



American Aerospace Leadership Depends on Quantitative Literacy

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America: Aerospace R & D Leader

- A Nation of Immigrants
- Free people and free markets
- Meritocracy
- Social and Economic Mobility
- Universal Public Education
 - Quantitative Literacy
- Inclusive higher education
 - Land Grant universities
 - Harvard, MIT, Cal Tech, Stanford, CWRU, OSU, ...
- Rewards for innovation, invention
 - Wright Brothers, Edison, Firestone, Fraze...
 - Intellectual Property Protection
- Research Institutions
 - Bell Labs, APL, JPL, Lincoln Lab, Draper, Sandia, Livermore, Los Alamos, NRL, NASA Glenn, AFRL...
- But our lead is eroding... STEM education...



Worrisome Indicators

- In 1999, 69% of US 5-8th-grade students received instruction from a mathematics teacher who did not hold a degree or certification in mathematics.
- 2003 study: Fewer than one-third of US 8th-grade students performed at or above a “proficient” level in mathematics; “proficiency” was considered the ability to exhibit competence with challenging subject matter.
- About one-fifth of the 4th graders and one-third of the 8th graders lacked the competence to perform basic mathematical computations.
- US 15-year-olds ranked 27th out of 39 countries that participated in a 2003 administration of the Program for International Student Assessment (PISA) examination, which assessed students’ ability to apply mathematical concepts to real-world problems.
- The proportion of bachelor's degrees in physics to total degrees awarded was twice as high the year before Sputnik, deemed a time of dangerous educational neglect, as in 2004
- In 2001, US industry spent more on tort litigation than on research

Note: As reported in **Rise Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future**, The National Academies Press, 2005



Ohio

The Aerospace State

Home to

- Wright-Patterson Air Force Base
- Air Force Research Laboratory
- NASA Glenn Research Center
- National Aviation Hall of Fame
- National Museum of the United States Air Force
- International Women's Air & Space Museum
- National Aviation Heritage Area
- National Composites Center

Education

- Ten leading universities with doctoral and research programs in aerospace
- Nation's 1st graduate program in Astronautical Engineering (AFIT)
- Nation's 2nd Aeronautical Engineering Department
 - University of Cincinnati





Ohio

The Aerospace State

Unsurpassed heritage

- Wright Brothers, “Hap” Arnold, Eddie Rickenbacker, Jimmy Doolittle, Bennie Schriever, Hans Von Ohain, John Glenn, Neil Armstrong, Judith Resnick, Guy Bluford...
- Birthplace of the powered airplane, high bypass turbofan engines, ion thrusters, hydrogen rockets...
- Huffman Prairie, Wright Field, Lewis Field, Cleveland Air Races...
- The nation’s second top astronaut producing state... 24 Ohio Astronauts
 - STS-70 had an “All Ohio” Crew
- Cleveland produces more astronauts than any other U.S. metropolitan area





Ohio

The Aerospace State

Did You Know...

- The world's oldest operational wind tunnel is in Ohio, and is still in use (Five foot tunnel at WPAFB, completed in 1922, used by the Wright Brothers)
- The aircraft lighting industry started in Ohio (Grimes Lighting, Urbana)
- Ohio will be home to the world's largest flight simulator training facility (FlightSafety, Columbus)
- Two worldwide leaders in private aviation are based in Ohio:
 - NetJets, in Columbus, invented fractional jet ownership and has the world's largest private jet fleet
 - FlightOptions, in Cleveland, is the second ranked provider of fractional jet ownership in the USA
- The world's leading manufacturer of propeller systems is in Ohio (Hartzell Propeller, Piqua)
- Aerospace is growing rapidly
 - Record sales of \$199B in 2007, projected \$210B in 2008
 - US Aerospace employment is growing (652K in Mar 2008)
 - Airlines will need over 28,600 airplanes valued at \$2.8 Trillion between now and 2026
 - Ohio is Boeing's second largest supplier (\$4B in annual sales)





Ohio

The Aerospace State

Did You Know...

- The Aerospace industry is our nation's largest positive contributor to the balance of trade, with \$92B in exports in 2007
- The world's largest commercial jet engine company is in Ohio (GE Aviation, Evendale)
 - GE purchased more than \$650M in goods and services from 625 Ohio companies in 2007
- Ohio invented and developed the engine that powers all modern jet airliners (high bypass turbofan)
- NASA Glenn developed the upper stage rocket that put men on the Moon (Centaur)
- Ohio is a leader in reducing aviation carbon emissions through ultra-efficient jets
- Ohio leads the world in research for advanced jets





Final Thoughts

- Aerospace is an exciting growth industry.
- Ohio is an aerospace leader.
- Aerospace can lead Ohio's economic recovery.
- Aerospace is a high tech, highly quantitative and analytic enterprise.
- Ohio's aerospace enterprise will require educated, quantitatively literate employees.
- Education is the key... We must appeal to the sense of wonder and capture our youth's interest at an early age.