The AFIT of today is the Air Force of tomorrow.

Dr. Todd I. Stewart
Director and Chancellor
Air Force Institute of Technology

Overview

• 2011 AFIT Highlights
• HLC Status
• Institution Improvement Plan
The AFIT of today is the Air Force of tomorrow.
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Air Force Institute of Technology
Est. 1919

To advance air, space, and cyberspace power for the Nation, its partners, and our armed forces by providing relevant defense-focused technical graduate & continuing education, research, & consultation.

Graduate Education
Graduate School of Engineering and Management
(Civilian Institution Programs)
Students: 817 (res); 2,641 (CI); Resident Faculty: 168
Programs: 26 MS, 14 PhD

Professional Continuing Education
School of Systems and Logistics
Faculty: 61
Students: 28Kyr
Courses: 125
The Civil Engineer School
Faculty: 29
Students: 7Kyr
Courses: 118
Cyberspace 200/300
Instructors: 6
Students: 600/yr

Consultation
2 - AF Centers
5 - AFIT Centers
Subject Matter Experts
Worldwide Impact
Combatant Cmds
Functional Areas

Research
2 - AF Centers
5 - AFIT Centers
$21M+ annually
Sponsor funded, Defense-focused, Collaborative, Ops-driven, Publications & Patents

Publications & Patents
Consultation
2 - AF Centers
5 - AFIT Centers
Subject Matter Experts
Worldwide Impact
Combatant Cmds
Functional Areas

We are AFIT!
Nuclear Programs
Cyberspace Mission
Acquisition Excellence
STEM Workforce

This is AFIT!
Technologically focused education is essential to the Air Force. Unique military and civilian faculty, defense-focused research. Vital connected and relevant to current operations across the globe. Unmatched speed and adaptability to changing mission focus.

Value: Defense-focused education; building relationships among DoD STEM workforce.
AFIT Highlights
The Graduate School of Eng & Mgmt

- Secretary Donley visited in July and was briefed on AFIT’s research into nuclear weapons effects, cyber security, and advanced navigation techniques
- Cyber 200 & 300 Courses can be used for credit toward CCAF degrees and are formally “Joint Certified”
- Dr. James Moore presented “A2L2 Lifetime Achievement Award” by AF/A9
- Nuclear Graduate Certificate program operational
- OSD Scientific Test & Analytical Techniques Center of Excellence
- Won 1st and 2nd for graduate schools at the 2012 Cyber Defense Exercise
- Stood up new satellite ground station at Vandenberg for training
- NRO is currently funding 39 students and 2 satellite builds. Working with AFRL/RV and RZ to increase funding of AFIT space research
- Granted authority to enroll up to 125 Defense Industry Civilians in grad programs
- Tasked to head AU’s Cyber ACTS. Working with representatives from all AU Centers

Graduate School of Engineering &Management
New, External FY11 Awards*

<table>
<thead>
<tr>
<th>Research</th>
<th>$19.8M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>$1.8M</td>
</tr>
</tbody>
</table>

525% growth since FY02!

AFIT Estimated Manpower Contribution Provides ~ 50% cost share

* Project period of performance may extend into subsequent fiscal year. Does not include FY10 carryover or in-kind contributions.
AFIT Highlights
The School of Systems & Logistics

• Produced highest student throughput in LS history in FY11
  • 28,199 students (4,500 more than previous high)
• Sent team of 6 faculty to Iraq for month of Sept and conducted extremely successful train-the-trainer sessions for Iraq military instructors
• Moved back on-campus
• SAF/AQC has decided AFIT/LS will provide initial skills training for all new officer contracting accessions

AFIT Highlights
The Civil Engineer School

• Doubled the distance learning students in FY11 vs FY10
• Participated in CENTCOM AOR Contingency Construction Program Management Review with ARCENT, AFCENT, USACE and CJ-ENG
• Provided structural engineer support and expertise to Safety Investigation board at Nellis AFB
• Selected by OSD to represent AF in trilateral environmental deployment agreement between Sweden, Finland and US
• Provided technical support to Air Force Civil Engineer Support Agency during fraud investigation
• Tasked by HAF/A7C to delivered EOD Range Safety seminar in response to Airman death at Balad AB – live broadcast to 24 locations world-wide
AFIT Highlights
Center for Systems Engineering

- Provided SE support to SAF/AQ, ASC/CC High Velocity Acquisition initiative
- Sponsored 2nd Annual AF SE Conference—434 attendees from throughout DoD and industry
- Conducted SE Tools Executive Steering Group—forum to champion common tools and resources
- Strengthened collaborative efforts with SMC/EN and Aerospace Corp

Major AF/National-level faculty recognition & achievements

- AETC Civilian Educator of the Year, 2011: Dr. Matthew Fickus
- AETC Military Educator of the Year, 2011: Capt Tim Scheffler
- DoD Women’s STEM Role Model Award, 2011: Dr. Heidi Ries
- Strategic Air Command Faculty Excellence Award AV 2010-2011: Capt Tim Scheffler
- AF-level STEM Award: 2011 Systems and Engineering Award: Capt Paul LaTour
- National C. Holmes McDonald Outstanding Elec/Comp Engineering Teacher: Dr. Barry Mullins
- Awarded patents in: software protection, detecting attacks against mobile computing devices, microelectronic devices
- Fellow, Ohio Academy of Science & American Society of Mechanical Engineers: Dr. Tom Christian
- Student team finalist in 2011 National Security Innovation Competition: LTC (USA) John McClory
- AETC CE Manager of the Year: Maj Jon Gray
- AETC Maj Gen L. Dean Fox Award: Maj Kelly Hannum
- Lt Col Mark Friend, Lt Col Ariel Acebal, Dr. John Colombi, Dr. Matthew Fickus and Dr. Eric Swenson were recognized as Excellence in Education Honorees as “outstanding teachers at colleges and universities around the state” by Ohio Magazine (Dec 11 issue)
Major AF/National-level student recognition & achievements

- Maj Paul Welling, Army JAG School – 1 of 4 honor grads from joint class of 110 officers.
- Maj Dean Berck, Olmsted Scholar, Brazil awarded Dept of State’s “Meritorious Honor Award”
- Capt Priscilla Wong, Madigan Army Medical Center (MAMC), Pediatrics Residency, top 15% nationally and #1 in her MAMC class
- Maj Ely Wolin, Penn State Milton S. Hershey Med Ctr – “Resident Teacher of the Year,” the second ever to be recognized twice
- Capt Megan Schmid, Villanova – #1/235 Law School grads and inducted in Order of the Coif National Honor Society (top 10% JD law school students)
- Capt Marcus McNabb - Air Force Company Grade Lessons Learned Military Professional of the Year for work on Op ODYSSEY DAWN (Libya)
- Maj Norman Stone - Maimonides Medical Center’s 2011 Resident Achievement Award; award only given to 2 out of 240 residents.
- Capt Brandon Kofford, UT Health Sciences Center - Tylman Grant for research; only 1 of only 4 nationwide.
- Maj Matthew Boarts, Iliff School of Theology - Received “Outstanding Achievement” award--1 of only 2 out of 20 grads to receive; graduated "With Distinction"
- Capt Christopher Joers, NPS - AFA "Outstanding USAF Student" and NPS NSA Dept "Outstanding USAF Graduate" Awards; 1 of 10 DU students selected to attend lunch with SECDEF Leon Panetta

Overview

- 2011 AFIT Highlights
- HLC Status
- Institution Improvement Plan
HLC Status

• Higher Learning Commission - North Central Association
  – Accreditation visit Oct 2010
  – Received 10-year reaffirmation in April 2011

• Four items identified for formal follow-up:
  1. Laboratory safety concerns
     • Safety concerns with Buildings 470, 194, and 168
     • Report submitted Dec 2011; follow-on report due in Dec 2012
  2. Strategic planning and implementation
     • Develop an integrated AFIT strategic plan and execute it using identified key business indicators
     • Report due Dec 2012

3. Institutional plans for assessment
   • Address assessment of all academic programs especially Ph.D. programs.
   • Policy and processes for assessing effectiveness of support offices
   • Report due Dec 2012

4. Position of the Chief Academic Officer
   • Report due Dec 2012
Overview

- 2011 AFIT Highlights
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Institution Improvement Plan

- Organizational Challenge – Provost (the three action items fit here)
- Strategic Planning – A stronger commitment to strategic planning to promote unified organizational ethos and ability to respond to institutional challenges
- AFIT’s Mission – Revise mission statement to communicate dual military and academic heritage and commitment to quality, scholarly purpose, and expectations for student learning
- Institutional Assessment – Assessments of programs and support affecting student learning
- Engagement – Enhanced visibility and recognition; actionable plans for outreach, PR, and marketing
The AFIT of today is the Air Force of tomorrow.
AFIT Manning Reductions

The AFIT of Today is the Air Force of Tomorrow.

- Reduced Manning Decision
  - Two drills starting in early Fall 2011
- Announcement of RMD 703 Round 1 Late Fall 2011
  - 3 Vacant Positions Removed
- After Three-Star Summit RMD 703 Round 2 Winter 2012
  - 49 Support Positions Removed
- AFIT "Fat" Compared to Other Graduate Schools
  - MIT: 8:1
  - University of Michigan: 8:1
  - Texas A&M: 9:1
  - Princeton: 3:1
  - Rice: 1:1
  - Duke: 5:1
  - Arizona State: 8:1
  - AFIT: 6:1
- HAF/A1 Military Force Development
  - 85 Positions in First Round January 2012
  - 15 Officer, 1 enlisted

HAF/A1 Military Force Development

- Eliminated 7 educational technician positions (8 people) from LS staff
- These 8 individuals were our most experienced staff, averaging 22+ yrs of govt administrative work, majority of their time w/AFIT
- One person retired on 30 Apr; expect remaining 7 to be placed in jobs across WPAFB beginning in Jun; all gone by Sep 12
- Impacts (not fully realized because the personnel are still present):
  - Teaching faculty/remaining staff to absorb ed tech functions
  - Potential student throughput reduction of 25% (approx 7K students)
  - Delay course updates and developments; direct loss of curriculum currency and relevancy
  - Reduce Help Desk functions (serving 600 customer requests/mo)
  - Change 2-instructor policy for shorter course offerings (<5 days); offerings at risk if instructor N/A (sickness, other mission priorities)
**RMD 703 Impacts on CE**

- Registrar position gone 30 Apr
  - Have temporarily assigned Capt to fill and come up with transition plan for transferring duties to faculty and remaining staff
- Course managers reduced from 3 to 2
  - Immediate impact since position went vacant when employee departed with spouse PCS
  - Looking for new registration system to reduce work load
- 2 Education Techs, GS-7s surplussed
  - No academic and student support remain
  - Transferring must do activities to faculty
- 1 Faculty GS-13 surplussed
  - Redistributing courses based on priority and will have to cut at least 1 course and reduce offerings of others

**RMD 703 Impacts on EN**

<table>
<thead>
<tr>
<th></th>
<th>AFIT</th>
<th>EN</th>
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<tbody>
<tr>
<td>Round 1</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>Round 2</td>
<td>-49</td>
<td>-23</td>
</tr>
<tr>
<td>Military cuts</td>
<td>-16</td>
<td>-5</td>
</tr>
</tbody>
</table>

- 3% education technician support across academic depts, 29% total admin support reduction
- **Military cuts**: lost 1 PhD faculty psn, NRO liaison, student support officer, 2 cyber PCE support officers
- TOV Funds
- Program impacts: TBD
Graduate School of Engineering and Management Overview

Dr. M. U. Thomas
Dean

14 May 2012

Overview/Update of Our:

BOV Recommendations
Mission
2011 Highlights
Academic Programs
Faculty and Students
2012 Goals
BoV Subcommittee 2011
Recommendation: 04-2009-07
The AFIT of Today is the Air Force of Tomorrow.

<table>
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<tr>
<th>#</th>
<th>Issue</th>
<th>OPR</th>
<th>Recommendation</th>
<th>Action</th>
<th>Status</th>
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<tbody>
<tr>
<td></td>
<td>Enlisted –to-AFIT Program Executive</td>
<td>AFIT/EN</td>
<td>The Enlisted-to-AFIT program is currently being reviewed by USAF senior leadership to ensure that the</td>
<td></td>
<td>update</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td></td>
<td>requirements generation, selection, and assignments processes are operating effectively. At future meetings of the AFIT</td>
<td></td>
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</table>

*Spreadsheet Attached*

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BoV Subcommittee 2011
Recommendation: 11-2010-18
The AFIT of Today is the Air Force of Tomorrow.

<table>
<thead>
<tr>
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<th>OPR</th>
<th>Recommendation</th>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Approval authority for AD faculty actions</td>
<td>AFIT/EN</td>
<td>Current policies and procedures have the AU Commander as approval authority for AD actions with recommendation from VP for Academic Affairs .....</td>
<td>Open</td>
<td>Open</td>
</tr>
</tbody>
</table>

AFIT is a separately accredited research-based graduate academic institution operates in accordance with standard processes and AAUP guidelines and oversight for comparable civilian institutions

- **Added reporting to AU does not add value to the process**
- **Counter to “cost conscientious” procedures**
- **Negative impact on faculty and morale**
Mission: To provide high-quality graduate education programs and engage in research activities that enable the U.S. Air Force to maintain its scientific and technological dominance

Vision: To be the top-ranked graduate school of choice in engineering and applied science for defense-focused research-based education

Accreditation

• Professional accreditation: Accreditation Board for Engineering and Technology (ABET)
  • ABET accredited since 1954
  • Last visit: September 2009

• Regional accreditation: North Central Association of Colleges and Schools (Higher Learning Commission/HLC)
  • Initial MS level accreditation – 1960, extended to PhD – 1964
  • Last visit: October, 2010

• Carnegie Classification: Doctoral/Research University
A Few 2011-2012 Highlights

- AFIT leading reinvigoration of nuclear enterprise--developed nuclear logistics management specialty for Logistics and Supply Chain Management MS degree programs
- Center for Operational Analysis designated – OSD Center of Excellence
- AFIT’s Center for Cyber Space Research offering Cyber 200 & 300 career field professional continuing education courses – certified as “joint” courses
- Stood up a satellite ground station
- AFIT’s sponsored funding for research and education programs approached $21M in FY11

Graduate School of Engineering & Management Organization
### Current Profile

*The AFIT of Today is the Air Force of Tomorrow.*

- Faculty: 62 MIL/70 CIV
- Students: 798
- Support Staff: 131
- Research: $146K / FTE
- Student/Faculty: 6.7/1

*Fall 11 data

### Graduate Education

*The AFIT of Today is the Air Force of Tomorrow.*

- 6 traditional academic departments
- 5 research centers
- 14 PhD programs
- 26 MS programs
- 8 Graduate Certificate Programs
### Resident Academic Degree Programs

**MS and PhD Programs**
- Aeronautical Engineering
- Applied Physics
- Applied Mathematics
- Astronautical Engineering
- Computer Engineering
- Computer Science
- Electrical Engineering
- Logistics (PhD only)
- Materials Science
- Nuclear Engineering
- Optical Science and Engineering
- Operations Research
- Space Systems
- Systems Engineering

**MS Only Programs**
- Air Mobility
- Combating Weapons of Mass Destruction
- Cost Analysis
- Cyber Operations
- Cyber Warfare
- Engineering Management
- Environmental Engineering and Science
- Industrial Hygiene
- Information Resource Management
- Logistics Sciences
- Logistics and Supply Chain Management
- Operational Analysis
- Research and Development Management

### Graduate Certificate Programs

**Demand-driven programs for individuals seeking advanced-level education in selected specialty areas beyond the bachelor’s level (but not necessarily leading to a graduate degree)**

**Current Offerings:**
- Systems Engineering
- Space Systems
- Advanced Geospatial Intelligence
- Combating Weapons of Mass Destruction
- Operational Technology
- Supply Chain Management
- Test & Evaluation
- Information Assurance
- Nuclear Weapons Effects, Policy & Proliferation
The AFIT of Today is the Air Force of Tomorrow.

Air University: The Intellectual and Leadership Center of the Air Force

Aim High…Fly - Fight - Win

Enrollments

Fall 11 enrollment: 22 IDE, 678 resident, 26 international students, 120 civilians (includes 81 DoD civilians and 39 Non-DoD civilians)

Total Spring 12 enrollment:
1. 664 (566 resident, 98 distance learning)
2. 457 AF, 32 Sister Service, 137 civilians, 25 international, 13 Non-Degree

AFIT/EN Resident Students

AF Officers, 529
AF Enlisted, 12
Civilians, 120
Sister Service, 31

International Officers, 26
Argentina: 2
Australia: 2
Bahrain: 2
Brazil: 3
Chile: 1
Colombia: 1
Greece: 1
Korea (South): 1
Pakistan: 1
Singapore: 2
Tunisia: 1
Turkey: 9

*Fall 11 data
EN Personnel Deployed

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Aim High...Fly - Fight - Win

EN Personnel Deployed

Total # Deployed in 2011: 13
Projected 2012 Deployments: 4
*as of 1 Mar 12

Number of Deployed Members per Month

Research $/FTE

The AFIT of Today is the Air Force of Tomorrow.
Sponsored Research

- Continued growth in sponsored funding; trend continuing in FY11
- 25 MIL/56 CIV serve as PIs
- 24% of faculty generate more funding than their salaries

Faculty Publications

- FY11 Totals:
  - 131 FTE Faculty Members
  - 206 Refereed Journals
  - 337 Refereed Conferences
- Per FTE:
  - 03 04 05 06 07 08 09 10 11
EN Productivity Statistics

Academic Year 2011-2012

- Average Faculty Teaching Load
  - 18.1 credit hours/year
- Student/Faculty Ratio based on FTEs
  - 6.7 to 1
- Average Class Size
  - 12.40 students

* Data are yearly averages

FY2012 DIRECTION
FY2012 EN Direction

• Focus on gaining operational efficiencies and ways to cope with the reduced O&M budget

• Continue improving the student and faculty visibility

• Develop a program for accommodating and integrating civilian students in the Graduate School

• Develop collaborations with appropriate institutions (including NPS) to leverage research capabilities

Questions?
The AFIT of Today is the Air Force of Tomorrow.

Educating the World’s Best Air Force

The School of Systems and Logistics

Col Tim Fennell
Dean, AFIT/LS

Mission
Equip the world’s best managers of air, space, and cyberspace systems through professional continuing education, consulting, and research.

Vision
The Air Force’s first source for acquisition and logistics continuing education.

50 YEARS
Professional Continuing Education
1962 - 2012
The School of Systems & Logistics

Department of Acquisition Management
Course Examples:
- Mission Ready Contracting
- Acquisition Management
- Project Management

Department of Logistics Management
Course Examples:
- Combat Logistics
- Depot Maintenance
- Applied Maintenance Mgt

Department of Systems & Software Eng
Course Examples:
- Software Prof Dev Program
- Architecture
- Risk Management

Tailored Professional Continuing Education
Logistics Management
Program Management
Budget and Cost Analysis
Test and Evaluation
Software Engineering
Systems Engineering

125 courses available in-residence, on-site and by distance learning

Our Customer Base

Over 75,000 “students” in the AF Acquisition & Logistics Workforce
- ~ 65,000 Civilians (66%)
- ~ 10,000 Military (34%)

Major Functional Categories (Career Field Manager)
- 50,000 Maintainers and other Logisticians (AF/A4L)
- 7,300 Scientists & Engineers (SAF/AQR)
- 4,200 Program Managers (SAF/AQH)
- 3,600 Budget/Financial Managers (SAF/FM)
- 7,600 Contracting (SAF/AQC)

We will touch approx 40% of that workforce this year with some form of education activity—ca. 30,000 students
Total AFIT/LS Student Production

Student Graduates

- FY04
- FY05
- FY06
- FY07
- FY08
- FY09
- FY10
- FY11
- FY12

- Resident
- Online
- On-site
- Workshops

28,199 grads in FY11 – Most in school history!

15,287 grads thru 2QTR FY12
On pace for 30,000 grads

AFIT/LS Annual Operating Budget*

- Sec 852
  (SAF/AQ)
- APDP O&M
  (SAF/AQ)
- AETC O&M

* Does not include:
  - Customer funded TDYs for instructor travel
  - Sponsor funding for new course development
  - CENTCOM funding for Iraq course development ($5M in FY12)
### Courses by Air Force Career Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Required</th>
<th>Recommended</th>
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<tbody>
<tr>
<td><strong>Initial Skills</strong></td>
<td>4 Courses</td>
<td>1 Course</td>
</tr>
<tr>
<td>(01-03; GS5-11)</td>
<td></td>
<td>FAM</td>
</tr>
<tr>
<td><strong>Technical Expertise</strong></td>
<td>29 Courses</td>
<td>2 Courses</td>
</tr>
<tr>
<td>(03-04; GS11-13)</td>
<td></td>
<td>FAM</td>
</tr>
<tr>
<td><strong>Senior Leadership</strong></td>
<td>25 Courses</td>
<td>5 Courses</td>
</tr>
<tr>
<td>(05-06; GS14-15)</td>
<td></td>
<td>FAM</td>
</tr>
<tr>
<td><strong>Scientist</strong></td>
<td></td>
<td>MRCP</td>
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<tr>
<td><strong>Engineer</strong></td>
<td></td>
<td>MRCP</td>
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<tr>
<td><strong>Acquisition Manager</strong></td>
<td></td>
<td>IPM 301</td>
</tr>
<tr>
<td><strong>Contracting</strong></td>
<td>6 Courses</td>
<td>2 Courses</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>20 Courses</td>
<td>3 Courses</td>
</tr>
<tr>
<td><strong>Logistics Readiness</strong></td>
<td>17 Courses</td>
<td>3 Courses</td>
</tr>
</tbody>
</table>

Maintenance and Logistics Readiness courses also part of enlisted career professional development.

### Overseas Teaching Locations

- Osan AB
- Aviano AB
- Mildenhall AB
- Spangdahlem AB
- Guam
- Misawa AB
- Nias AB
- Yokota AB
- Kadena AB
- Guam

*A small school...*
Air University: The Intellectual and Leadership Center of the Air Force

Aim High…Fly - Fight - Win

Reviews/Outreach

Reviews and Outreach

- Conducted course reviews that cover over 40% of our active courses
- Held Program Reviews with Senior Leaders: Acquisition Management, Logistics, Systems Engineering, and Software portfolios
- Assessed status of new course development with Tools, Training & Reengineering Council (T2RC), SAF/AQ, HAF/A4, HQ AFMC, and AF Human Systems Integration Org
- Met with Senior Leaders from Combatant Commands, Major Commands, Air Staff
- Provided tailored workshops at various levels
- Requested by C-130 Avionics Modernization Program office to help review docs for new start ACAT-1 program
- Consulted with DOJ on contract claims issues from defense contractor
- Supported OSD Acquisition Competencies Development Team
- Supported AFIA by creating/teaching Baldrige course
LS Accomplishments

The AFIT of Today is the Air Force of Tomorrow.

- Initiated market-based, fee-for-service business model for Logistics Professional Development Program (LOG X99) courses
  - Enabled continued offering to worldwide USAF logistics community despite loss of central funding
  - Student, instructor, guest speaker funding provided by local requesting orgs
  - Courses remain highly-demanded and attended (50 crses/1000 students)
- Developed Logistics Transformation DL courses for HAF/A4
  - Primary avenue for indoctrinating personnel about major process changes that enhance future USAF logistical posture
  - Eleven course suite averages over 9K student enrollments annually
- Created 1st-ever intermediate Logistics Readiness Officer (LRO) exportable courses at CSAF request
  - Three dynamic courses provide LROs with intermediate-level education designed to augment on-the-job training
  - Prepares LROs to make immediate impact in garrison and contingency ops, supply chain management, and distribution

LS Initiatives

The AFIT of Today is the Air Force of Tomorrow.

- Developed 7 log and acq courses for US Forces Iraq (CENTCOM)
  - Designing for Iraqi ownership; nearly all Iraqi officers take courses
  - AFIT conducted “train-the-trainer” sessions in Iraq
  - Funded to $5M through CY12 for 7 more courses (more in CY13?)
- Software Professional Development Program (SPDP)
  - AF-level software group identified new project mgmt and engineer education needs for acquisition software community
  - LS developed 2-track curriculum (14-courses) for software PMs & engineer
  - SPDP program delivered to meet 400 annual student rqmts (AQR push)
- Science of Test (SOT)
  - AFMC/A3 approached AFIT/ENS for technical solution to providing SOT courses ranging from Executive Overview to a 2-week practitioners course
  - LS working with ENS to formalize 3 SOT courses into ISD-acceptable AETC format so courses can transition with LS as administrator in FY13
- 19 new courses in active development
LS Initiatives (Cont.)

The AFIT of Today is the Air Force of Tomorrow.

- Directly supported CSAF goal of Recapturing Acquisition Excellence
  - Provided 52 targeted acq courses to Acq Workforce (75,000 members)
  - Increased capacity in key acquisition courses:
    - Fundamentals of Acq Mgmt Course
    - Mission Ready Contracting Officers Course (expanded, more thruput)
    - Intermediate Project Management Course
- AFRL Curriculum
  - AFRL requests new course to teach program mgmt within S&T context; course now taught to 750 students per year (25 offerings, LAB 101, 102)
- Test & Evaluation Workforce Development support for AFMC/A3
  - Developed competencies needed for an effective Air Force T&E workforce (over 7300 professionals)
  - Emphasis on "early influence" in rqmts development & acquisition
  - Identified gaps in education; building two live, two DL courses

Summary

The AFIT of Today is the Air Force of Tomorrow.

- Ready
  - Our faculty are unique combination of 80 Air Force and Navy officers and DOD civilians who blend practical field experience with world-class academic expertise
- Responsive
  - We rapidly and continually add new courses and modified existing courses to meet sponsor requirements
  - We provide tailored workshops for unique organizational needs
- Relevant
  - We are championing CSAF goal of Recapturing Acquisition Excellence
  - Meeting the education and consulting needs of the Acquisition and Logistics Workforce
  - Directly supporting nation-building efforts for international partners
AFIT/NPS MOA Update

Col Timothy Lawrence
Commandant

14 May 2012

Background

• SECNAV/SECAF MOA – 4 Dec 02
  • Created Joint Oversight Boards
  • Directed curriculum movement (Aero, Meteorology, Acquisition)
  • Directed development of NPS/AFIT MOU
• NPS/AFIT MOU – updated 18 Aug 09
  • Created eight working level teams
  • Established staff interactions to share best practices
  • Look for areas of excellence, collaboration, efficiencies
• NPS BOA – Oct 2010
  • Decided MOA did not need updating at that time
Issues

- Decline in cross-enrollment/A1D Constrained
- Effectiveness of oversight boards
- MOA signed 2002. Has not been updated to reflect current environment

Questions?
Air bases are a determining factor in the success of air operations. The two-legged stool of men and planes would topple over without this equally important third leg.

-- Gen Henry H. “Hap” Arnold
Mission

The AFIT of Today is the Air Force of Tomorrow.

Providing vital, relevant and connected education that enables Airmen to be ready engineers and great leaders who know how to build sustainable installations to last while leading the change for the Civil Engineer career field.

FY12 – Great Year

- Educated over 7000 Civil and Environmental Engineer Professionals
- Award winning faculty
  - AU CGO of the Year
  - AETC CGO of the Year
  - AETC Educator of the Year
  - AETC Federal Engineer of the Yr
  - AFA’s Col Charles A. Stone Award winner
  - AFIT FGO of the Year
  - AETC CE 4 Annual Award winners
  - HAF/A7C Society of American Military Engineers Newman Medal runner-up
FY12 – Great Year

The AFIT of Today is the Air Force of Tomorrow.

• Partnered with Afghanistan-Pakistan Hand program to teach Afghan CE engineer management
• CE rep on accident invest board for $10M facility collapse
• CE tech reps for federal fraud investigation
• Completed EOD Range Safety Satellite Seminar. Discussed lessons learned from Joint Base Balad, Iraq tragedy

FY12 – Great Year

The AFIT of Today is the Air Force of Tomorrow.

• Provided 8 instructors to AF Environmental Symposium, educating over 1000 AF members in environmental topics.
  • Given responsibility for curriculum development for Fy13 symposium
• Selected by OSD to represent AF for multinational agreement in environmental management in deployed locations
Course Funding Sources

The AFIT of Today is the Air Force of Tomorrow.

Aim High…Fly – Fight – Win

- Operational Funding (AETC/AU/AFIT)
- Technical and Management Department Courses (AF Education Review Board/AF/A1D)
- MGT 101 Accession course (2AF)
- Environmental Department Courses (AF/A7CA)
- Energy Courses (AFCESA)
- Housing Courses (AF/A7CH)
- MGT 102 and MGT 484 (Guard and Reserve)
- MGT 401 (AFCENT)
- Palace Acquire (AETC)
- Superintendent Course (AF/A7C)
- Wage Grade Civilian Course (AF/A7C)

Education Gap Growing

The AFIT of Today is the Air Force of Tomorrow.

- Air Force Educational Review Board (AFERB) cut FY13 school quotas 13% despite AF Professional Continuing Education budget growing 4%
- Result – we can only meet 25% of resident requirement
- We are taking risk in satellite courses by shifting all funds to resident courses
  - Air Technical Network is not currently charging for broadcast satellite time
Solve Requirement Disconnect

- MAJCOMs not reporting true requirement to AFERB
- Working with customer (A7C) to implement inventory management to identify course population requirement
- Course inventory management helps us:
  - Determine the mode (satellite, resident, Web) used in offering course
  - Articulate impact of limited resources cutting courses
  - Make risk management decisions on what gets taught and what does not
  - Target audience for filling courses
  - Advocate for resources

Satellite Overhaul

- Revamping satellite courses
  - Reduce 8 hour days of looking at TV screen
  - Targeting time zones to better serve far west and far east costumers
  - More targeted and shorter seminars (BIM, Electrical Safety, EOD)
- Satellite not reaching all customers
  - Working with Air Technical Network to solve PACAF and USAFE connectivity issues
- Broadcast Support now contracted
  - 88th ABW cut all broadcast personnel as of 31 Dec 11
  - Solution: HAF/A7C is providing funds for a single contract broadcaster to run studios and train a handful of SC personnel as back-ups
  - Will improve long term broadcast quality
Resurrecting On-sites

- Looking to meet specific needs (Air Staff, MAJCOM, FOA, Installations)
  - 6 students minimum
  - The Civil Engineer School will fund instructor travel as far as funds will allow
  - Recommend cost share with customer to fund instructor travel to stretch capability

Live Courses Over HD-Internet

- Experimenting with Cisco’s Tandberg equipment and software to take satellite broadcast to internet
  - Purchased Tandberg equipment to produce High Definition signal to send over internet
  - We will test capability and to build template for delivering courses
- Need new rules of engagement to guard student time/course time at home station
  - Squadron training room?
  - Base education office – may not need any more
  - Library – to be away from office distractions?
  - Targeted to individual computers?
  - TDY – in-place
Hybrid learning

- Rethinking what a course is
  - Breaking the 1-2 week mold
    - Do we need modularize courses into smaller chunks?
  - Hybrid blended learning – you do some work at home station and reduce time in-residence/broadcast time
  - Bring the functional area instructors into a course without bringing them TDY
- Need to value resident courses in today’s environment
- Today’s students have grown up in a digital world
  - Allows many avenues to be explored to educate
  - But what about relationship building?

The Civil Engineer School

Empowering Civil Engineers to lead the way in the 21st century
AF CSE History

- Established in 2003 by SECAF to Advance Systems Engineering (SE) across USAF Enterprise
- Rotational Engineer Program
- Recent AF SE Conferences
- Program Office Consulting for AF PEOs and other services
- Sponsored Systems Engineer courses from AFIT and other institutions
- Supported successful KC-46 Source Selection

AF CSE Legacy

- Weapons Systems SE Case Studies (15 studies completed; last study: LAIRCM Feb 2012)
- Air Force Systems Engineering Assessment Model (AF SEAM)
- AF SE Knowledge Management (built on Electronic Systems Center's Wiki)
- Common SE Tool Set for the Program Offices
  - Migrating tools and guides from AF CSE web page to new location
- AF SE Day in collaboration with NDIA Annual SE Conference (San Diego, CA Oct 2012)
- Providing Entry-level SE course as well as Chief Engineer seminar
Air University: The Intellectual and Leadership Center of the Air Force

The AFIT of Today is the Air Force of Tomorrow.

Col Timothy Lawrence

Clean Tent for CubeSat Development & Test

CubeSat Solar Simulator

3-axis Random Vibe Table

1000 Class Cleanroom For CubeSat Final Assembly

3-axis CG & MOI Measurement System

TVAC Chamber (+80C/-60C, 10^-5 Torr)
AFIT’s Ground Station

- Controls AFIT’s CubeSats & observatories
- Incorporated into curriculum of AFIT’s spacecraft systems engineering course
- Will allow command and control of multiple CubeSats concurrently as well as permit “lights out” autonomous operations
- Intent is to add AFIT as another node to DoD small satellite C2 network

Responsive Orbits

- Investigate novel orbits for:
  - Responsive on-demand coverage of specific ground site
  - Determination of non-Keplarian orbits from ground-based sensors
  - Persistent dynamic orbit change
- Continuous thrust coverage approach
  - Dynamic non-Keplarian orbits
  - Non-traditional use of electric propulsion
  - Highly-elliptical, dip into atmosphere
  - Responsive coverage (satellite over any lat/lon in <24hrs)
  - Highly-elliptical, dip into atmosphere
Satellite tracking using KAM Tori*

Problem - Space is a congested environment
- Number of space objects will continue to increase
- Current orbit prediction methods based on 1950’s tools

Benefits:
- Satellite orbits are KAM tori: long term prediction
- Orders of magnitude improvement in orbit prediction accuracy and speed
  - 10 meter accuracy over five years
- Critical enabler for SSA: extending the satellite catalog to small objects

Current Works:
- Converting satellite catalog to KAM Tori
- KAM torus orbit fitting

* Kolmogorov, Arnol’d and Moser tori

AFIT Satellite Operations Center (ASOC)

- Provides students hands-on academic and research experience conducting satellite operations supporting National Space Situational Awareness objectives
- Three primary components
  - RF Tracking System
  - Optical Tracking Network
  - Command & Control Ground Station
**AFIT’s Satellite Simulator, SimSat, Designed, Built, and Tested by Students**

The AFIT of Today is the Air Force of Tomorrow.

SimSat II, equipped with reaction wheel and CMG attitude control system, sits atop an air-bearing pedestal.

**Technology Challenges:**
- Need to understand Chemistry and Ignition phenomena for new liquid monopropellant
- Understanding basic behavior key to designing operational thrusters in the future
  - Optimization studies of chamber size
  - Transition from liquid phase to gas phase needs to be better understood

**Warfighter Benefits:**
- Reduced Corrosivity /Toxicity (compared to Hydrazine)
- Required protective gear
- Allows fuelled auxiliary payloads to be integrated before primary on launch vehicle
- 10% potential improvement in performance (specific impulse) over Hydrazine

**“Green” Monopropellant Program**

AFRL/RZ Initiative – AFIT conducting studies

Description:
- AFRL/RZSP initiative — create a ‘Greener’ monopropellant for spacecraft → AFM315
- Under test with AFIT student at AFRL/RZS—reduced hazards & higher performance
- AFIT/ENY performing some basic science on the liquid to gas transition of AFM315 as part of AFRL combustion modeling effort

**Laser Optical Access**

**Pressurant and Purge Plumbing**

**Electrode Feedthroughs**

**Propellant Insertion Port**
AFRL/RV Sponsored CubeSat Design

The AFIT of Today is the Air Force of Tomorrow.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Design</th>
<th>Hardware</th>
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<td>Iridium Satellite</td>
<td>Satellite w/ LEO Satcom modem</td>
<td>Iridium Gateway</td>
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<td>PC or PDA</td>
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<td></td>
<td>Internet</td>
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</table>

Spring 2011 Design Projects

The AFIT of Today is the Air Force of Tomorrow.

- **FalconSat 7 (FS-7)**
  - Photon Sieve
  - Sponsor: USAFA

- **Magnetically Morphed Small Satellite Experiment (M2S2)**
  - Morphing CubeSat with Control Moment Gyros
  - Sponsor: AFRL/RV

- **Concept of a Highly Evolutionary & Responsive Utility Bus (CHERUB)**
  - 10 cm Annular Optic for CubeSats
  - Sponsor: AFRL/RV

- **Swarming Formation Flying**
  - Sponsor: SMC

- **Space Traffic Control Iridium and Globalstar Modems**
  - Sponsor: AFRL/RV; SMC/STP

- **CubeSat Plume Detector**
  - Detect Fires/Volcanoes
  - Sponsor: SMC

- **High Bandwidth Satellite Comm**
  - Sponsor: SMC
**AFIT LEO iMESA CNT Experiment (ALICE)**

**Objective**
On-orbit testing of AFIT developed CNT field emission arrays

**Delivery**
Fall 2011

**Carbon Nanotube (CNT) Field Emission Array (FEA)**

**External payload assembly**
- 3 iMESA heads
- 1cm² CNT FEAs
- Electronics package

**Internal payload assembly**
- Cover provides some contamination protection

**ALICE CubeSat**

**Payload Section of CubeSat**

**UNCLASSIFIED//FOUO**

---

**Persistent TT&C using LEO Satcom (PTLS)**

**Iridium Satellite**

**Satellite w/ LEO Satcom modem**

**Iridium Gateway**

**PC or PDA**

**Internet**
Future CubeSat Experiments

- Precision Timing and Ranging
  - Two-way time transfer is a previously investigated topic

- New Propulsion technologies
  - Electrospray colloid thruster is a probable candidate

- Downselect from ASYS 632 projects
  - “Space Traffic Control” is a probable candidate
  - Will be briefed at upcoming SERB

CubeSat Development Model

- Sponsor Identified
- Mission
- ASYS 631 – Preliminary Design
- On-Orbit Operations
- Thesis Research – Space Experiment
- ASYS 632 – Prototype
- Provides students with an immersive hands-on satellite design, build, test, & operations experience
Notional 18 Month Timeline

The AFIT of Today is the Air Force of Tomorrow.

1st FY

ASYS 631
- Paper mission design & analysis
- Defines mission & system requirements for sponsor experiments / missions
- Sponsors attend final outbriefs

AF SERB (if necessary)

Finalize Experiment & Satellite Design

DoD SERB (if necessary)

Payload Delivery

2nd FY

ASYS 632
- Prototype & test selected missions from ASYS 631
- Sponsors attend final outbriefs

PDR
- Sponsors attend

CDR
- Sponsors attend

Payload Integration Complete

CDR
- Sponsors attend

Finalize Experiment & Satellite Design

Payload Delivery

FRR
- Sponsors attend

Deliver for Launch

ASYS 531
Space Mission Analysis & Systems Design

Provides a detailed overview of the fundamental principles & processes for designing effective space systems

Mission Analysis

Risk Management

Concept of Operations

Cost Analysis

Requirements Development

Technical Reviews

Preliminary Design

Verification & Validation

Detailed Design

Development & Deployment

UNCLASSIFIED

UNCLASSIFIED

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ASYS 631
Spacecraft Systems Engineering

Provides a detailed introduction to the design of complex space systems

Lectures
Modeling Tools
Design Teams

Results in...
Satellite Design

ASYS 632
Satellite Design and Test

Provides a comprehensive overview of the design, manufacture, & testing of complex space systems

Hardware, Electronics, & Software Development

- Custom Boards
- Student designed hardware

CubeSats

Space Qualification

- Functional Check
- TVac Chamber
- Random Vibe
FalconSAT-3
Mission Ground Station Network

The AFIT of Today is the Air Force of Tomorrow.

Vandenberg AFB California
Undergraduate Space Training Satellite C2 Experience

UST instructors conducting a FalconSAT-3 pass

Former NASA Administrator Mike Griffin with cadets operating FalconSAT-3

AFIT Mission Ground Station

AFIT Ohio Graduate-level satellite ops

USMA West Point NY Satellite Command & Control Experience

West Point cadets checking out their new FalconSAT-3 equipment

UST & FalconSAT-3

The AFIT of Today is the Air Force of Tomorrow.

- Currently, no real space asset used in entry space education – Think: basic pilot training with no flying

- Enhance current UST curriculum with real world asset
  - Learn space by doing space
  - Satellite subsystem & acquisition lessons
  - FS3 is forgiving, non-critical, & existing space asset
  - Utilize as a tool for teaching space operations

- Provides common ops experience baseline
  - Introduce crew mentality – classroom alone cannot achieve

- USAFA, AFIT, & USMA operations heritage
  - Cheap: ~$30k ground station

Air University: The Intellectual and Leadership Center of the Air Force
Impact

The AFIT of Today is the Air Force of Tomorrow.

- Discussion of satellite subsystems using collected data
- Augment lessons with real data collected by students
  - Aides second level thinking on subsystem interactions
  - Translate satellite theory into practice and prove with data
- Increases rigor of course by having students conduct passes and analyze real data
- Reinforce understanding of crew actions and preparations for a successful mission
- Augmented lessons with FS-3 examples:
  - Space weather  Payload design
  - Acquisition     Communication, jamming
  - Space system engineering  Ground, C2, user segments
  - Orbit principles  Satellite bus subsystems
  - Spacelift, LV subsystems  Position, navigation, timing

- Result: better trained graduate to AFSPC!
AFIT Nuclear Programs

Dr. Nancy Giles
Professor of Physics and Head, Department of Engineering Physics

15 May 2012

State of AFIT’s Nuclear Engineering Program

Historically
- Effective and knowledgeable faculty
- Close working relationships with USAF and DoD
- Same nuclear core for 20+ years – nuclear weapons emphasis
- ABET Accreditation (2009)
- Recognized in DoD as providing a unique graduate nuclear engineering education

Where we are today
- Substantial program growth
- Quota & civilian student increase
- Research funding and capability increase
- Increased collaboration with Universities, DoE, and DHS
- Expanding services to meet demands of operational nuclear forces
- Increased breadth in the program
- Strong partnerships with sister services

We maintain our historical strengths, but are in a period of significant growth due to recent AF emphasis on reinvigorating our nuclear weapons expertise.

Challenges:
- Maintaining focus: Keep doing what we are good at!
- Maintaining excellence: Potential challenges ahead as senior faculty retire
- Limited resources: Declining budgets ➔ harder push for research sponsors
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Aim High...Fly - Fight - Win

Balanced Development

• AFIT Research and Outreach focus
  • Increased research efforts
  • Post-doctoral/Research faculty

• Engagement with non-engineering education
  • Nuclear Weapons Effects, Policy, and Proliferation graduate certificate
  • Nuclear Minor
  • Distance Learning

• Civilian students

Air University: The Intellectual and Leadership Center of the Air Force

Aim High...Fly - Fight - Win
The AFIT of Today is the Air Force of Tomorrow.

Air University: The Intellectual and Leadership Center of the Air Force

Aim High…Fly - Fight - Win

Nuclear Program Students

Graduate Program Achievements Jan10 - Pres

18 students at 12 conferences and workshops
- ANS, NSREC, HEART, AVS
- SORMA, AVS, MRS, NSS, OSAPS
- DOE Forensics,

13 Archival publications in 2011

Most Recent Graduates

DTRA (4), AFWNC (3), AFTAC (2) 498 NSW (1), USAF (2), NORTHCOM (1), 20th SPT (1), DIA (2), STRATCOM (1)

Where GNE Students Serve Post Graduation (2002-2011)
Nuclear Weapons Focus

- Detect SNM
- SREMP
- Fuel Cycle
- Counter proliferation
- Standoff Detection
- UO2 Modeling
- Safeguards
- Fallout

Pre (LOB) H-hour Post (ROB)

PERSONNEL/EXPERTISE
RESEARCH/CAPABILITY

University Collaborations

- Wright State Univ. Detection Radiation Effects
- Ohio State Univ. Detection Radiation Effects
- Univ. of Michigan Detection Forensics
- Wayne State Univ. Detection
- Univ. of Cincinnati Gamma Detection
- USMA Gamma Detection
- SUNY-Buffalo UO Analysis
- West Virginia Univ. Detector Materials
- Indiana Univ. Radiation Effects
- Georgia Tech Thermal Effects Gamma Detection
- UC, San Diego EMP Signatures
- Univ. of Nebraska Detection Actinide Chemistry
- Univ. of Missouri Neutron Detection Radiation Effects
- Louisiana State Neutron Detection Actinide Chemistry

new collaboration within past 3 years
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Air University: The Intellectual and Leadership Center of the Air Force

Aim High…Fly - Fight - Win

Government Research Partners

- STRATCOM
- AFRL-RD
- AFRL-RY
- AFRL-RX

- NSWC-Crane
- AFRL-RD
- AFRL-RY
- NSREC

- DTRA
- DOE - NNSA
- AF-A10
- DHS

- AFIT/EN
- Lawrence Livermore National Laboratory (LLNL)
- Los Alamos National Laboratory (LANL)
- AFRL-AFRL-WPAFB
- AFRL-Kirtland
- DTRA-Kirtland

- Brookhaven National Laboratory (BNL)
- Oak Ridge National Laboratory (ORNL)
- Pacific Northwest National Laboratory (PNNL)
- Idaho National Laboratory (INL)
- Oak Ridge National Laboratory (ORNL)
- Pacific NW NL

- New collaboration within past 3 years

Collaborative Research Facilities

- Univ. of Nebraska
- Indiana Univ
- AFRL-WPAFB
- Wright State Univ
- Ohio State Univ

- LLNL
- Sandia NL
- AFRL-Kirtland
- White Sands MR
- Louisiana State

- West Virginia Univ
- Oak Ridge NL

- NTS
- EMP Effects
- AEML
- Pulsed Neutrons Portal Detectors
- DTRA-Kirtland
- AFRL-Kirtland
- EMP Simulator Fast Burst Reactor

- LLNL
- NIF, Forensics Labs
- AFRL-WPAFB
- White Sands MR
- Louisiana State

- new collaboration within past 3 years
AFIT Nuclear Engineering Labs

- Lab refurbishment (started in FY 10) makes more effective use of current facilities
- Added capability since FY10
  - Neutron generator
  - Positron beamline
  - Enhanced spectroscopy labs
  - Enhanced nuclear electronics labs
  - Enhanced computational capabilities
- Primary concerns
  - Outgrowing space
  - Environmental conditions (temperature / power) in labs

AFIT Nuclear Weapons Effects, Proliferation, and Policy (NWEPP) Graduate Certificate

**Purpose:** To increase graduate level knowledge of nuclear weapons throughout the USAF.

- 3 courses, 12 graduate credits:
  - NENG 500: Nuclear Weapons Strategy and Policy
  - NENG 591: Nuclear Weapons and Proliferation
  - NENG 596: Nuclear Weapon Effects

**Primary Benefits:**
- DL format: delivered worldwide to meet high OPTEMPO requirements.
- Graduate course / graduate credits
- Multiple offerings per year
- Developed by AFIT nuclear eng. faculty
- Updated/relevant to current mission
- 12 credits satisfy concentration for:
  - AETC/AU On-Line Master Degree
  - Select AFIT graduate programs

**Content:**
- Nuclear Weapon Effects
- Targeting/Delivery
- Proliferation methods/risks
- Nuclear deterrence
- Life Extension/Reliability
- Results of Schlessinger report
- USAF Inventory and development
- Nuclear Weapons Testing

**Delivery/Sustainment:**
- Certificates awarded:
  - Winter 2012 – 3
  - Spring 2012 – 12 (est)
- Future: 2 FT faculty (PhD) & funding for
  - 2-3 civilian teach assistants
  - 1 DL implementer
  - Admin support
  - Travel, Supplies

**Throughput:** ~120 students/yr
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**NWEPP Demographics**

- Launched Summer 2011
- Anticipate awarding 26 certificates in FY12
- ~40% of current students have a technical undergraduate degree
- By MAJCOM
  - 20 AFGSC
  - 3 AFIT in-residence
  - 2 USSTRATCOM
  - 1 HAF

**NWEPP in the Year Ahead**

- Up to 40 students will start in June 2012
- Beginning FY13 will be fully funded; up to 125 certificates awarded each yr
- Received authorization summer 2012 to hire 2 full-time civ faculty to support program
- Increase in ENP teaching load and visibility to AF
Combating Weapons of Mass Destruction (CWMD) Program

- CWMD MS and graduate certificate programs establish a broad base of knowledge in all areas of combating WMD.
- **Challenges:**
  - Few AF/Army quotas for program
  - Strong nuclear track, weaker in chem/bio
  - Next year focus will be on reinvigoration of program
    - Assess DOD demand, advertise and restructure

Questions?
Center for Directed Energy (CDE)

Dr. Steven Fiorino, Acting Director
Dr. Glen Perram, Professor

Department of Engineering Physics
Graduate School of Engineering and Management

History of Lasers/Optics & CDE

Airborne Laser (ABL)
Development of an airborne weapons system consisting of a COIL laser on a 747 platform, laser beam propagation through the atmosphere

Weapon Effectiveness
Overall systems and tactical applications of high-energy laser systems

PILOT and COIL
AFIT program emphasis changed to physics of high energy semiconductor lasers as well as high energy gas lasers in the near infrared for weapons applications

CDE was the 1st AFIT Center Established in 2001 for specialized research
### Center for Directed Energy

**The AFIT of Today is the Air Force of Tomorrow.**

**CDE Technical Advisor**

Professor Glen Perram

**CDE Acting Director**

Dr. Steven Fiorino

**CDE Executive Administrators**

Ms. Ashley Ungericht (RRP)

Mr. Eric Smith - Budget (ORISE)

---

#### Laser Target Interaction

**Lead:** Dr. Michael Marciniak

- Dr. Glen Perram
- Dr. C. Keenan (NRC)
- Dr. S. Nauyoks (ORISE)

---

#### Atmospheric Effects

**Lead:** Dr. Steve Fiorino

- Dr. Kevin Keefee (IPA)
- Dr. Jack McCrae (ORISE)
- Ms. Michelle Via (RRP)
- Maj. Kevin Bartlett

---

#### Adaptive Optics & Beam Control

**Lead:** Dr. Sal Cusumano

- Maj. Millo Hyde, PhD
- Dr. J. McCrae (ORISE)
- Mr. Matt Kizzo
- Mr. Noah Van Zandt

---

#### Gas Lasers

**Lead:** Dr. Glen Perram

- Dr. Dave Weeks
- Dr. Gordon Hager
- Lt Col Jeremy Holtsgrave, PhD
- Mr. Charles Phelps
- Dr. Grady Phillips
- Ms. Ericka Acosta

---

#### HEL M&S

**Lead:** Dr. Steve Fiorino

- Dr. Kevin Keefee (IPA)
- Dr. Jack McCrae (ORISE)
- Mr. Matt Kizzo
- Mr. Noah Van Zandt

---

#### Space Telescope

**Lead:** Dr Rich Cobb

- Dr Sal Cusumano
- Dr Jonathan Black
- Mr. Noah Van Zandt

---

#### RPA/UAV Applications

**Lead:** Dr Dave Jacques

---

#### War Gaming

**Lead:** Dr. Ray Hill

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#### Collaborators:

- AFRL, NASIC, UD
- **Publications:**
  - Archival Publications: 7
  - Funding: $510K
  - Proceedings: 12
  - Presentations: 22

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### Atmospheric Effects

**The AFIT of Today is the Air Force of Tomorrow.**

**Lead:** Dr. Steven Fiorino

**Faculty:**

- Lt. Col. Randall (AFWA)
- Maj. Kevin Bartlett (Incoming)

**Researchers:**

- Ms. Michelle Via (Riverside)
- Dr Kevin Keefee (IPA)
- Mr Stephen Shirey (ORISE)
- Dr Jack McCrae (ORISE)

**Students:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Degree</th>
<th>Project Description</th>
<th>Funding</th>
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<tbody>
<tr>
<td>Capt Jonathan Spaulding</td>
<td>PhD</td>
<td>Modification of LEEDR code for RY (2012)</td>
<td>$108,000</td>
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<tr>
<td>Capt Jarred Burley</td>
<td>MS</td>
<td>Atmos Propagation Testing JHPSSL – SMDC</td>
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<td>Capt Ben Roth</td>
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<td>2012 AFIT DE Summer Intern Program</td>
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<td>Lee Burchett</td>
<td>MS</td>
<td>Deep Turbulence MURI with UD</td>
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<td>Joseph Schofield</td>
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<td>Capt Jean Cohen</td>
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<td>Modification of LEEDR code for RY (2011)</td>
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<td>Capt Frank Echevernia</td>
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<td>Capt Seth Marek</td>
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<td>Atmos Effects &amp; Codes/Short Course (2011)</td>
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<td>Capt David Simmons</td>
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Atmospheric Effects

The AFIT of Today is the Air Force of Tomorrow.

HELEEOS
High Energy Laser End-to-End Operational Simulation
Global Aero-Surface 9 km x 9 km, 6 km Saint Range Comparison

Worldwide predictive capability as a function of season, time of day & altitude
- Based on probabilistic data for 573 land sites, 1 x 1 oceanic grid
- Captures variability in atmospheric boundary layer critical to outcome of tactical missions at any wavelength (.355 to 15 μm), includes probability of cloud free line of sight
- Can also ingest & process real-time forecast data

LEEDR
Laser Environmental Effects Definition and Reference

Operational oriented metrics
- HELEEOS: SHARE scaling
- Worldwide atmospheric Off-axis beam scatter
- Cloud free line of sight data

Adaptive Optics & Beam Control

The AFIT of Today is the Air Force of Tomorrow.

Lead: Dr. Sal Cusumano
Faculty: Maj Milo Hyde

Researchers:
Dr. Santasri Basu, Dr. Jack McCrae, Mr. Rick Bartell, Mr. Matthew Krizo, Mr. Noah Van Zandt

Students:
Chad Taguba MS
Mark Spencer MS 2011
Undergrad Interns 15

Grants:
- HEL Laser Communications Performance Assessments from Remotely-Sensed Measurements of Beam Scatter $230,000 NSF
- Lecture Series on Development of Lasers in Defense $5,000 SPIE
- Tactical HEL Weapon Alignment System Architecture Efficiencies $354,700 HELJTO
- Airborne Aero-Optical Laboratory $415,000 HELJTO
- Compensator of Arial-Optical and Atmospheric Disturbances via Coherence Phasing Loops of a Fiber Laser Array $150,000 AFOSR
- Beam Control for Optical Phased Array Weapons $29,958 IOSS
- Wave Optics Modeling and Simulation & Laser Target Interaction $125,000 NPS

Total Funding: $1,615,000

Collaborators:
the Optical Sciences Company (tOSC), UCLA, MZA, University of Notre Dame, AFRL/RD

Publications:
- Archival Publications: 1
- Proceedings: 4
- Presentations: 10
- Reports: 1
Aero Optics Research
Down Selection for Chase Plane
The AFIT of Today is the Air Force of Tomorrow.

Passenger compartment of Citation aircraft:
Dome with on-gimbal fiber & camera
Passenger window/heliostat

Large optical quality window/heliostat
Coude path with dome

Luggage compartment of Citation aircraft:
Dome with on-gimbal fiber beam delivery & camera

Multi-Fiber Laser Source
The AFIT of Today is the Air Force of Tomorrow.

- Investigations into Methods for Coherency, Laser Target Interaction, and phasing multiple coherent array with target return

Tiled array of fiber lasers
No error case
Model aperture phase errors:
- piston
- tilt
- beam quality
HEL Modeling & Simulation

The AFIT of Today is the Air Force of Tomorrow.

**Lead:** Dr. Steven Fiorino
**Faculty:** Dr Sal Cusumano, Dr Glen Perram, Dr Mike Marciniak
**Researchers:** Mr Rick Barbol, Dr Kevin Keefe (IPA), Dr Stephen String (ORISE), Dr Jack McCrea (ORISE), Mr Matt Kizlo, Mr Noah Van Zandt

**Students:**
- Capt Jarred Burley MS
- Capt Ben Roth MS
- Lee Burchett MS
- Capt Jean Cohen MS 2009
- Capt Frank Echeverria MS 2009
- Capt Seth Marek MS 2009
- MAJ Buckley O' Day MS 2009
- Capt James Boxers MS 2010
- Capt John Haiducek MS 2010
- Dane Ranney MS 2010
- MAJ April Miller MS 2011
- Capt David Simmons MS 2011
- Undergrad Interns 15

**Grants:**
- CY12 M&S TAWG Product Development $625,000 HELJTO

**Collaborators:**
- HEL-JTO, DEPS

**Publications:**
- Archival Publications: 7
- Funding: $2,112.5K
- Proceedings: 12
- Presentations: 22

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The HEL Tactical Decision Aid

The AFIT of Today is the Air Force of Tomorrow.

**HELTDA - High Energy Laser Tactical Decision Aid**

- 1.045 µm
- 3000 m alt
- 6000 m SR
- WPAFB, summer, 1500-1800L

HELTDA refinement - Develop updated performance model for tiled systems
UAV Tracking &Targeting Simulation

- Validate passive tracker performance predictions with Black Dart data

Model, using HELJTO-sponsored tools, the target tracking sensor used during Black Dart testing

- Then add modeling of active track

Gas Lasers

Lead: Dr. Glen Perram
Faculty: Dr. Dave Weeks, Dr. Gordon Hages, Lt. Col. Jeremy Holtgrave, Dr. Sal Casumano
Researchers: Mr. Charles Phelps, Dr. Grady Phillip, Ms. Ericka Acosta

Students:

- Major Jeffrey Gallagher PhD 2010
- Major Kirk Brown PhD 2009
- L. Blank PhD
- Lt. Gordon Lott MS
- Ryan Richards MS
- Ryan Hendrix BS
- Lt Col Monte D. Anderson PhD 2010
- Maj Clifford V. Sulham PhD 2010
- Greg A. Pitz PhD 2010
- Capt Charleton D. Lewis PhD 2011
- Maj Patrick D Koe PhD 2008
- Lachlan Belcher PhD 2011
- Matthew Lange PhD 2011
- Lt Douglas Thornton MS 2010
- Lt Woddy Miller MS 2010
- Lt Shawn Hackett MS 2010
- Capt Edward Hurd MS 2011
- Paul Jones MS 2010
- Eric Guild MS 2011
- Charles D. Fox MS 2011

Grants:

- Diode Pumped Alkali Lasers $3,235 K $1,889 K HEL JTO MRI
- High Energy Laser Center of Excellence $2,100 K $ 86K AFOSR
- Electric Discharge Oxygen Iodine Laser $3,100 K $457K HEL JTO MRI
- DPAL Kinetics: Spin-Orbit Relaxation $1,100 K $155K HEL JTO
- Gas Laser Thermal Control: Heat Pipes $569 K $124K HEL JTO

Collaborators:

- Emory University, University of Illinois, University of Central Florida, University of New Mexico, US Air Force Academy, New Mexico Tech, Air Force Research Laboratory, Major Shared Resource Center (WPAFB)

Publications:

- Archival Publications: 16 Funding: $3,511 K
- Proceedings: 20 PhD: 8
- Presentations: 15 MS: 9
- Interns: 4
Gas Lasers

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- Scaled DPAL quasi-cw intensity to >30 times threshold with >50% efficiency
- Scaled DPAL pulsed intensity to > 5 MW/cm² with >10% efficiency
- Observed thermal effects on radial alkali concentrations
- Developed analytic model with broadband, radial dependent pumping
- Characterized Beam Quality for longitudinally pumped, low-Q stable resonator
- Observed higher order Stimulated Raman Scattering in potassium

DPAL Intensity Scaling

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![Image of laser experiment setup]

- 17 mW (average)
- 170 kW (peak)
- 5.4 MW/cm²

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5/11/2012
Laser Target Interaction

The AFIT of Today is the Air Force of Tomorrow.

Lead: Dr. Michael Marciniak
Faculty: Dr. Glen Perram, Dr. Sal Cusumano, Dr. Kevin Gross
Post Doctoral Researchers: Dr. Stephen Nauyoks, Dr. Cameron Keenan

Students:
- Capt Roberto Acosta PhD
- Thomas Fitzgerald PHD
- C. Dean Roberts PHD
- Capt Jason Vepa PHD
- Capt Michael Seal PhD
- Sahin Ruhmann MS
- Michael Benson MS
- Lt Simon Ferrel MS
- Capt Shane McColmel MS
- Lt Jessica Schafer MS
- Capt Spencer Sellers MS
- Lt Col Walter Cole PhD 2008
- Lt Col Mark Hoelscher PhD 2011
- Capt Bradley Baling MSEE 2009
- David Beeler MS
- Paul Galvan MS 2008
- Capt Benjamin Hurst MS 2011
- Capt Robert Larmott MSEE 2009
- Capt Kyle McAbee MSEE 2008
- Capt William Palm MS 2011
- Capt Joshua Rasmussen MSEE 2008
- Capt John Tatar MSEE 2009

Grants:
- Hyper-spectral Imaging for Laser Lethality $3,100K $1,600K HEL JTO
- DOO BRDF measurement system $100K AFRL/RY
- BRDF Measurement Research $446K AFRL/RY
- OpticalThermal Meta-materials Research $284K AFRL/RX
- Infrared Counter-Countermeasures Research $133K AFRL/RX

Collaborators:
- University of Virginia, University of Dayton, Air Force Research Laboratory (RDLE, LHMEL, RZPG)

Publications:
- Archival Publications: 4 Funding: $2,563K
- Proceedings: 19 PhD: 6
- Presentations: 42 MS: 17

Interns: 4

Laser Irradiated Fiberglass

The AFIT of Today is the Air Force of Tomorrow.

Painted Fiberglass
- Before
- After
- 1” ~ 1.3 cm

Unpainted Fiberglass
- Before
- After

Capt Penny Meehan MSEE 2008
Capt William Palm MS 2011
Capt Joshua Rasmussen MSEE 2008
Capt John Tatar MSEE 2009

Aim High...Fly - Fight - Win
Remote Sensing

The AFIT of Today is the Air Force of Tomorrow.

Lead: Dr. Kevin Gross
Faculty: Lt. Col. Michael Hawks, Dr. Glen Perram
Researchers: Mr. Jeremy Pitz

Students:
- Christopher Rice PhD
- Capt Jake Harley PhD
- Michael Rhoby PhD
- Randy Baetick PhD
- Lt Evian Carlson MS
- Capt Chad Su.e MS
- Aaron Blake BS
- Bryan Steward PhD
- Lt Col Joe Gordon PhD
- Capt Ken Bradley PhD
- Major Joel Anderson MS
- Lt Jennifer Davis MS
- Capt Matthew Spidell MS
- Capt Tony Young MS
- Capt Steve Siegel MS
- Capt Spencer Bowen MS
- Capt Dan O’Dell MS
- Capt Doug MacDonald MS
- Capt Tony Vincent MS

Grants:
- DPAL Atmospheric Transmission $895K $245K HEL JTO
- HSI for Radioactive Source Detection $1,031K $1,031K DTRA
- Monocular Passive Ranging 217K NASIC
- Transient Combustion Event Detection 296K NRO
- MASINT Ground Truth Data Collection 1,059K NASIC
- IED Fireball Forensics 147K JIEDDO
- Grants: Funding: $2,738K

Collaborators:
Georgia Tech, Rose Hulman, USAF Test Pilot School, Naval Surface Warfare Center, Air Force Research Laboratory, National Air and Space Intelligence Center, National Ground Intelligence Center, ATK Thiokol, Aerospace Corp, Telops Inc, US Air Force Academy

Publications:
Archival Publications: 6
Proceedings: 27
Presentations: 41
Funding: 7
Interns: 1

Monocular Passive Ranging

Developed method for passively determining range to missile using atmospheric absorption. Range errors of <1% demonstrated for static rocket motor test. Flight test of tunable filter system against F-16 in afterburn. Range error of < 3% for launch of Falcon 9.