

**Col. Rob Fredell, US Air Force Academy chief scientist,
response to the *Daily Report on US News and World Report's*
2010 rankings of best colleges**

While our national rankings are indeed a source of pride, they are not the best measure of our success nor do they provide insight into needed areas of improvement.

National rankings are unable to capture our primary duty of preparing cadets with the knowledge, skills, and responsibilities to serve effectively as officers. The reason is simply that these rankings fail to measure the one thing that matters most—the quality of cadet learning.

Statistics such as standardized test scores, program size, or acceptance rates, no matter how impressive, do not capture what our cadets learn or what they are able to accomplish as graduates.

While these ratings are important public recognition, put simply, cadet learning is our ultimate focus, and therefore cadet learning is our most important metric of our success. Our priority continues to be measuring, assessing, and improving in a way that best develops leaders of character to serve our Air Force and our nation.

Every measure of external validation confirms the strength of our engineering programs.

In 2009, the Engineering Accreditation Commission and Computing Accreditation Commission of ABET [the Accreditation Board for Engineering and Technology] granted the maximum six-year accreditation to the 10 engineering and computer science programs, including the first-time accreditation for systems engineering, retroactive to the program's 2006 inauguration.

ABET noted no deficiencies or weaknesses in any of these programs and lauded our facilities, integrated real-world design programs, research-centered education, and strong faculty interaction with students.

ABET was particularly impressed with the emphasis on project and design-based learning, much of it accomplished through externally sponsored research.

USAFA ranks highest among undergraduate-only research programs, and 147th overall in the Fiscal 2008 National Science Foundation rankings, with \$44 million. This funding has grown rapidly as outside organizations continue to see a tremendous return on their investment. By comparison, the US Military Academy ranks 247th nationally (\$9 million), while Embry Riddle (both campuses combined) ranks 304th (\$5 million).

Recent research customers include:

- Air Force Research Laboratory/Air Mobility Command: KC-135R winglet study
- NASA Johnson Space Center: Assessment of Orion vehicle launch abort tower, forward bay cover (parachute protection) separation
- Natick Soldier Center (US Army): Parachute component drag study

- Air Force Research Laboratory: 'Revolver' unmanned aerial vehicle aerodynamic and stability investigations, fighter-sized target (drone) evaluation, Combat Aerodynamics Modular Prototype Unmanned Aircraft System (CAMPUS) development, Predator UAV fuels testing
- National Science Foundation: Ocean wave energy extraction
- Air Force Office of Scientific Research: Aerodynamic plasma actuator development and closed-loop flow control
- 436th Airlift Wing (Dover AFB, Del.): Flight line maintenance trailer wind-loading study
- Arnold Engineering Development Center: F-109 turbine engine inlet swirl investigation
- Office of the Secretary of Defense, Director, Operational Test and Evaluation (OSD/DOT&E): Fighter-sized aerial target (FSAT)
- Air Force Research Laboratory Air Vehicles Directorate: CAMPUS and OA-X CAS aircraft
- Aeronautical Systems Center Capability Integration Directorate (ASC/XR): MC-130 replacement, T-38 replacement, and OA-X CAS aircraft

Other examples of engineering cadets/faculty success:

- Our cadets participate in the American Institute of Aeronautics and Astronautics (AIAA) regional competitions each year, as do students from the Navy. USAFA cadets have won our region every year for the past decade and have gone on to win at the national/international competition in four of the previous 10 years—a record unmatched by any other school, including those with PhD programs.
- Our cadets also compete very well in regional competitions with IEEE [Institute of Electrical and Electronics Engineers] (robotics and circuit design) and the Association for Computing Machinery.
- Mechanical engineering cadets participate in multiple competitions, including the SAE [Society of Automotive Engineers] Formula 1 competition at the national level (approximately 80 schools), winning the award for the Best Technical review in 2008-2009; the ASME [American Society Of Mechanical Engineers] national Baja competition (approximately 50 schools); and the AFRL Service Commander's Challenge hosted by the AFRL/CC, designing the best special operations vehicle for the second year in a row.
- Civil engineering cadets participate in ASCE [American Society of Civil Engineers] and ASC regional competitions in concrete canoes (#2), bridge building (#6), and in design-build. In 2007-2008, our cadets won the ASCE regionals and represented the region at the national competitions. In 2008-2009 our cadets finished #2 at the ASCE regional competitions.
- The tremendous success of our graduates in graduate programs brings additional credibility to our undergraduate programs. They attend top graduate programs and finish with high GPAs and many outstanding thesis awards.
- Our sponsored faculty, about 50% of whom are graduates, also represent us well in M.S. and PhD programs. Their continued success secures our reputation with peer educators as they add

to the depth and breadth of our programs.

- FalconSAT-5 is a \$12 million spacecraft flying real DOD space experiments.
- FalconLAUNCH-8 is the first-ever undergraduate sounding rocket to fly a real DOD payload provided by AFIT [Air Force Institute of Technology]/AFRL. The Astronautics Department and Space Systems Research Center is currently consulting with West Point to help them to build a Space Systems minor—they are using our lesson plans and course notes. We will also be installing a FalconSAT-5 ground station for them . . . so they can start a 'hands-on' space operations program at West Point.
- The Air Force Space and Missile Systems Center in Los Angeles has funded two Master's slots annually for graduates of the FalconSAT capstone engineering program at MIT for the next five years. These new USAFA graduates will direct MIT's nascent small satellite design/build/fly program, and then work for SMC after their graduate studies are complete. This external validation is the highest form of praise.

USAFA's high rankings are due in large part to an unrivaled emphasis on learning-focused education:

- All aeronautics majors participate in original research, most funded by Air Force, other DOD, NASA and commercial partners, the only undergraduate program that requires rigorous research of all graduates.
- All aeronautics majors engage in aircraft/turbine engine design projects.
- All astronautics majors engage in either FalconSAT or FalconLAUNCH programs. These programs are unmatched by any other undergraduate program, including the undergraduate rocket launch altitude record of over 350,000 feet and operating a cadet-built sensor satellite on station.
- Engineering capstone experiences rival those of many graduate programs.

Comparison to West Point/Annapolis and impact on the US Air Force Academy engineering programs:

As said earlier, cadet learning is our most important metric of our success. We believe our project and design-based learning approach that engages cadets in real Air Force problems produces the best engineering education.

While we are pleased to be included in the top tier undergraduate rankings of *USN&WR*, we do not typically base either our pedagogy or curriculum on those numbers. Rather we focus on the knowledge of the needs of our constituency and current state-of-the-art engineering education pedagogy. We use sound practices as evidenced by our success in ABET accreditation to gather feedback from our graduates and their supervisors two to five years following graduation.

In addition we conduct a bi-annual Engineering Program Advisory Committee conference where we receive guidance from the major Air Force agencies as to our program operational goals.