National Aeronautics and Space Administration

Educating the Engineer of 2020:

Visions of Engineering in the New Century

2010 Fall South East Space Grant Regional Meeting

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Educating the Engineer of 2020

Outline

- NASA Langley at a glance
- NASA Langley's core competencies
- STEM pipeline including limitations
- The future of engineering
- The engineer of 2020
- Student Externships – NASA LARSS
- Faculty Externships – EPSCoR/NASA Langley summer faculty fellowship program
- Concluding remarks

NASA Langley at a Glance (2009)

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Founded in 1917
1st civil aeronautical research lab

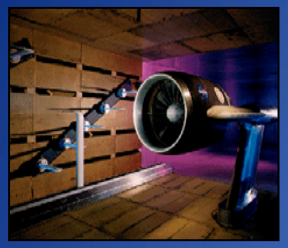
~$800M Budget (incl Recovery Funding)
~$750M NASA Langley budget
~$50M External business

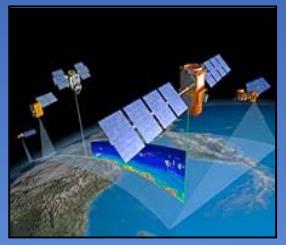
~3,700 Workforce
~1,900 Civil Servants
~1,800 Contractors (on/near-site)
(~250 students)

Infrastructure/Facilities
788 acres, 205 Buildings
$3.3B replacement value

Langley's Economic Impact (2008)
National economic output of ~ $2.2B and generates over 18,200 high-tech jobs
Virginia economic output of ~ $1.1B and generates over 9,600 high-tech jobs

Aeronautics	Exploration	Science	Space Operations	Education
49%	24%	23%	2%	2%





Cross-Agency Support

- Center Management & Operations
- Construction of Facilities/Environmental Compliance
- Agency Management & Operations

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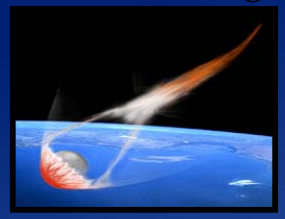
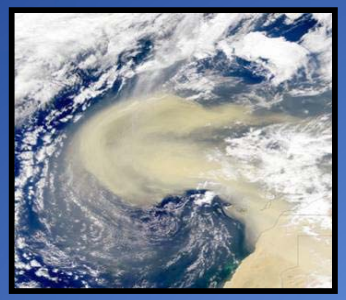
NASA Langley Core Competencies

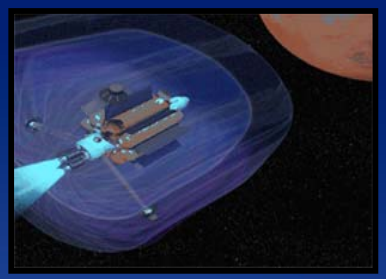
Aerosciences
Research for Flight in All Atmospheres
(Includes Entry, Descent & Landing)

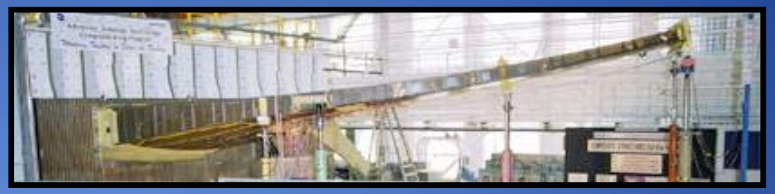



Characterization of all Atmospheres
(Agency = Lasers & LIDAR)

Aerospace Systems Analysis





Aerospace Structural and Material Concepts

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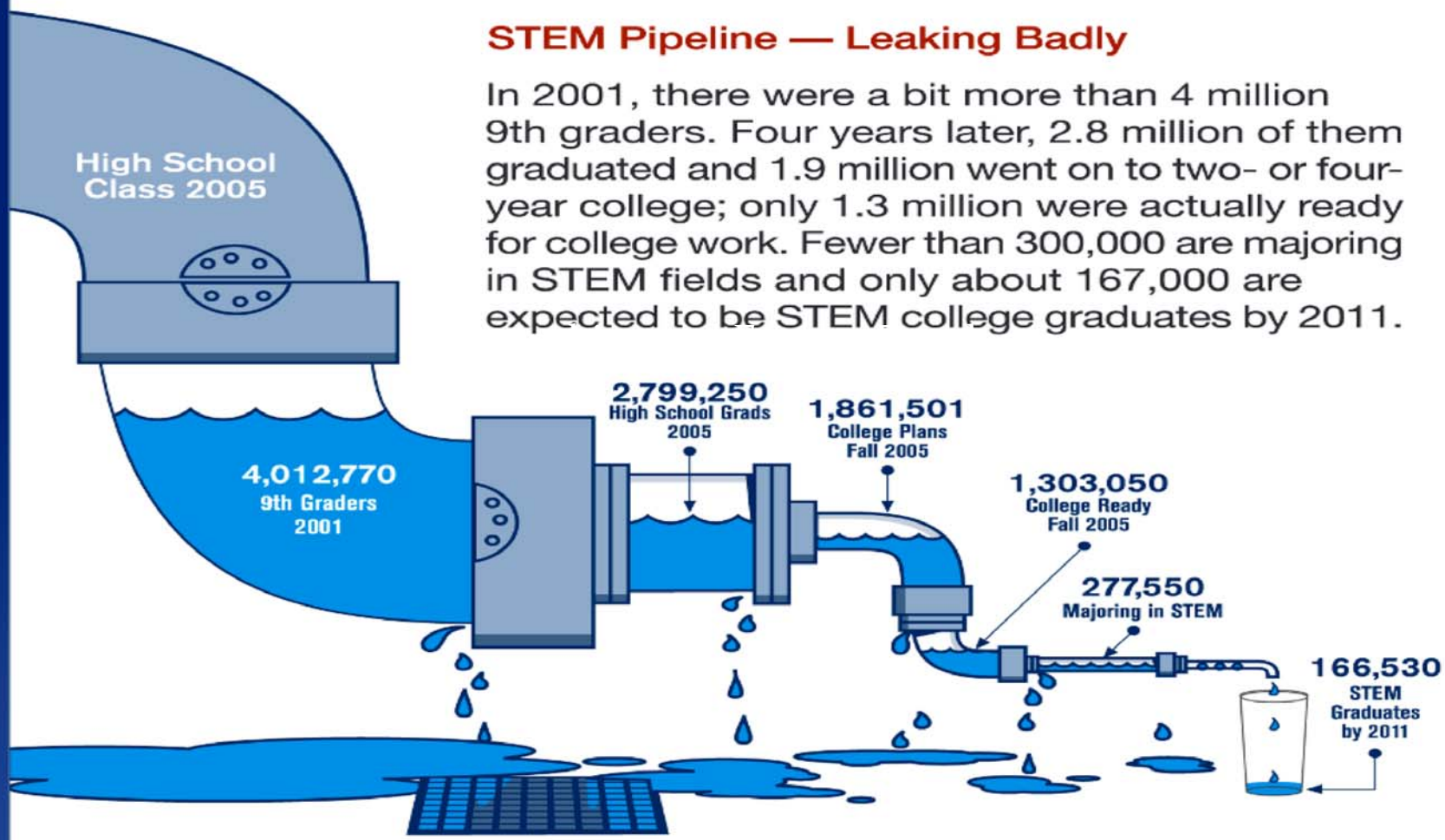
STEM Pipeline — Leaking Badly

In 2001, there were a bit more than 4 million 9th graders. Four years later, 2.8 million of them graduated and 1.9 million went on to two- or four-year college; only 1.3 million were actually ready for college work. Fewer than 300,000 are majoring in STEM fields and only about 167,000 are expected to be STEM college graduates by 2011.



Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008

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Limitations of the Pipeline Model

- Used since the late 1970's
- Represents a process that is not linear
- Emphasizes supply
- Not tied to demand
- Does not account for varied career paths, exits, and re-entry
- Does not account for the role informal education and the community college plays in the STEM pipeline

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Limitations of the Pipeline Model cont.

- Need to transition to a dynamic, interactive (systems-based) model – See Raytheon and Business Higher-Education Forum – because educators and policymakers
- Need to understand and respond to the overall system
- Need to see how effects, impacts, and changes in one part of the system flow through and
- Need to see the entire system and understand how changes propagate over time

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What should be done to educate the engineer of 2020?

- We know that engineering
  - Is becoming more collaborative, more interdisciplinary
  - Is placing greater emphasis on systems thinking and research
  - Graduates must be technically excellent and "work ready" and committed to "life-long learning

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What should be done to educate the engineer of 2020? Recommendations of the NAE Study – *Visions of Engineering in the New Century*

- The B.S. degree should become a "pre-engineering" degree?
- Four-year colleges and community colleges must achieve "workable" articulation
- Both groups must work together to put a "public face" on engineering and improve technological literacy

Educating the Engineer of 2020

What should be done to educate the engineer of 2020? Recommendations of the NAE Study – *Visions of Engineering in the New Century*

- Make engineering students more "work ready"
- How accomplished? Close the gap Increased student participation in externships and cooperative education

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Langley Aerospace Research Summer Scholars (LARSS) Program

- Provides research opportunities for undergraduate and graduate students to conduct NASA project- and mission-related research
- Students work under the supervision/direction of a NASA technical monitor
- Summer program 10 weeks long
- Students receive a stipend

Langley Aerospace Research Summer Scholars (LARSS) Program

- Eligibility – Applicants must
  - Be U.S. citizen (sophomore) attending an accredited U.S. college or university
  - Be pursuing a bachelor's or master's degree in a STEM-(science, technology, engineering, and mathematics) related field
  - Have a 3.0 GPA or greater
- Deadline for application, February 1, 2011
- POC Debbie Murray 757.864.5215
Email: Deborah.B.Murray@nasa.gov
- URL: www.nianet.org/larss

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What should be done to educate the engineer of 2020? Recommendations of the NAE Study – *Visions of Engineering in the New Century*

- Increase the connect between "theory and practice" (i.e., how engineering is taught and how it is practiced)
- How accomplished? Close the gap
- Increased faculty participation in government- and industry-based research experiences

Proposed EPSCoR/Langley Summer Faculty Fellowship Program

Goals

- Develop professional relationships with NASA Langley engineers and scientists
- Build research capacity in community colleges, colleges/universities
- Enable faculty to perform high-quality research
- Expand student internship and employment opportunities
- Increase the effectiveness and relevance of courses and curriculum by relating classroom study to the "world of work"

Proposed EPSCoR/NASA Langley Summer Faculty Fellowship Program

- Eligibility –Participants must
  - Be a citizen or legal permanent resident of the United States
  - Hold a full-time appointment at an accredited community college, college/university
  - "Be in residence" at NASA Langley for 8 weeks in the summer

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- Concluding Remarks
  - "Engineering education must be aligned to promote attainment of the characteristics desired in practicing engineers, and this must be done in the context of engineering practice and engineering education."

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- Concluding Remarks – Desired Characteristics – The ability to
  - Adaptability – cope with uncertain, new, and challenging assignments
  - Communications – effectively process and interpret both verbal and non-verbal information and instructions
  - Non-routine problem-solving – examine and interpret a broad spectrum of verbal and non-verbal information and develop solutions
  - Self-management, self-development – work autonomously and in groups; to be a leader and to be led; to be self-motivating
  - Systems thinking – understand how an entire system works; how an action, change, or malfunction in one part of a system affects the rest of the system