnerships with Industry and Academia
- Technology Push!
What Do Air Force Engineers Do?

- Operate
  - Highly Instrumented Aircraft
  - Specialized Ground Facilities
- Manage Land, Sea, and Air Test Ranges
- Conduct Test & Evaluation and Training
What Do Air Force Engineers Do?

- Designated Acquisition Commander
- Program New Starts and Planning
- Program Execution
- Cradle-to-Grave Management

Long Range Strike

Space Launch

Acquisition

JASSM

UCAV

F-22A
What Do Air Force Engineers Do?

- Sustaining Engineering
- System Enhancements
- Disposition

Modification and Sustainment

Nuclear Sustainment
Where do AF Engineers Work? - Ohio
Where do AF Engineers Work? - Florida

- JDAM
- AMRAAM
- AGM-130
- CALCM
- GWEF
- JASSM
- GBU-28
- Gunship
Where do Engineers Work – New Mexico
Where do Engineers Work - California
AF Engineers Across the World

• Florida - Missiles
• Ohio - Aeronautical
• California – Space Launch
• New Mexico – Directed Energy
• Colorado – Space Control
• Texas – Electronics Intelligence
• Utah, Oklahoma, Georgia – Sustaining Engineering
• Washington DC – Basic Research
• Hawaii – Optics
• Massachusetts – Command and Control
• And Many Others States and Countries
System-of-Systems Interoperability

Network Centric Environment

C4ISR Systems
(Platforms)

Operator
(Pilot & Nav)

Display
(MFD)

Information
Visualization

Operator
(Pilot)

Display
(DDI)

Information
Visualization

C4ISR Systems
(Platforms)

System

DataLink

Box-to-Box

Terminal (JTIDS)

Host (F-3 Tornado)

Data

010110

RF

Data/Protocol

Brain-to-Brain

System-of-Systems Interoperability
Life Cycle Testing

**Laboratory**
- Evaluate network performance
- Simulation of C4ISR, National Assets, and next generation weapon, and tactical reconnaissance
- Conduct mission rehearsals

**Hardware-in-the-Loop**
- Simulation of C4ISR, National Assets, and tactical reconnaissance
- Measure next generation weapon inputs, processing, and outputs
- Measure emitters, ISR inputs, countermeasures
- Simulate C4 and tactical reconnaissance

**Captive Flight Test**
- Measure next generation weapon inputs, processing, and outputs
- Measure emitters, ISR inputs, countermeasures
- Simulate C4ISR and tactical reconnaissance

**Live Fire Test**
- Measure next generation weapon in-flight via TM (countermeasure response)
- Measure next generation weapon outputs and accuracy (miss distance)
- Simulate or provide C4ISR inputs and tactical reconnaissance

**Joint Experiments**
- Simulate next generation weapon tactical employment
- Measure C4ISR and National Asset inputs
- Conduct mission planning, execution, and tactical reconnaissance modeling and simulation
Predator Hellfire Integration
Higher-Level Integration

Legacy Force Structure
“Not Plug and Play”

Future Force Structure
“Holy Grail”

Networking The Force
Sensors
Regardless of Platform

Decision Makers
Regardless of Location

Shooters
Regardless of Service

Warfighting Effects

- Network-centric
- Platform-centric

Forces Applied

Why?

What?
Integrated Collaborative Environment

• **Enable Capability Centric Development and Test**
  – Identify system integration risks early in acquisition cycle
  – Capture complexity of network warfare realistically
  – Enable collaboration across system acquisition programs

• **Responsive Analyses**
  – Answers on time (when promised)
  – Timely capability delivery

• **Efficient Analyses**
  – Avoid rework - Leverage past MS&A investments
  – Reduce cost of analyses

• **Credibility**
  – Enables consistent analyses and conclusions
  – Builds trust between warfighters and acquirers

“This is all about running a distributed network for development and test -- not about a facility.” - Dave Tillotson
Integrated Collaborative Environment Demonstration
July 17-21 2006

INTEGRATED

- Standardize event planning process
- Web-based collaboration

PERSISTENT

- Identify and address multi-level security processes (AFSO 21)
- Establish dedicated network hardware

REUSABLE

- Capture data and models in an organized and accessible repository
Scientists and Engineers
Make it Happen

The F-22A Raptor
Air Force Recruiting

- Electrical Engineers 200 / year
- Aero Engineers 75 / year
- Mechanical Engineers 50 / year
- General (System) 30 / year
- Computer Engineering 25 / year
- Other 25 / year
  - Computer Science, Physics, Chem, Biology, Industrial, Materials, Math, Nuclear, …)

- Larger number of mid-grade hires
Air Force Careers

- Incredible diversity of experiences available
- Attractive education and retirement benefits
- Significant number of mid-career hires due to cutbacks 15 years ago
  - Recruiting from industry and military
What Do AF (Civilian) Engineers Earn?

- Entry-level engineers make $35-50K
  - Some may get a signing bonus
  - Some may get a guaranteed year off, with pay and tuition, for an advanced degree
- Mid-grade (GS-13) make $75-100K
- Senior Engineers can make $100-160K
Summary

• Lots of exciting science and engineering going on in the Air Force

• Modeling and Simulation growing in importance as a tool for higher-level integration
  – Tools are improving
  – Seeking greater standardization of tools

• Multidisciplinary teams of great people make it happen
Questions?

MISSION

Deliver sovereign options for the defense of the United States of America and its global interests -- to fly and fight in Air, Space and Cyberspace