



*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

Report Documentation Page

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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

 <p>School of Systems and Logistics</p> <p>Faculty: 61 Students: 28K/yr Courses: 125</p>	 <p>The Civil Engineer School</p> <p>Faculty: 29 Students: 7K/yr Courses: 118</p>
 <p>Cyberspace 200/300 Instructors: 6 Students: 600/yr</p>	

Research

2 - AF Centers
5 - AFIT Centers

\$21M+ annually
Sponsor funded,
Defense-focused,
Collaborative,
Ops-driven

Publications & Patents



Consultation

2 - AF Centers
5 - AFIT Centers

Subject Matter Experts

Worldwide Impact
Combatant Cmts
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 flexibility to adapt to changing mission focus

Value: Defense-focused education; Building relationships among DoD STEM workforce



Wright-Patterson
Air Force Base,
Dayton, Ohio





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 AY 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 DLI 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



HLC Status

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



AIR FORCE INSTITUTE OF TECHNOLOGY

Overview

- 2011 AFIT Highlights
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AIR FORCE INSTITUTE OF TECHNOLOGY

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



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AFIT Manning Reductions



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- 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

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RMD 703 Impacts on LS



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- 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)

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RMD 703 Impacts on CE



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- 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 surplus
 - No academic and student support remain
 - Transferring must do activities to faculty
- 1 Faculty GS-13 surplus
 - Redistributing courses based on priority and will have to cut at least 1 course and reduce offerings of others

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RMD 703 Impacts on EN



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	<u>AFIT</u>	<u>EN</u>
Round 1	- 2	- 1
Round 2	- 49	- 23
Military cuts	- 16	- 5

- 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**

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**Graduate School of
Engineering and Management
Overview**

Dr. M. U. Thomas
Dean

14 May 2012

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Overview/Update of Our:



- BOV Recommendations
- Mission
- 2011 Highlights
- Academic Programs
- Faculty and Students
- 2012 Goals



BoV Subcommittee 2011 Recommendation: 04-2009-07



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

***Spreadsheet Attached**

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BoV Subcommittee 2011 Recommendation: 11-2010-18



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#	Issue	OPR	Recommendation	Action	Status
	Approval authority for AD faculty actions	AFIT/EN	Current policies and procedures have the AU Commander as approval authority for AD actions with recommendation from VP for Academic Affairs	Open	

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**

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Graduate School of Engineering and Management



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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



The AFIT of Today is the Air Force of Tomorrow.

- **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



Leadership and Quality Assurance in Applied Science,
Computing, Engineering, and Technology Education





A Few 2011-2012 Highlights



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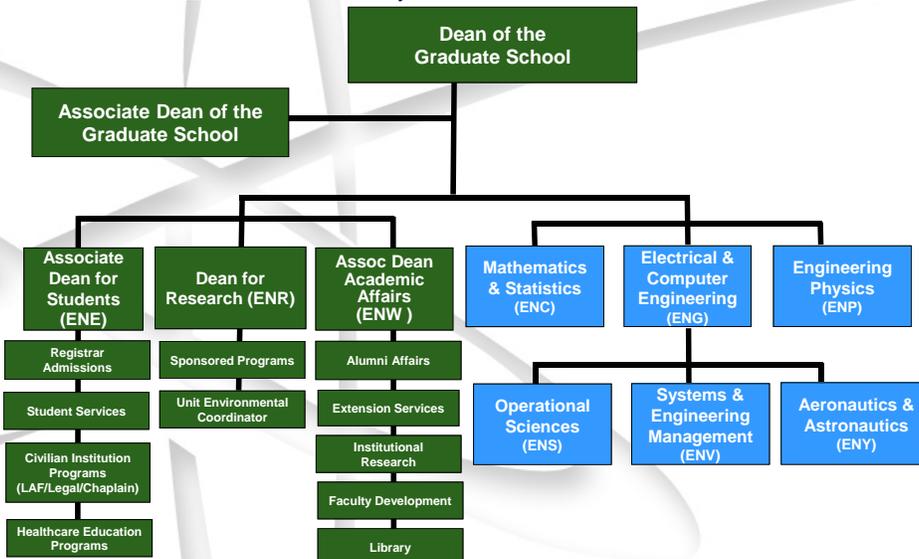
- AFIT leading reinvigoration of nuclear enterprise--developed nuclear logistics management specialty for Logistics and Supply Chain Management MS degree programs
- Center for Operational Analysis designated – OSD Center of Excellence
- AFIT's Center for Cyber Space Research offering Cyber 200 & 300 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



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Current Profile



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



*Fall 11 data

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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



Mathematics & Statistics

Electrical & Computer Eng

Engineering Physics Operational Sciences

Systems & Engineering Mgt

Aeronautics & Astronautics





Resident Academic Degree Programs



The AFIT of Today is the Air Force of Tomorrow.

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

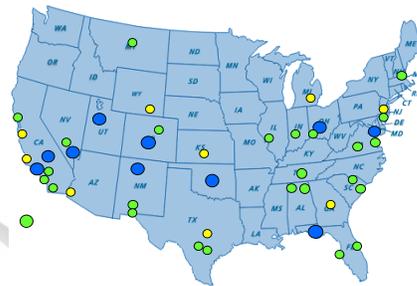


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Demand-driven programs for individuals seeking advanced-level education in selected specialty areas beyond the bachelor's level (but not necessarily leading to a graduate degree)

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



Other Locations:

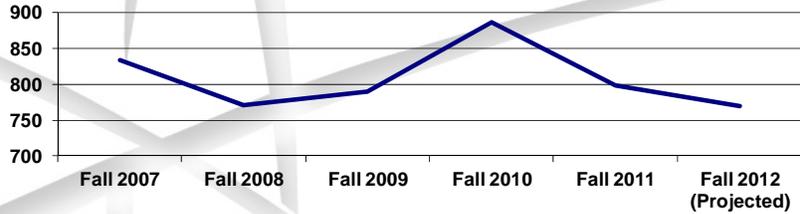
- Aviano AFB Italy
- Kabul (Afghanistan)
- Kadana (Japan)



Enrollments



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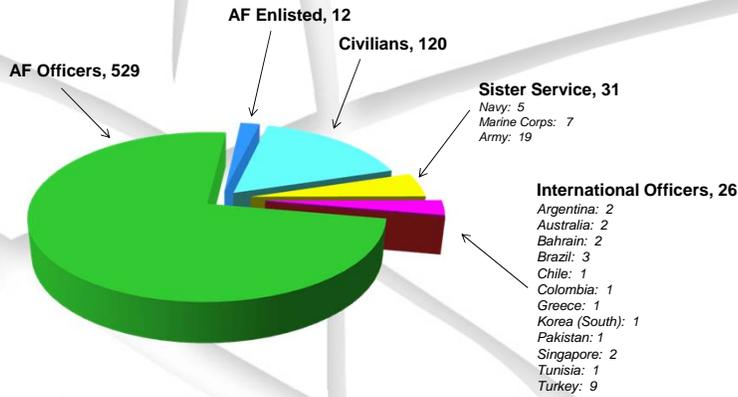
- Fall 11 enrollment: 22 IDE, 678 resident, 26 international students, 120 civilians (includes 81 DoD civilians and 39 Non-DoD civilians)
- Total Spring 12 enrollment:
 - 664 (566 resident, 98 distance learning)
 - 457 AF, 32 Sister Service, 137 civilians, 25 international, 13 Non-Degree



AFIT/EN Resident Students



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*Fall 11 data

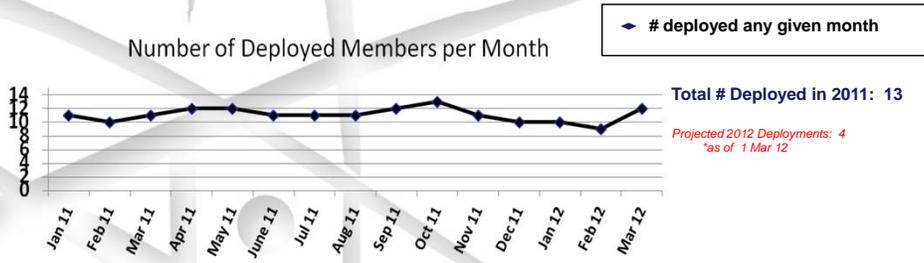




EN Personnel Deployed



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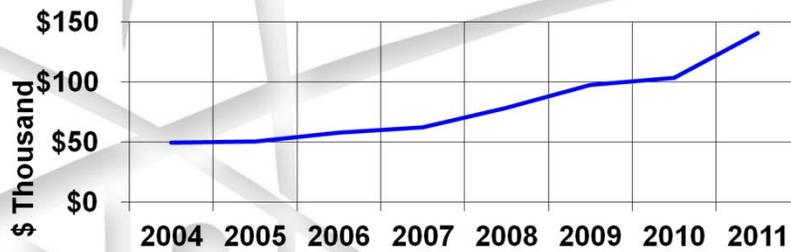
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Research \$/FTE



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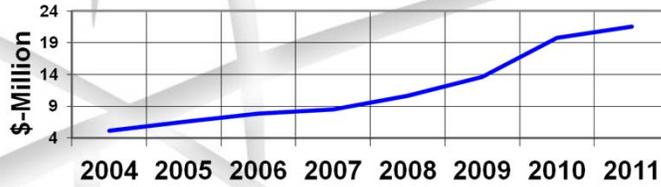
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Sponsored Research



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- 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



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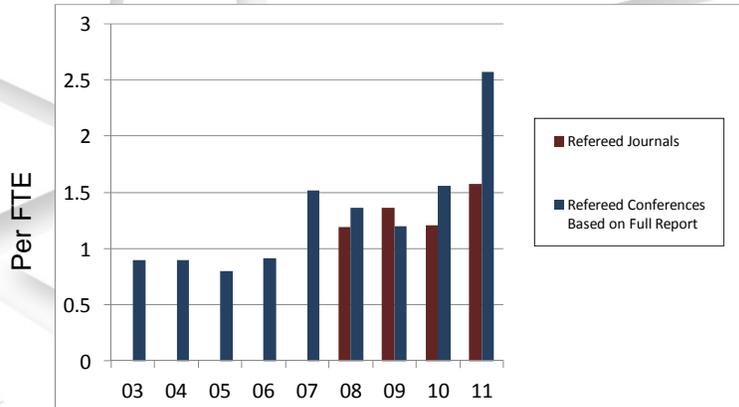
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Faculty Publications



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FY11 Totals:
 131 FTE* Faculty Members
 206 Refereed Journals
 337 Refereed Conferences
 *Full-Time Equivalent

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EN Productivity Statistics



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Academic Year 2011-2012^a

- 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

^a Data are yearly averages



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FY2012 DIRECTION



FY2012 EN Direction



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- 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

Build prominence through research and academic programs



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Questions?



Air Force Institute of Technology



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Educating the World's Best Air Force



U.S. AIR FORCE

The School of Systems and Logistics

Col Tim Fennell
Dean, AFIT/LS

As of 1 Mar 12

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School of Systems and Logistics



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Mission

Equipping the Air Force's acquisition and logistics workforce to be 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.

AFIT School of Systems and Logistics



50 YEARS

Professional Continuing Education

1962 - 2012

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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



The AFIT of Today is the Air Force of Tomorrow.

- 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



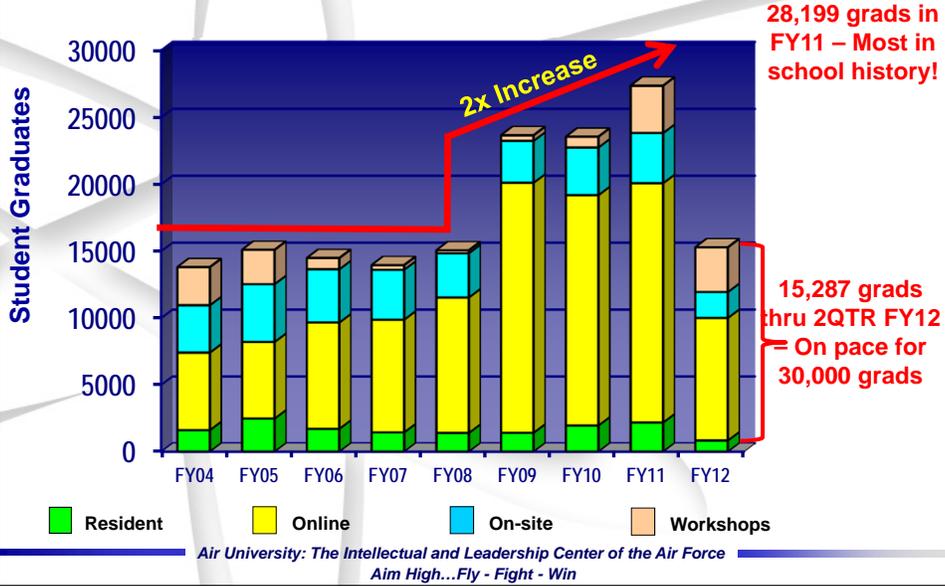
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Total AFIT/LS Student Production



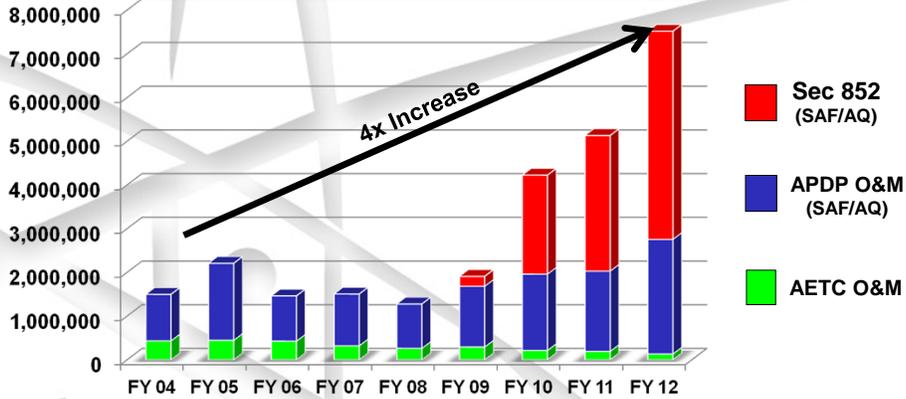
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AFIT/LS Annual Operating Budget*



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*** Does not include:**

- Customer funded TDYs for instructor travel
- Sponsor funding for new course development
- CENTCOM funding for Iraq course development (\$5M in FY12)

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Courses by Air Force Career Fields



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Initial Skills (01-03; GS5-11)	Technical Expertise (03-04; GS11-13)	Senior Leadership (05-06; GS14-15)
FAM	4 Courses	1 Course
Scientist		
FAM	29 Courses	2 Courses
Engineer		
FAM	IPM 301 25 Courses	5 Courses
Acquisition Manager		
MRCO	CON 170 6 Courses	2 Courses
Contracting		
20 Courses		3 Courses
Maintenance		
17 Courses		3 Courses
Logistics Readiness		

Required Recommended

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

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Overseas Teaching Locations



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A small school . . .

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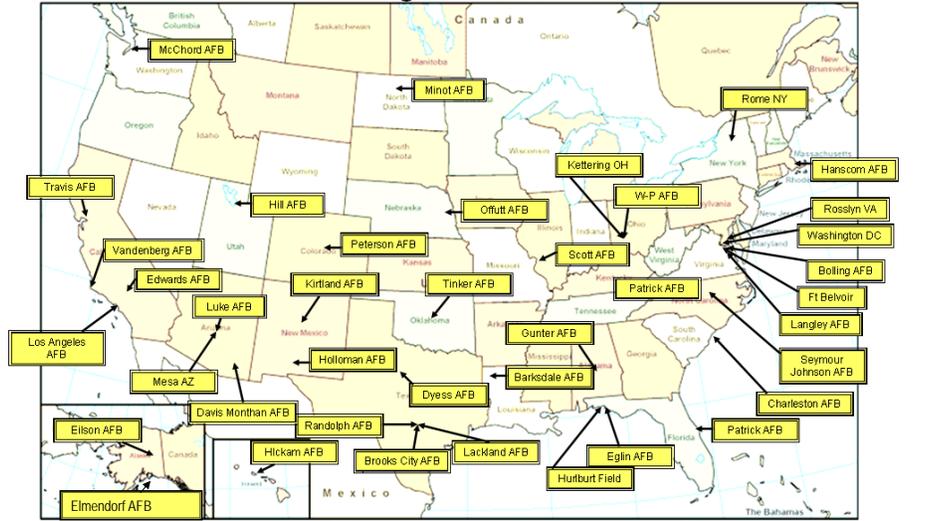




CONUS Teaching Locations



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... but a giant footprint!

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Reviews/Outreach



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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

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LS Accomplishments



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- **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

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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**

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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 thrupt)
 - 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

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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

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AFIT/NPS MOA Update



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Col Timothy Lawrence Commandant

U.S. AIR FORCE

14 May 2012



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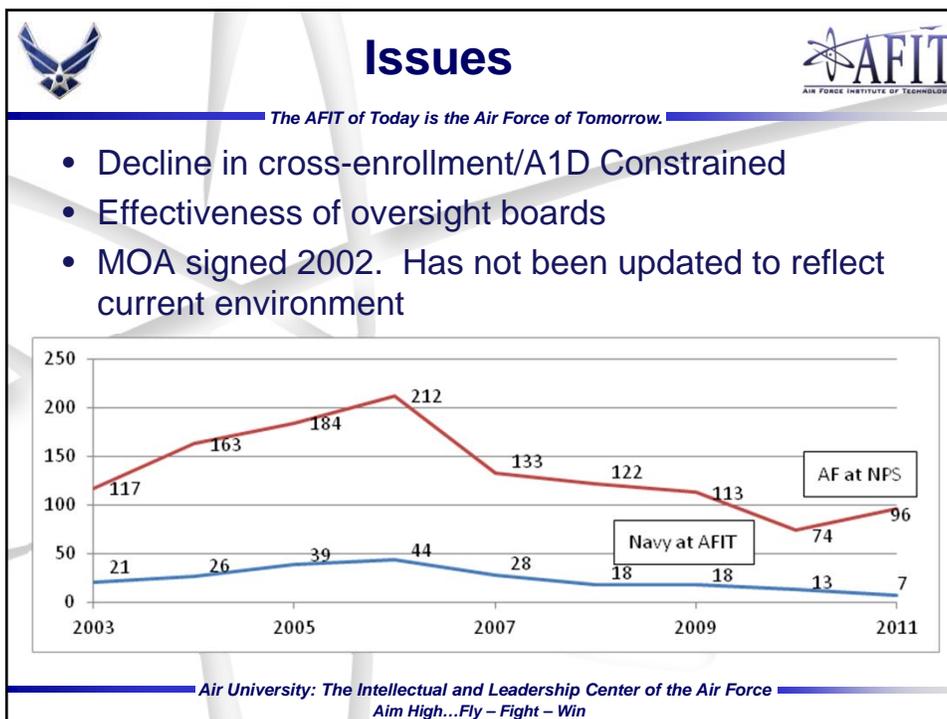
Background



The AFIT of Today is the Air Force of Tomorrow.

- 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

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Questions?

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The Civil Engineer School

The AFIT of Today is the Air Force of Tomorrow.



Col Rodger Schuld

Dean

The Civil Engineer School



12 Mar 2012

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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*

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FY12 – Great Year

The AFIT of Today is the Air Force of Tomorrow.

- 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

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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

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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

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Course Funding Sources



The AFIT of Today is the Air Force of Tomorrow.

- 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) ↔

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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

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Solve Requirement Disconnect



The AFIT of Today is the Air Force of Tomorrow.

- 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

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Satellite Overhaul



The AFIT of Today is the Air Force of Tomorrow.

- Revamping satellite courses
 - Reduce 8 hour days of looking at TV screen
 - Targeting time zones to better serve far west and far east customers
 - 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

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Resurrecting On-sites



The AFIT of Today is the Air Force of Tomorrow.

- 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

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Live Courses Over HD-Internet



The AFIT of Today is the Air Force of Tomorrow.

- 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

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Hybrid learning

The AFIT of Today is the Air Force of Tomorrow.

- 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?

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The Civil Engineer School



*Empowering Civil Engineers
to lead the way in the 21st century*

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AF CSE History



The AFIT of Today is the Air Force of Tomorrow.

- 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

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AF CSE Legacy



The AFIT of Today is the Air Force of Tomorrow.

- 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

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 **Air Force Institute of Technology** 
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**SPACE
STUDIES AND
RESEARCH**

Col Timothy Lawrence

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 **Space Hardware Test Facilities** 
The AFIT of Today is the Air Force of Tomorrow.


**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)**

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AFIT's Ground Station



The AFIT of Today is the Air Force of Tomorrow.

- 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




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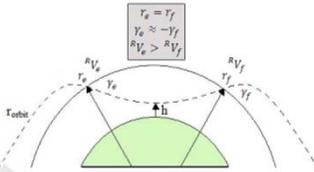


Responsive Orbits



The AFIT of Today is the Air Force of Tomorrow.

- 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

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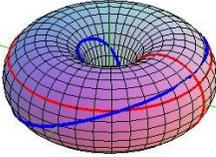
Satellite tracking using KAM Tori*



The AFIT of Today is the Air Force of Tomorrow.

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 vice SGP4 (years vs. days)
 - *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

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AFIT Satellite Operations Center (ASOC)

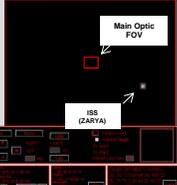


The AFIT of Today is the Air Force of Tomorrow.

- 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






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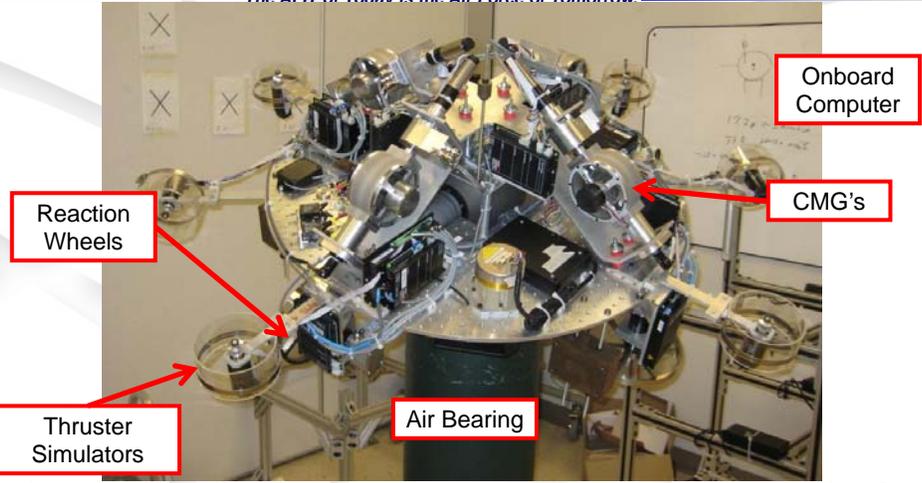
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AFIT's Satellite Simulator, SimSat, Designed, Built, and Tested by Students

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

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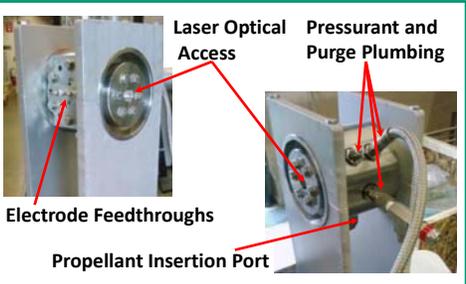


"Green" Monopropellant Program

AFRL/RZ Initiative – AFIT conducting studies

The AFIT of Today is the Air Force of Tomorrow.





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

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

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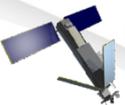
AFRL/RV Sponsored CubeSat Design



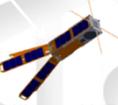
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Concept



Iridium Satellite



Satellite w/ LEO
Satcom modem



Iridium
Gateway



PC or PDA

Internet

Design



Hardware



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Spring 2011 Design Projects



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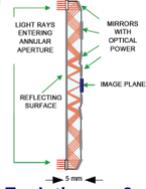
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**FalconSat 7 (FS-7)
Photon Sieve**
Sponsor: USAFA



**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

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AFIT LEO iMESA CNT Experiment (ALICE)

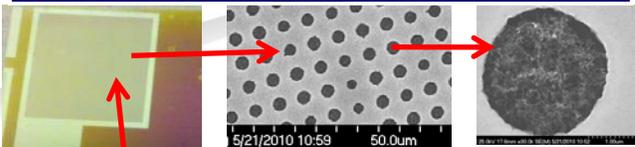


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Objective
On-orbit testing of AFIT developed CNT field emission arrays

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

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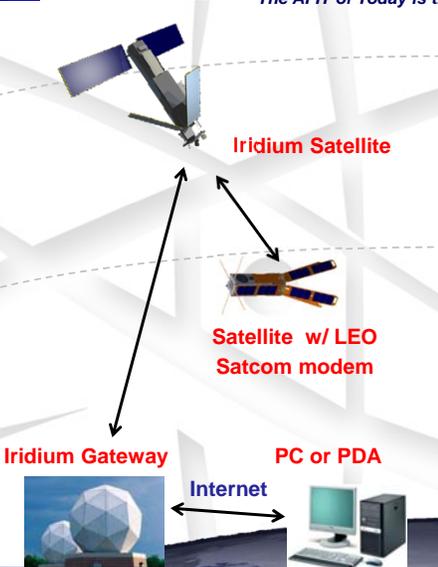
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Persistent TT&C using LEO Satcom (PTLS)



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Iridium Satellite

Satellite w/ LEO Satcom modem

Iridium Gateway

PC or PDA

Internet



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Future CubeSat Experiments



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- **Precision Timing and Ranging**
 - Two-way time transfer is a previously investigated topic
- **New Propulsion technologies**
 - Electro spray colloid thruster is a probable candidate
- **Downselect from ASYS 632 projects**
 - “Space Traffic Control” is a probable candidate
 - Will be briefed at upcoming SERB



Electrospray Colloid Thruster

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CubeSat Development Model



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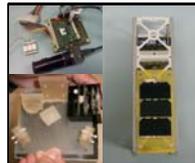
Sponsor Identified Mission



ASYS 631 – Preliminary Design



ASYS 632 – Prototype

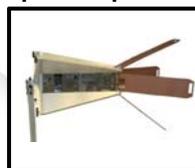


Provides students with an immersive hands-on satellite design, build, test, & operations experience

On-Orbit Operations



Thesis Research – Space Experiment



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ASYS 631
Spacecraft Systems Engineering
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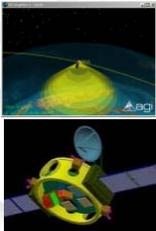
Provides a detailed introduction to the design of complex space systems



Lectures



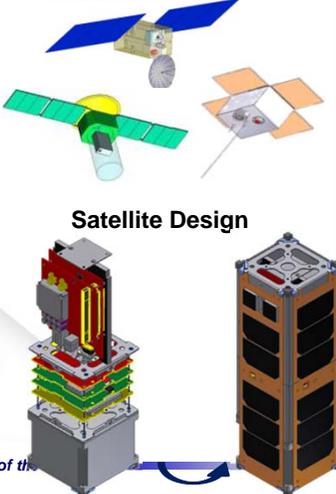
Design Teams



Modeling Tools

Results in...





Satellite Design

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ASYS 632
Satellite Design and Test
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Provides a comprehensive overview of the design, manufacture, & testing of complex space systems

Hardware, Electronics, & Software Development



Custom Boards



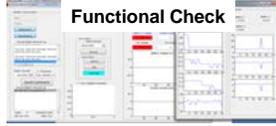
Student designed hardware



CubeSats



Space Qualification



Functional Check



TVac Chamber



Random Vibe

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FalconSAT-3

Mission Ground Station Network

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Vandenberg AFB
California
Undergraduate Space Training
Satellite C2 Experience




USAFA
Colorado
Satellite Control Authority
Primary Operations




AFIT
Ohio
Graduate-level satellite
ops




USMA
West Point NY
Satellite Command &
Control Experience





UST instructors conducting
a FalconSAT-3 pass



Former NASA Administrator
Mike Griffin with cadets
operating FalconSAT-3



AFIT Mission Ground Station



West Point cadets checking
out their new FalconSAT-3
equipment

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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

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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
 - Acquisition
 - Space system engineering
 - Orbit principles
 - Spacelift, LV subsystems
 - Payload design
 - Communication, jamming
 - Ground, C2, user segments
 - Satellite bus subsystems
 - Position, navigation, timing
- Result: better trained graduate to AFSPC!

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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*

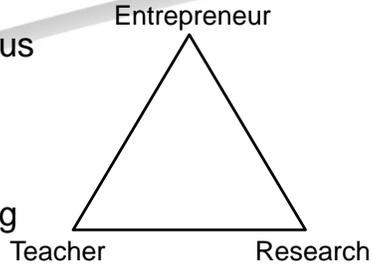


Balanced Development



The AFIT of Today is the Air Force of Tomorrow.

- 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



Professor Nancy Giles (Dept. Head)

PhD Physics, North Carolina State U, 1987

Solid State Physics: photoluminescence (PL), absorption, Raman, and magnetic resonance (EPR) spectroscopy



Professor Emeritus James Bridgman

PhD Nuc. Eng. North Carolina State U. 1963

Nuclear Weapon Effects; fallout modeling; Technology aspects of non-proliferation of WMD



Professor Emeritus George John

PhD Nuc. Chem. Ohio State University 1952

Materials science; radionuclides in the environment; detection of nuclear radiation.



Professor Larry Burggraf

PhD Chem., University of Denver 1981

Atomic Force Microscopy; computational chemistry; nuclear fuel spectroscopy; imaging, positrons

Professor Kirk Mathews

PhD Nuc. Eng. Air Force Institute of Technology 1983

Radiation transport computational methods; Fuel cycle modeling; Nuclear effects; measurement analysis



Assistant Professor Dr. John McClory

PhD Nuc. Eng Air Force Institute of Technology 2008

Interaction of radiation with matter; condensed matter physics; recent AFIT/DTRA Research Officer

Assistant Professor Major Ben Kowash

PhD Nuc. Eng. University of Michigan 2008

Radiation Detection & Imaging, Nuclear Weapon Effects, Inverse Problems



Assistant Professor LTC Stephen McHale

PhD Nuc. Eng. Air Force Institute of Technology 2011

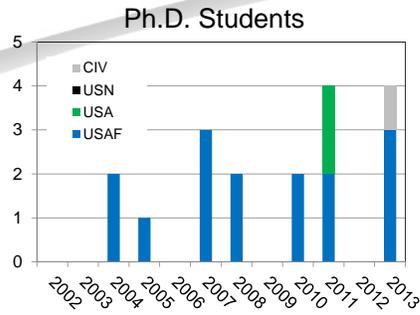
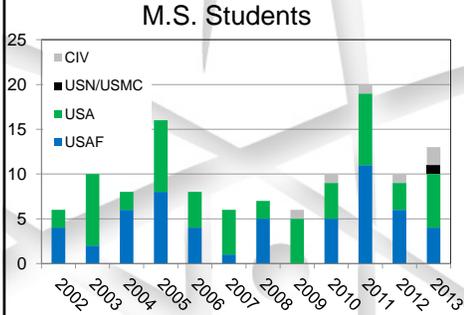
Solid state radiation detection devices, condensed matter physics



Nuclear Program Students



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Most Recent Graduates

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

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

AFIT/EN

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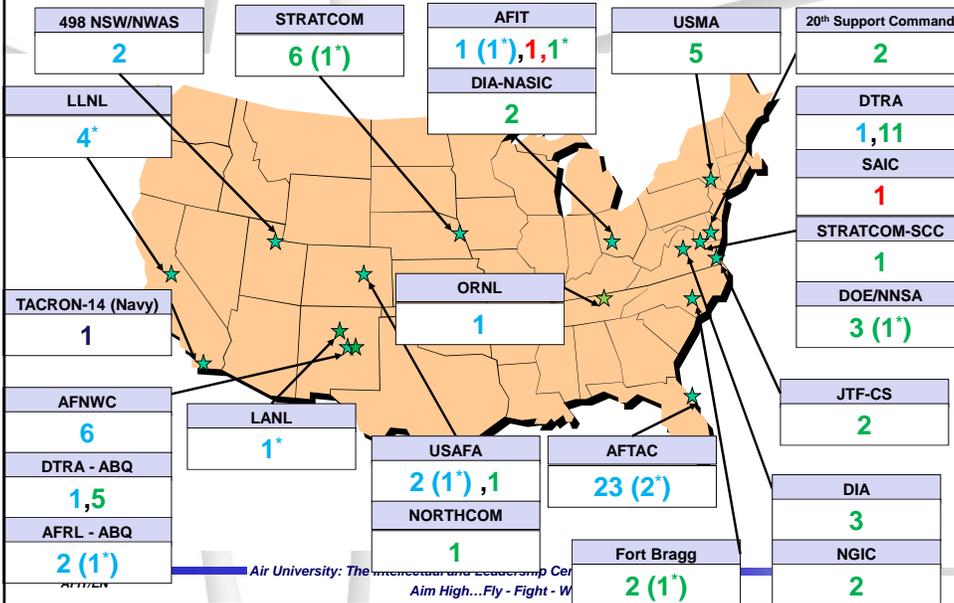
5



Where GNE Students Serve Post Graduation (2002-2011)



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Nuclear Weapons Focus



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Detect SNM



Portal Monitoring



Fuel Cycle Counter proliferation



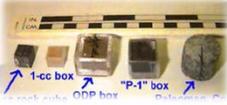
Standoff Detection



UO2 Modeling Safeguards



SREMP



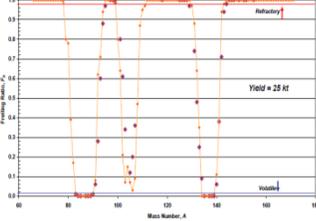
1-cc box
"P-1" box



Thermal Flash



Fallout





STANDOFF INTERDICTION

← Pre (LOB) H-hour Post (ROB) →

PERSONNEL/EXPERTISE

RESEARCH/CAPABILITY

SENSING ANALYSIS



University Collaborations



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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

USAFA

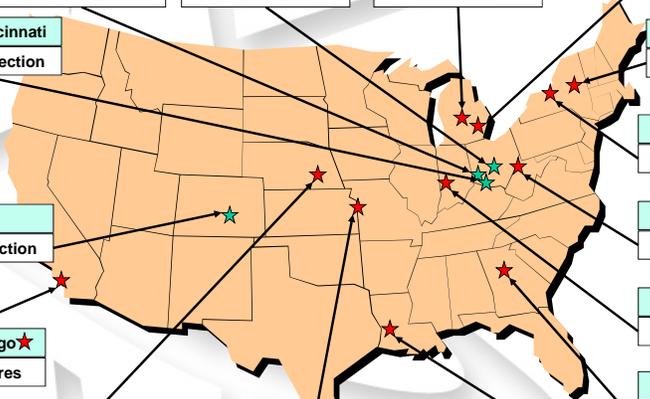
Gamma Detection

UC, San Diego★

EMP Signatures

Univ. of Nebraska★

Detection
Actinide Chemistry



USMA★

Gamma Detection

SUNY-Buffalo★

UO Analysis

West Virginia Univ.★

Detector Materials

Indiana Univ.★

Radiation Effects

Georgia Tech★

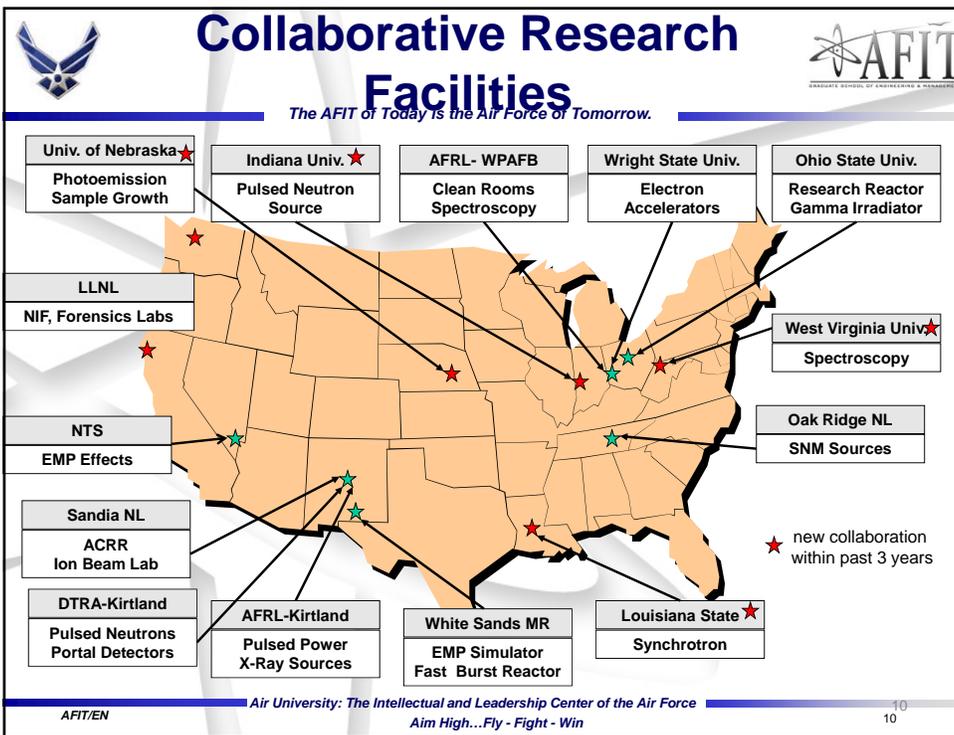
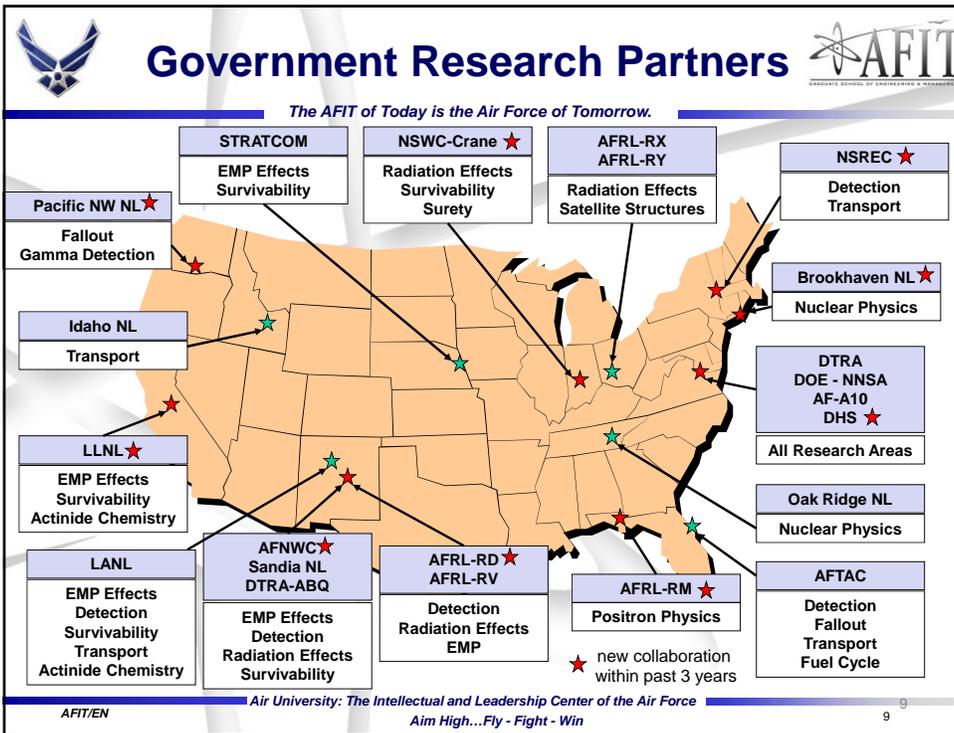
Thermal Effects
Gamma Detection

★ new collaboration within past 3 years

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AFIT Nuclear Engineering Labs



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- 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



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



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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

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



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



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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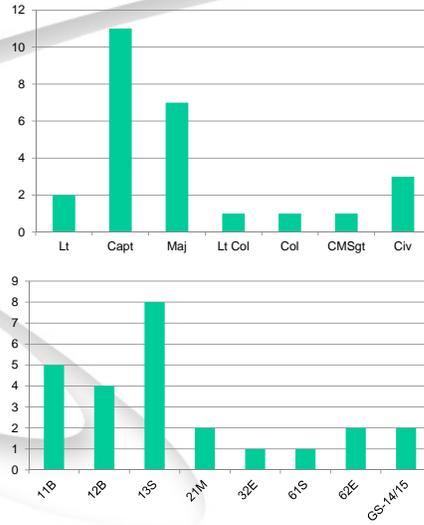


NWEPP Demographics



The AFIT of Today is the Air Force of Tomorrow.

- 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



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13

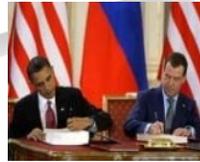


NWEPP in the Year Ahead



The AFIT of Today is the Air Force of Tomorrow.

- 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



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Combating Weapons of Mass Destruction (CWMD) Program



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- 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



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Questions?



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Air Force Institute of Technology

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Center for Directed Energy (CDE)



AIR FORCE STEM

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

Department of Engineering Physics
Graduate School of Engineering and Management

15 May 2012

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History of Lasers/Optics & CDE

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How optics research and education focus in ENP has evolved to address needs of the Air Force and DoD...

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



LtCol, later MGen,
Don Lamberson
(AFIT PhD '69)

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

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

Airborne Laser Lab (ALL)
Initiated AFIT program in Electro-optics to provide optics education to officers with an EE background

Tri-Service Gas Dynamic Laser
Initiated AFIT program to educate officers in the area of high energy laser and optical systems

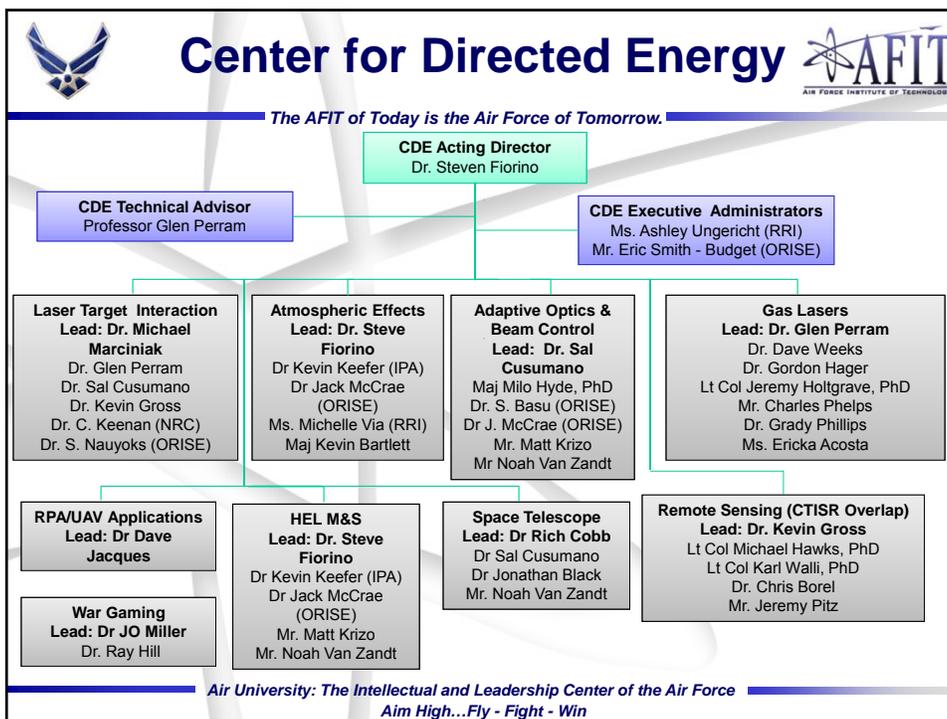
CDE was the 1st AFIT Center Established in 2001 for specialized research





1970 1980 1990 2000 2010

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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 Keefer (IPA), Mr. Stephen Shirey (ORISE), Dr. Jack McCrae (ORISE)
Students: Grants:

Capt Jonathan Spaulding	PhD	Modification of LEEDR code for RY (2012)	\$108,000	AFRL/Ry
Capt Jarred Burley	MS	Atmos Propagation Testing JHPSSL – SMDC	\$ 53,000	HEL-JTO
Capt Ben Roth	MS	2012 AFIT DE Summer Intern Program	\$ 50,000	DEPS (HELJTO)
Lee Burchett	MS	Deep Turbulence MURI with UD	\$270,000	AFOSR
Joseph Schofield	MS			
Capt Jean Cohen	MS 2009	Modification of LEEDR code for RY (2011)	\$105,207	AFRL/Ry
Capt Frank Echeverria	MS 2009	2011 AFIT DE Summer Intern Program	\$50,000	DEPS (HELJTO)
Capt Seth Marek	MS 2009	Atmos Effects & Codes Short Course (2011)	\$7,900	AFRL/Ry
MAJ Buckley O'Day	MS 2010	LEEDR Backscatter Modification (2011)	\$10,000	AFRL/Ry
Capt James Bowers	MS 2010			
Capt John Haiducek	MS 2010			
Maj David Meier	MS 2010			
Dane Ranney	MS 2010			
Capt Paul Domm	MS 2010			
MAJ April Miller	MS 2011			
Capt David Simmons	MS 2011			

Collaborators:
AFRL, NASIC, UD

Publications:

Undergrad Interns	15	Archival Publications:	7	Funding: \$510K
		Proceedings:	12	
		Presentations:	22	

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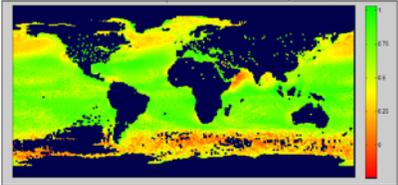


Atmospheric Effects



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HELEEOS
High Energy Laser End-to-End Operational Simulation
Global Air-to-Surface 3 km Alt, 6 km Slant Range Comparison

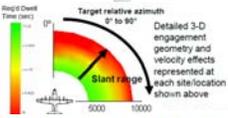


Worldwide comparison of normalized power delivered to a 5 cm diameter area, all ocean surface locations (1° x 1° grid) • 254 land surface sites, 1.045 μm, air to surface, 6000 meter slant range, platform at 3000 meter altitude, summer in both hemispheres. Dark blue locations over the ocean indicate lack of full required data.

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

Effects included: molecular and aerosol absorption & scattering, precipitation effects, optical turbulence, thermal blooming



Detailed 3-D engagement geometry and velocity effects represented at each site/location shown above

Operationally oriented metrics
→ required dwell, effective range, P_r

HELEEOS:
SHaRE scaling
Worldwide atmospheric
Off-axis beam scatter

LEEDR
Laser Environmental Effects Definition and Reference



Atmospheric propagation model:

- Creates physically realizable vertical profiles of meteorological data and environmental effects such as particle extinction
- Allow graphical access to and export of the probabilistic data from the ExPERT database

EXPERT Database

- 573 worldwide ground sites
- Provides statistical surface data for temperature, humidity, wind speed, etc...

• Includes C₂ profiles
• Cloud free line of sight data
• UV to RF spectral coverage

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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	Grants:		
Mark Spencer	MS 2011	HEL- Laser Communications Performance Assessments	\$230,000	NSF
Undergrad Interns	15	from Remotely-Sensed Measurements of Beam Scatter		
		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
		Compensation of Aero-Optical and Atmospheric Disturbances via	\$150,000	AFOSR
		Coherence Phasing Loops of a Fiber Laser Array		
		Beam Control for Optical Phased Array Weapons	\$29,958	IOSC
		Wave Optics Modeling and Simulation & Laser Target Interaction	\$125,000	NPS

Total Funding: \$1,615,000

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

Publications:
Archival Publications: 1
Proceedings: 4
Presentations: 10
Reports: 1

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Aero Optics Research

Down Selection for Chase Plane

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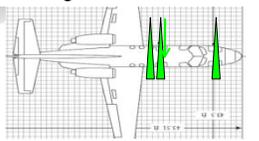


Passenger compartment of Citation aircraft:

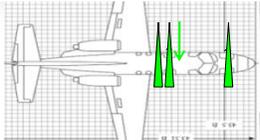
Dome with on-gimbal fiber & camera




Passenger window/heliostat




Large optical quality window/heliostat

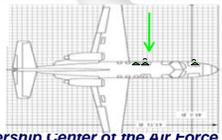



Coude path with dome




Luggage compartment of Citation aircraft:

Dome with on-gimbal fiber beam delivery & camera





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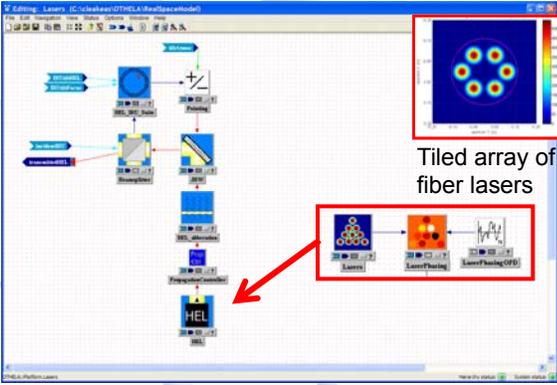


Multi-Fiber Laser Source

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



Tiled array of fiber lasers

Coherence = 0.5, jitter = 0	Coherence = 0.5, jitter = 0.25	Coherence = 0.5, jitter = 0.5
Coherence = 0.75, jitter = 0	Coherence = 0.75, jitter = 0.25	Coherence = 0.75, jitter = 0.5
Coherence = 1, jitter = 0	Coherence = 1, jitter = 0.25	Coherence = 1, jitter = 0.5

No error case

Model aperture phase errors:

- piston
- tilt
- beam quality

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HEL Modeling & Simulation



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Lead: Dr. Steven Fiorino
Faculty: Dr Sal Cusumano, Dr Glen Perram, Dr Mike Marciniak
Researchers: Mr Rick Bartell, Dr Kevin Keefer (IPA), Mr Stephen Shirey (ORISE), Dr Jack McCrae (ORISE), Mr Matt Krizo, Mr Noah Van Zandt

Students:	Grants:	
Capt Jarred Burley MS	CY12 M&S TAWG Product Development	\$625,000 HELJTO
Capt Ben Roth MS		
Lee Burchett MS		

	Collaborators:	
Capt Jean Cohen MS 2009	HEL-JTO, DEPS	
Capt Frank Echeverria MS 2009		
Capt Seth Marek MS 2009		
MAJ Buckley O'Day MS 2009		
Capt James Bowers MS 2010	Publications:	Funding: \$2,112.5K
Capt John Haiducek MS 2010	Archival Publications: 7	
Dane Ranney MS 2010	Proceedings: 12	
MAJ April Miller MS 2011	Presentations: 22	
Capt David Simmons MS 2011		
Undergrad Interns 15		

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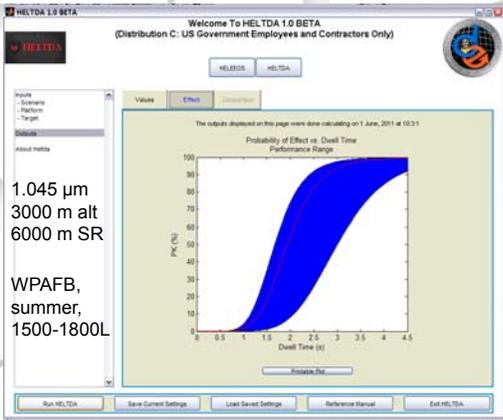


The HEL Tactical Decision Aid



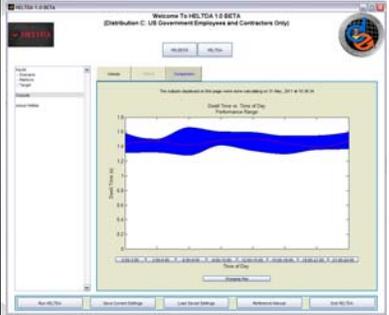
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HELTDA - High Energy Laser Tactical Decision Aid



1.045 μm
3000 m alt
6000 m SR

WPAFB,
summer,
1500-1800L





HELTDA

HELTDA refinement - Develop updated performance model for tiled systems

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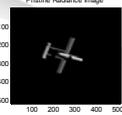


UAV Tracking & Targeting Simulation

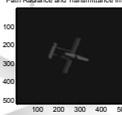


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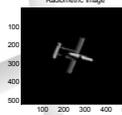
- Validate passive tracker performance predictions with Black Dart data



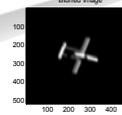
Pristine Radiance Image



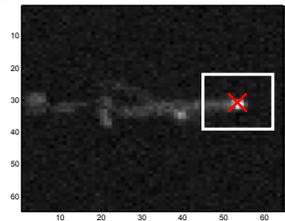
Path Radiance and Transmittance Image



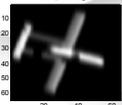
Radonometric Image



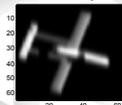
Blurred Image



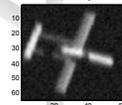
Detection Image



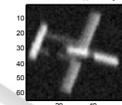
Sampled Image



Detection Image



Noise Image



Quantized/Clipped Image

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





- Then add modeling of active track

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Gas Lasers



The AFIT of Today is the Air Force of Tomorrow.

Lead: Dr. Glen Perram

Faculty: Dr. Dave Weeks, Dr. Gordon Hager, Lt. Col. Jeremy Holtgrave, Dr. Sal Cusumano

Researchers: Mr. Charles Phelps, Dr. Grady Phillip, Ms. Ericka Acosta

<p>Students:</p> <p>Major Jeffrey Gallagher PhD Major Kirk Brown PhD L Blank PhD Lt Gordon Lott MS Ryan Richards MS Ryan Hendrix BS</p>	<p>Grants:</p> <table border="0" style="width: 100%;"> <tr> <td>Diode Pumped Alkali Lasers</td> <td>\$3,235 K</td> <td>\$1,889 K</td> <td>HEL JTO MRI</td> </tr> <tr> <td>High Energy Laser Center of Excellence</td> <td>\$2,100 K</td> <td>\$ 886K</td> <td>AFOSR</td> </tr> <tr> <td>Electric Discharge Oxygen Iodine Laser</td> <td>\$3,100 K</td> <td>\$ 457K</td> <td>HEL JTO MRI</td> </tr> <tr> <td>DPAL Kinetics: Spin-Orbit Relaxation</td> <td>\$1,100 K</td> <td>\$ 155K</td> <td>HEL JTO</td> </tr> <tr> <td>Gas Laser Thermal Control: Heat Pipes</td> <td>\$ 569 K</td> <td>\$ 124K</td> <td>HEL JTO</td> </tr> </table>	Diode Pumped Alkali Lasers	\$3,235 K	\$1,889 K	HEL JTO MRI	High Energy Laser Center of Excellence	\$2,100 K	\$ 886K	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	<p>Collaborators:</p> <p>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).</p>	<p>Publications:</p> <table border="0" style="width: 100%;"> <tr> <td>Archival Publications:</td> <td>16</td> <td>Funding:</td> <td>\$3,511 K</td> </tr> <tr> <td>Proceedings:</td> <td>20</td> <td>PhD:</td> <td>8</td> </tr> <tr> <td>Presentations:</td> <td>15</td> <td>MS:</td> <td>9</td> </tr> <tr> <td></td> <td></td> <td>Interns:</td> <td>4</td> </tr> </table>	Archival Publications:	16	Funding:	\$3,511 K	Proceedings:	20	PhD:	8	Presentations:	15	MS:	9			Interns:	4
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Presentations:	15	MS:	9																																				
		Interns:	4																																				

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 Kee PhD 2008
 Lachlan Belcher PhD 2011
 Matthew Lange PhD 2011
 Lt Douglas Thornton MS 2010
 Lt Woody 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

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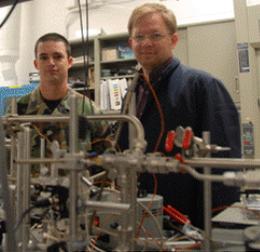
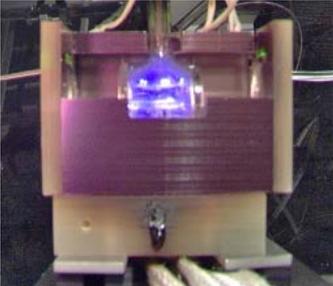
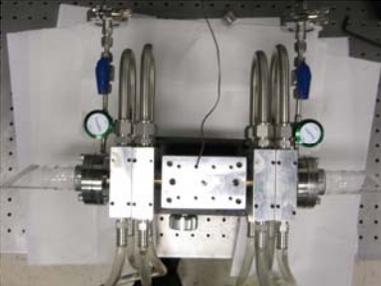


Gas Lasers



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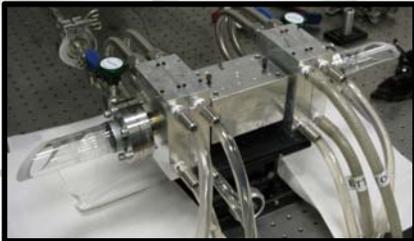


DPAL Intensity Scaling

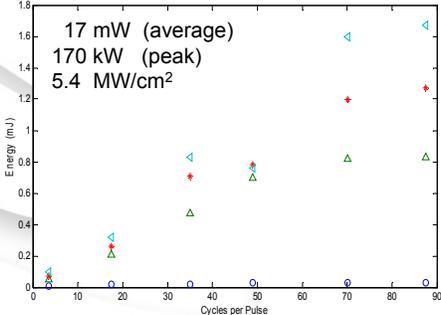


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- Scaled DPAL quasi-cw intensity to >30 times threshold with >50% efficiency
- Scaled DPAL pulsed intensity to > 5 MW/cm² with >10% efficiency
- Observed thermal effects on radial alkali concentrations
- Developed analytic model with broadband, radial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



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



Cycles per Pulse	Energy (mJ)
10	0.1
15	0.2
20	0.3
30	0.5
40	0.7
50	0.8
70	1.2
80	1.6
90	1.7

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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 Vap	PhD
Capt Michael Seal	PhD
Sean Baumann	MS
Michael Benson	MS
Lt Simon Ferrell	MS
Capt Shane McConnell	MSEE
Lt Jessica Schafer	MS
Capt Spencer Sellers	MSEE
Lt Col Walter Cole	PhD 2008
Lt Col Mark Hoetscher	PhD 2011
Capt Bradley Bailing	MSEE 2009
David Beeler	MS
John Callahan	MS 2008
Capt Benjamin Hurst	MS 2011
Capt Robert Lamott	MSEE 2009
Capt Kyle McAtee	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
DDD BRDF measurement system	\$100K		AFRL/RX
BRDF Measurement Research	\$446K		AFRL/RX
Optical/Thermal Meta-materials Research	\$284K		AFRL/RX
Infrared Counter-Countermeasure Research	\$133K		AFRL/RX

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

Publications:

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

Air University: The Intellectual and Leadership Center of the Air Force
Aim High...Fly - Fight - Win



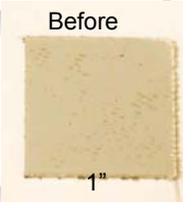
Laser Irradiated Fiberglass



The AFIT of Today is the Air Force of Tomorrow.

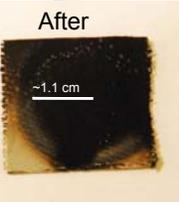
Painted Fiberglass

Before



1"

After



~1.1 cm

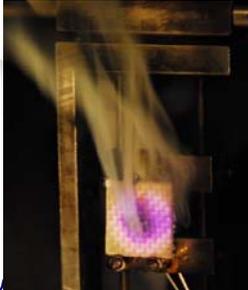
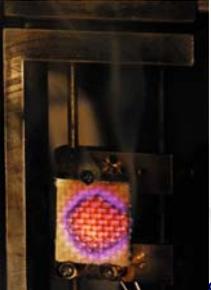
Unpainted Fiberglass

Before



After




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

<p>Students:</p> <p>Christopher Rice Capt Jake Harley Michael Rhoby Randy Bostick Lt Evan Carlson Capt Chad Su'e Aaron Blake</p>	<p>Grants:</p> <table border="0"> <tr> <td>PhD</td> <td>DPAL Atmospheric Transmission</td> <td>\$ 895K</td> <td>\$ 245 K</td> <td>HEL JTO</td> </tr> <tr> <td>PhD</td> <td>HSI for Radioactive Source Detection</td> <td>\$ 1,031K</td> <td>\$1,031 K</td> <td>DTRA</td> </tr> <tr> <td>PhD</td> <td>Monocular Passive Ranging</td> <td>217 K</td> <td>217 K</td> <td>NASIC</td> </tr> <tr> <td>MS</td> <td>Transient Combustion Event Detection</td> <td>296 K</td> <td>296 K</td> <td>NRO</td> </tr> <tr> <td>MS</td> <td>MASINT Ground Truth Data Collection</td> <td>1,059 K</td> <td>1,059 K</td> <td>NASIC</td> </tr> <tr> <td>BS</td> <td>IED Fireball Forensics</td> <td>147 K</td> <td>147 K</td> <td>JIEDDO</td> </tr> </table>	PhD	DPAL Atmospheric Transmission	\$ 895K	\$ 245 K	HEL JTO	PhD	HSI for Radioactive Source Detection	\$ 1,031K	\$1,031 K	DTRA	PhD	Monocular Passive Ranging	217 K	217 K	NASIC	MS	Transient Combustion Event Detection	296 K	296 K	NRO	MS	MASINT Ground Truth Data Collection	1,059 K	1,059 K	NASIC	BS	IED Fireball Forensics	147 K	147 K	JIEDDO	<p>Collaborators:</p> <p>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</p>
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<p>Bryan Stewart Lt Col Joe Gordon Capt Ken Bradley Major Joel Anderson Lt Jennifer Davis Capt Matthew Spidell Capt Tony Young Capt Steve Slagel Capt Spencer Bowen Capt Dan O'Dell Capt Doug MacDonald Capt Tony Vincent</p>	<p>Publications:</p> <table border="0"> <tr> <td>Archival Publications:</td> <td>6</td> <td>Funding:</td> <td>\$2,738 K</td> </tr> <tr> <td>Proceedings:</td> <td>27</td> <td>PhD:</td> <td>7</td> </tr> <tr> <td>Presentations:</td> <td>41</td> <td>MS:</td> <td>9</td> </tr> <tr> <td></td> <td></td> <td>Interns:</td> <td>1</td> </tr> </table>	Archival Publications:	6	Funding:	\$2,738 K	Proceedings:	27	PhD:	7	Presentations:	41	MS:	9			Interns:	1	<p>Air University: The Intellectual and Leadership Center of the Air Force <i>Aim High...Fly - Fight - Win</i></p>
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		Interns:	1															

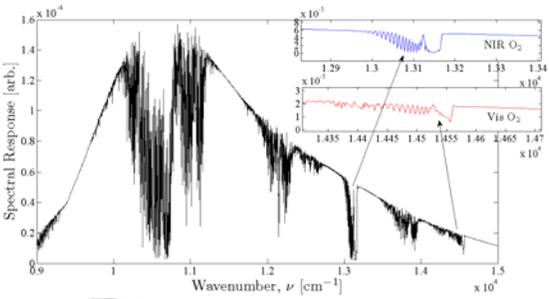


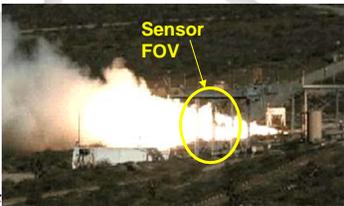
Monocular Passive Ranging



The AFIT of Today is the Air Force of Tomorrow.

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.




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