Educational Programs: Investment with a Large Return

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David L. Voss, PhD
UNP Program Manager
Air Force Research Laboratory
The Need for STEM Investment

• STEM: Science Technology Engineering and Math

  – Not including students who get a GED

  – Algebra I: 62.8%
  – Calculus: 13.6%
  – Physics: 32.7%

• 40% of students planning to be an engineer or science major in college end up switching or fail to get a degree
The Aerospace Dilemma

- 26-27% of aerospace workers were eligible to retire in 2008
- The average age of the production worker is 44 in the commercial sector, 53 in defense, and 51 at NASA
- The proportion of workers under 30 dropped from 18% in 1987 to 8% in 1999
- In a study of 500 aerospace workers, 80% said they would not recommend the aerospace field
- Nearly all space jobs require the worker to be a US citizen

(Commission on the Future of the United States Aerospace Industry, 2002)
Documented STEM Needs

• **U.S. Space Policy (NSPD 49):** “… implement activities to develop and maintain highly skilled, experienced, and motivated space professionals within their workforce.”

• **Rising above the Gathering Storm, Revisited (2010):** “In 2000 the number of foreign students studying the physical sciences and engineering in United States graduate schools for the first time surpassed the number of United States students.”

• **Preparing the next generation of STEM Innovators (NSF, 2010):** “The identification and development of our Nation’s human capital are vital to creating new jobs, improving our quality of life, and maintaining our position as a global leader in S&T.”
Current Gov-Sponsored Satellite STEM Programs

- Three complementary programs
- Significant impact to the space community
- All three programs focus on heavily involving students
- Together the programs have involved many thousands of undergraduate and graduate students

UNP: Focused on the design process of satellites
ELaNa: Focused on the launching of satellites
NSF CubeSat Program: Focused on the science return of the satellite
Growth of UNP Flight Opportunities

NS-1/2: 3-CornerSat
Launched: Delta-4

NS-3: FASTRAC
Launched: STP-S26

NS-4: CUSat

NS-5: DANDE

NS-6: Ho’oponopono
Launch: ELaNa

NS-6: Copper

NS-6: Violet
Launch: TBD

NS-6: Oculus-ASR
Launch: TBD

NS-7: Armadillo

NS-7: CADRE

NS-7: ARGUS


2003 NS-3
UT Austin - W
Washington U - St. Louis
Michigan Tech
Arizona State
Montana State - Bozeman
Penn State
Taylor University
U Colorado, Boulder
U Hawaii at Manoa
U Michigan
Worcester Polytechnic
New Mexico State
Utah State

2005 NS-4
U Cincinnati
U Minnesota
U Central Florida
Santa Clara U
Cornell University - W
U Missouri - Rolla
Texas A&M
New Mexico State
Washington U - St. Louis
Utah State
UT Austin

2007 NS-5
Boston U
U Colorado at Boulder - W
Montana State U
Michigan Tech
Minnesota U
Penn State U
Washington U in St. Louis
UT at Austin
Texas A&M U
Santa Clara U
Utah State U

2009 NS-6
Georgia Tech
University of Hawaii
MIT
Montana State University
Missouri S&T
Michigan Tech - W
Santa Clare University
University of Central Florida
University Minnesota
Cornell University
Washington University (St. Louis)

2011 NS-7
Georgia Tech
MIT
Montana State University
Missouri S&T
St Louis University
Boston University
University of Michigan
University of Texas
University of Buffalo
University of Maryland
UNP Lessons Learned

• **Lesson 1: STEM programs necessitate real engineering experiences**
  – Understand system well enough to incorporate constraints and make high-level trades
  – Need stakeholders, not just “mentors”

• **Lesson 2: Student turnover rate increases schedule challenge & impacts tech mission**
  – Descope early
  – Milestone based delivery schedule
  – Understand the impact of the launch rush

• **Lesson 3: Satellite volume based on mission requirements & program capability**
  – UNP accepts 1U CubeSats through 50 kg microsats
Return on Investment

• STEM students are a pool to hire from
  – Have learned many of the hard lessons by doing it themselves
  – Reduces the candidate pool to motivated, experienced graduates

• Potential for high payoff, high risk missions
  – Can tackle current and on horizon problems in the 5-year timeframe
  – Can tackle specific aspects of complex challenges (Technology Horizons)

• Out-of-the-box student mindset complements & contrasts prevailing culture

• Help address the national STEM crisis
Ways to get involved

• If you are a company, lab, agency
  – Become a stakeholder in a mission
  – Donate hardware to schools
  – Help fund a program ($10k goes a long way with student programs)
  – Drop by the University booths and talk to the students to see what their needs are

• If you are a university
  – UNP BAA is out on grants.gov for NS-8 (If you’re interested in submitting a proposal come talk to us)
  – NSF BAA
  – ELaNa
  – Seek out support from the community
“Leaders and role models in every walk of life should take on the responsibility to inspire and encourage young people to excel in education – and particularly in science and math. Every STEM-capable adult should mentor young people, and community leaders should communicate to the public the importance of STEM education and workforce preparation for our national well-being, as well as personal success.”

Aerospace Industries Association (June 20, 2012)