United States Air Force

The MathWorks Aerospace and Defense Conference 2006
"Innovation Across the Industry"

Washington, DC
14 June 2006

Dr. Steve Butler
Director, Engineering and Technical Management
Wright-Patterson Air Force Base, Ohio

Ready to Rumble

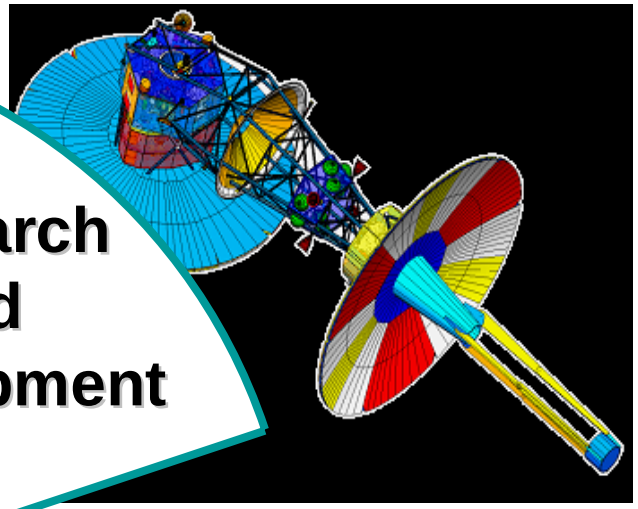
Mark Dusenberry pilots a replica 1905 Wright Flyer III over the Huffman Prairie Wednesday during the Centennial of Practical Flight ceremony. Mr. Dusenberry of Dover, Ohio, built the aircraft himself spending nearly 10,000 hours over eight years. The celebration was held at the same location where the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

What Do Air Force Engineers Do?

What Do Air Force Engineers Do?

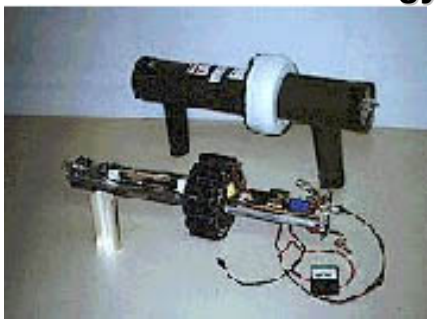
Space

GPS/INS

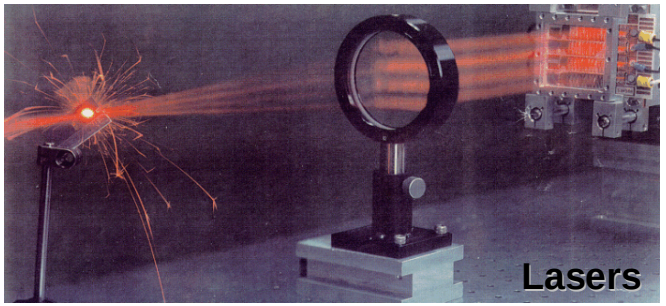


Research and Development

Tactical Directed Energy



Starfire Optical



Lasers

- Assess Emerging Technologies Through Applied Technology Demonstrations
- Create Partnerships with Industry and Academia
- Technology Push!

What Do Air Force Engineers Do?

Command and Control

National Radar Test Facility

Indoor Radar Range

Climatic Lab

Test and Evaluation

Test Ranges

Sled Track

- **Operate**
  - **Highly Instrumented Aircraft**
  - **Specialized Ground Facilities**
- **Manage Land, Sea, and Air Test Ranges**
- **Conduct Test & Evaluation and Training**

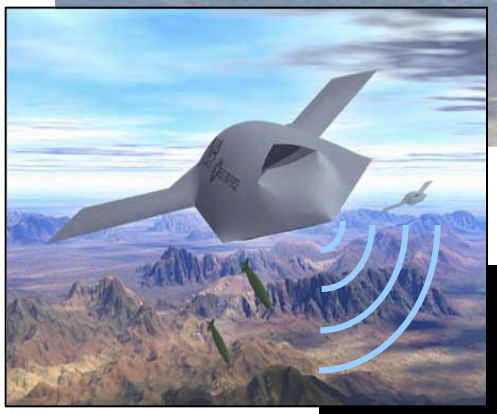
What Do Air Force Engineers Do?

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

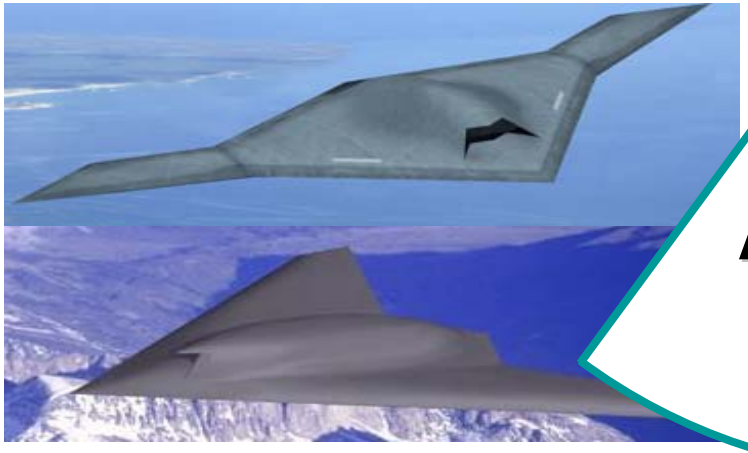
F-22A

JASSM

UCAV



Long Range Strike



Space Launch

Acquisition

What Do Air Force Engineers Do?

A-10

F-15

U-2

Modification and Sustainment

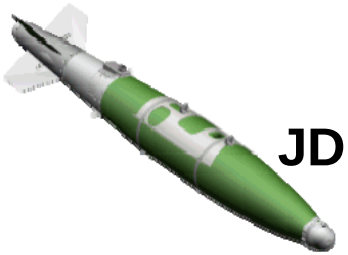
- SustainingEngineering
- System Enhancements
- Disposition

Nuclear Sustainment

AC-130

Where do AF Engineers Work? - Ohio

Where do AF Engineers Work? - Florida

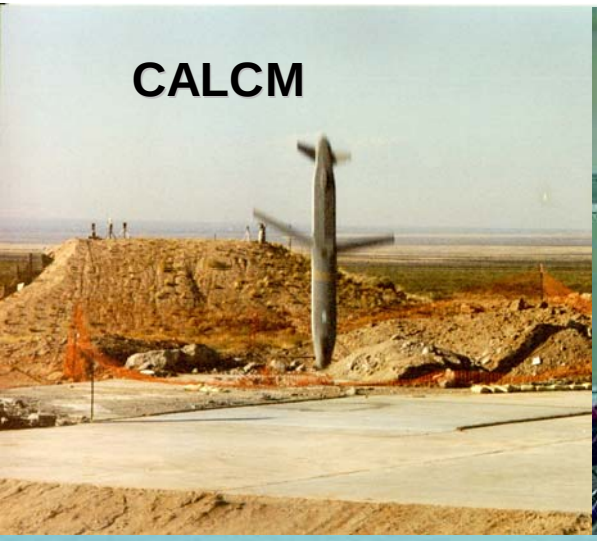


JDAM

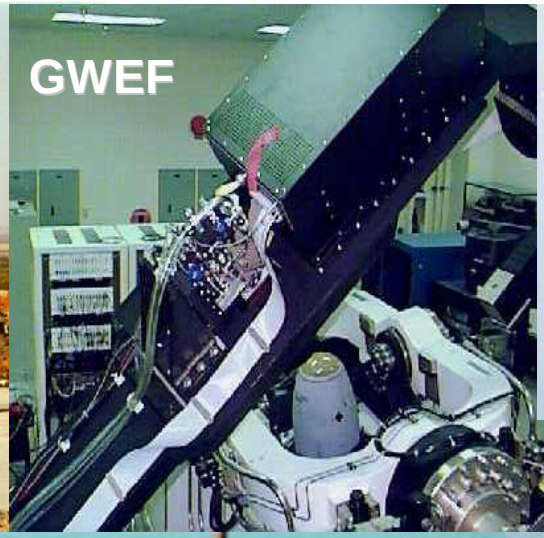
AMRAAM

AGM-130

CALCM



GWEF

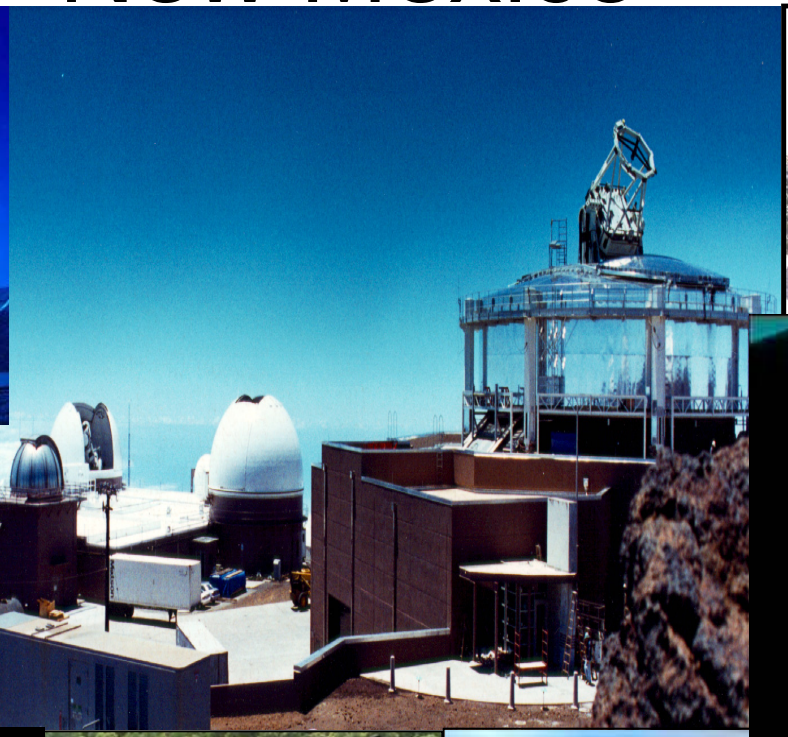


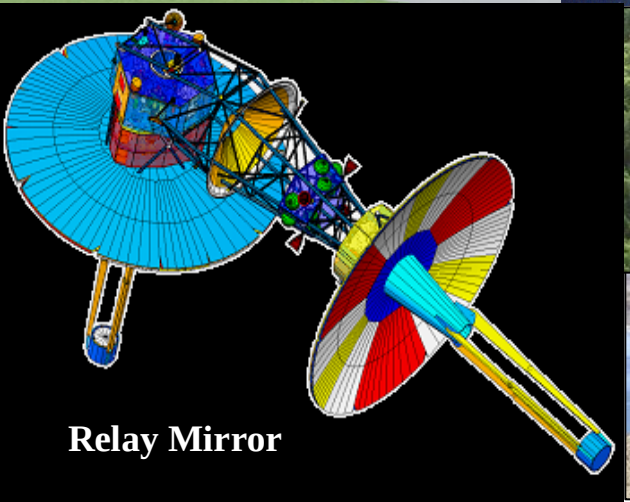
JASSM

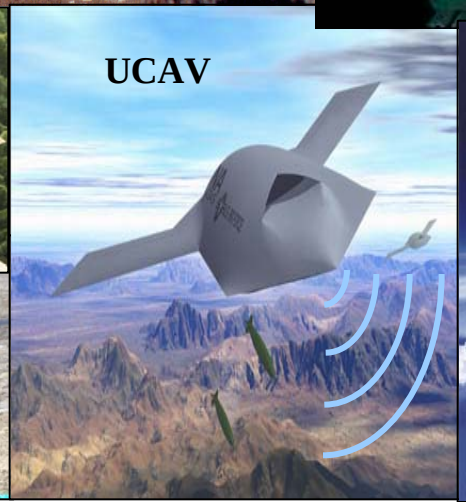
GBU-28

Gunship

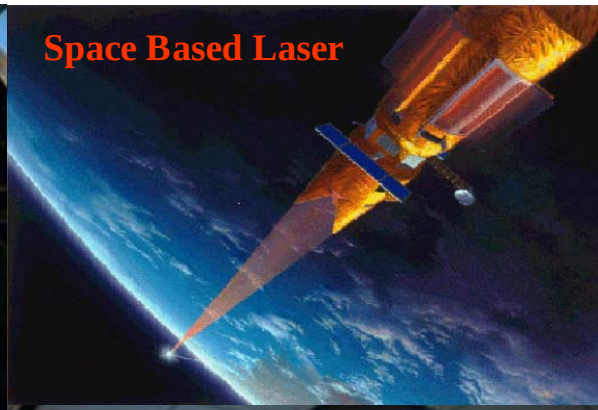
Where do Engineers Work – New Mexico







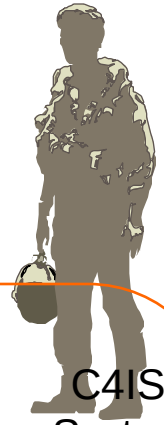
Where do Engineers Work - California



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)

Information

Display (MFD)

Visualization

System

DataLink

Host (F-3 Tornado)

Data

Box-to-Box

Terminal (JTIDS)

Terminal (MIDS)

010110

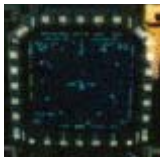
010110

RF

Host (F/A-18C Hornet)

Data

Display (DDI)

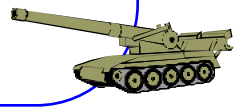


Visualization

Operator (Pilot)

Information

C4ISR Systems (Platforms)



Data/Protocol

Brain-to-Brain

System-of-Systems Interoperability

Life Cycle Testing

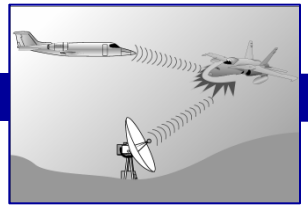
Laboratory

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

Hardware -in-the- Loop

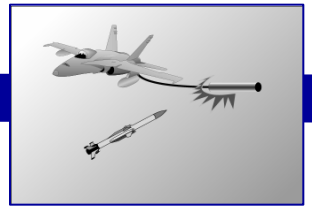
- Simulation of C4ISR, National Assets, and tactical reconnaissance
- Measure next generation weapon inputs, processing, and outputs

Captive Flight Test



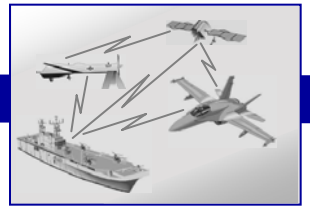
- Measure next generation weapon inputs, processing, and outputs
- Measure emitters, ISR inputs, countermeasures
- Simulate C4 and tactical reconnaissance

Live Fire Test

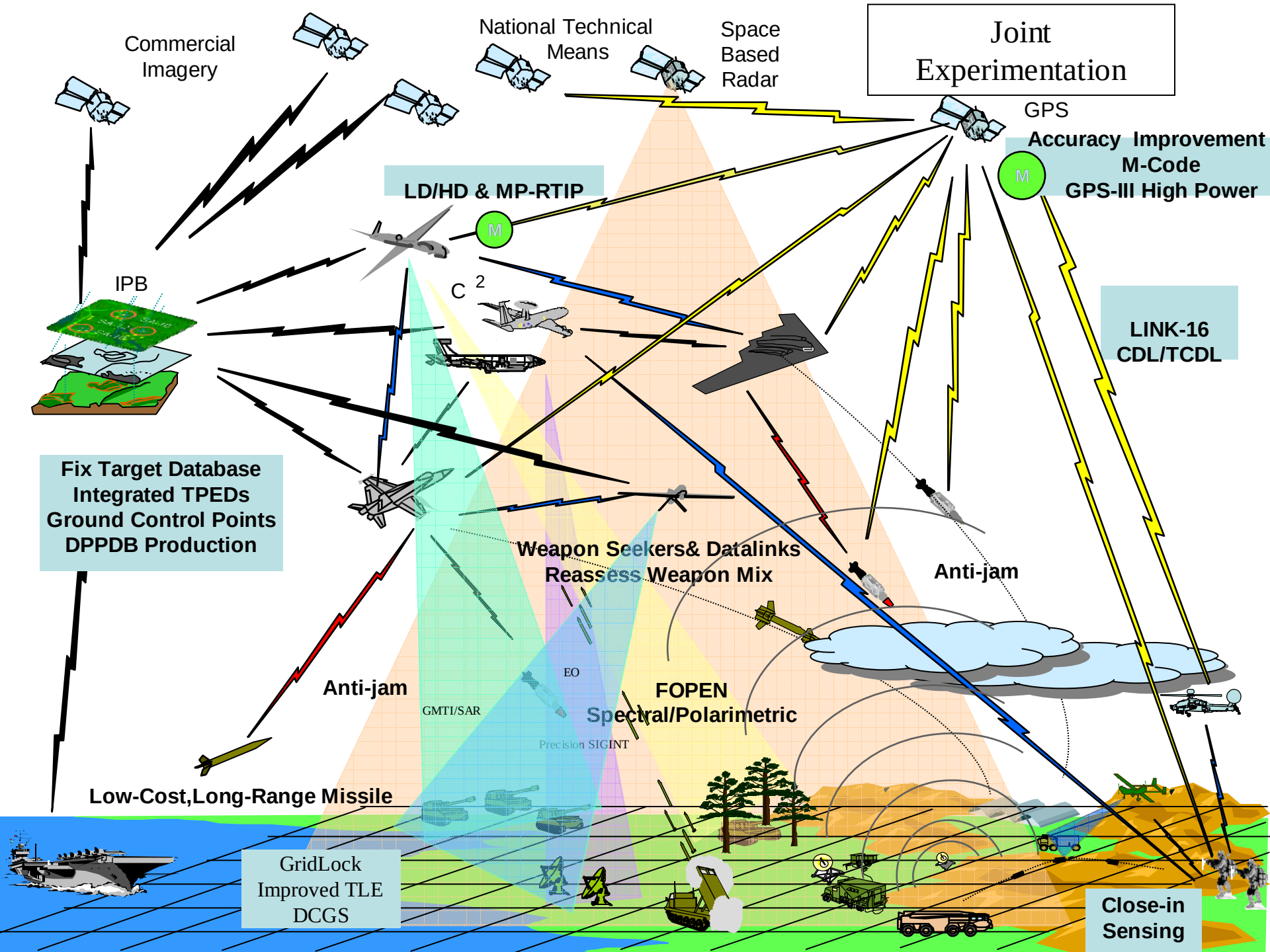


- Measure next generation weapon in-flight via TM (countermeasure response)
- Measure next generation weapon outputs and accuracy (miss distance)
- Simulate or provide C4ISR inputs and tactical reconnaissance

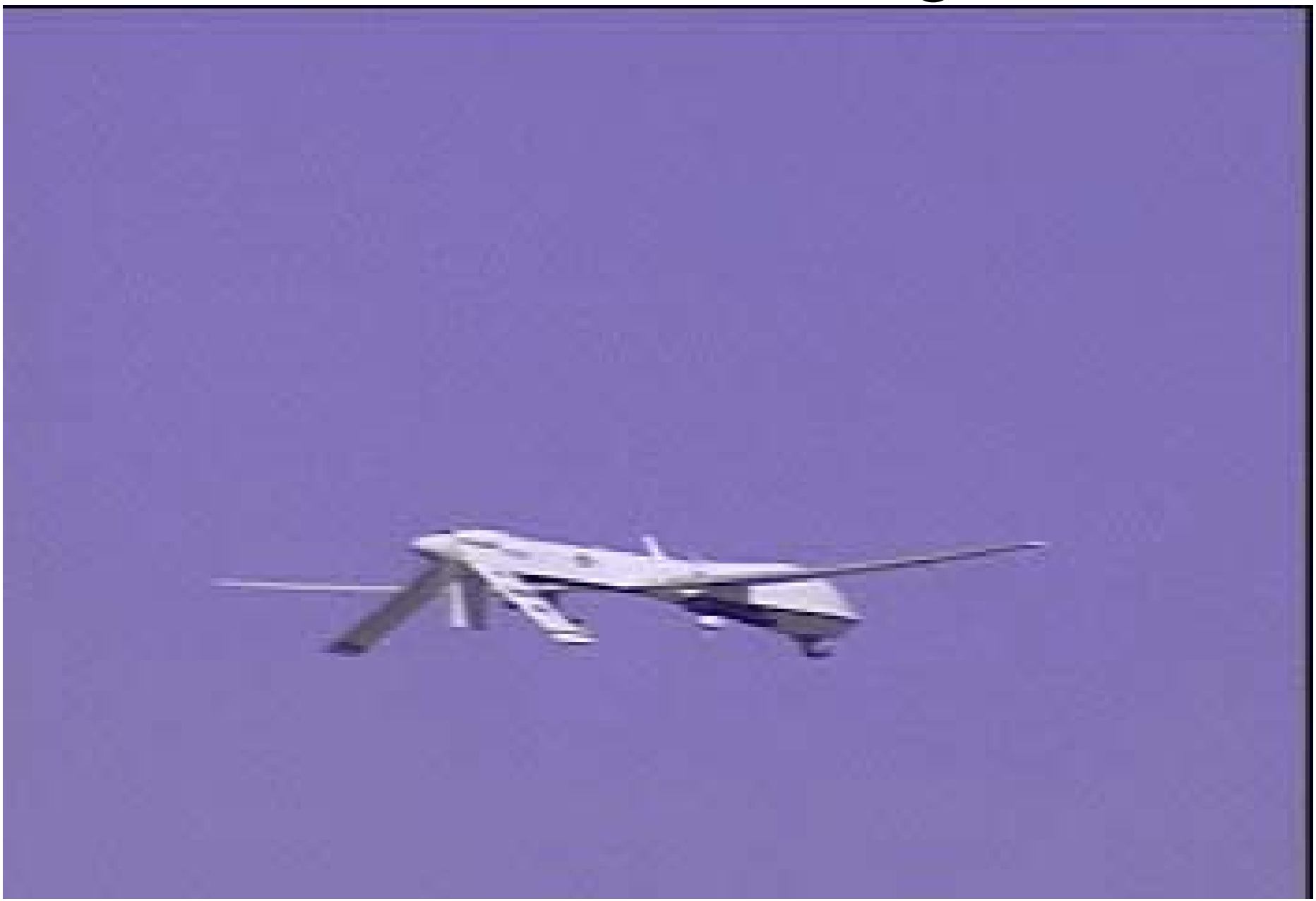
Joint Experiments



- Simulate next generation weapon tactical employment
- Measure C4ISR and National Asset inputs
- Conduct mission planning, execution, and tactical reconnaissance modeling and simulation


Commercial Imagery
National Technical Means
Space Based Radar
Joint Experimentation
GPS
Accuracy Improvement
M-Code
GPS-III High Power
LD/HD & MP-RTIP
IPB
C 2
LINK-16
CDL/TCDL
Fix Target Database
Integrated TPEDs
Ground Control Points
DPPDB Production
Weapon Seekers& Datalinks
Reassess Weapon Mix
Anti-jam
Anti-jam
EO
FOPEN
Spectral/Polarimetric
GMTI/SAR
Precision SIGINT
Low-Cost,Long-Range Missile
GridLock
Improved TLE
DCGS
Close-in Sensing

Predator Hellfire Integration



Higher-Level Integration

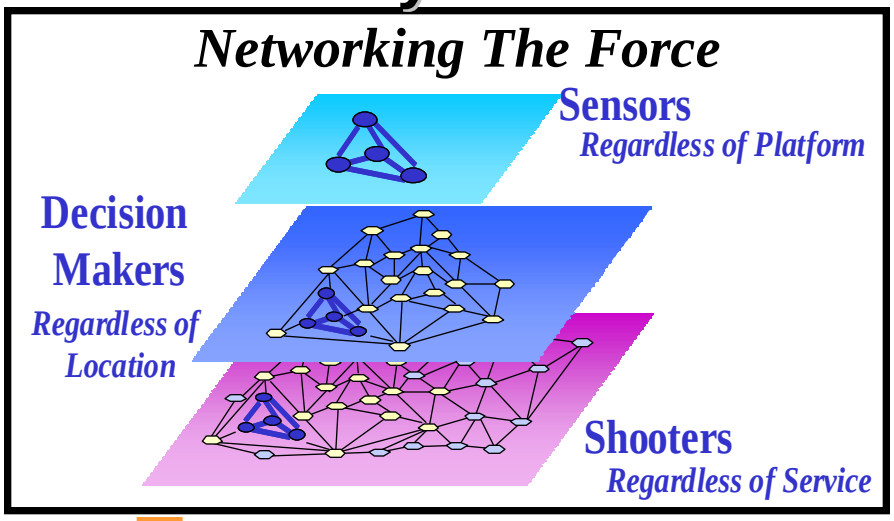
Legacy Force Structure

"Not Plug and Play"

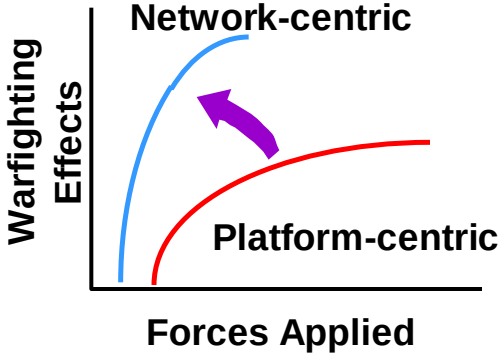
What?

Future Force Structure

"Holy Grail"



Why?



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

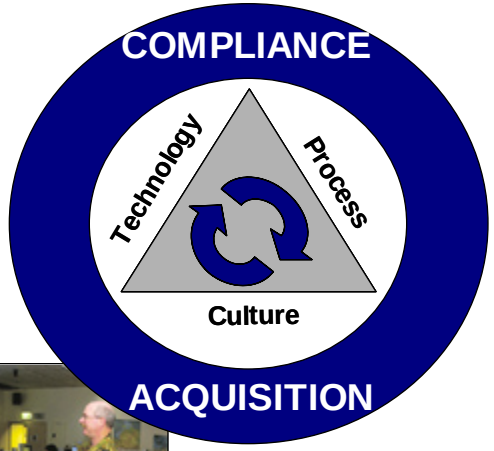
- **Standardize event planning process**
- **Web-based collaboration**

PERSISTENT

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

REUSABLE

- **Capture data and models in a organized and accessible repository**



AF ICE
One Team One Environment

ICE Breaker 06 Event Sites

9 Government and 3 Industry Sites

Blue = Simulation Site
Red = Network Node

Pentagon CVC

AFCA

ASC SIMAF
Network Hub

ESC CEIF

CIDS

AFSPC SIDC

SMC DSL

Raytheon
Tucson

DMOC
705 EXS

AAC GWEF
Lead

AFC2ISRC

LOCKHEED MARTIN
We never forget who we're working for™

Orlando

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

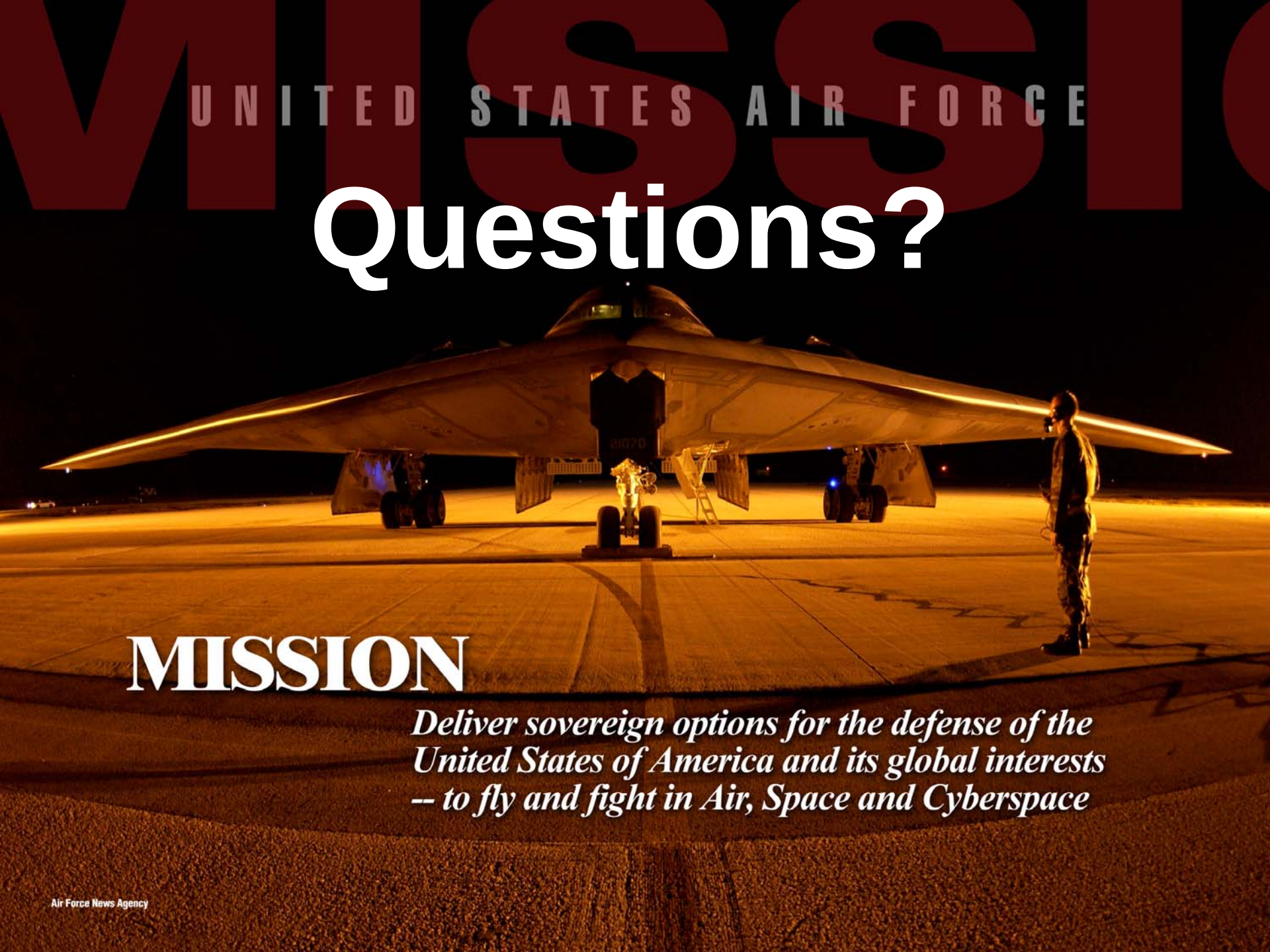
- Incredible diversity of experiences available
- Attractive education and retirement benefits
- Significant number of mid-career hires due to cutbacks 15 years ago
  - Recruiting from industry and military

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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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
Air Force News Agency