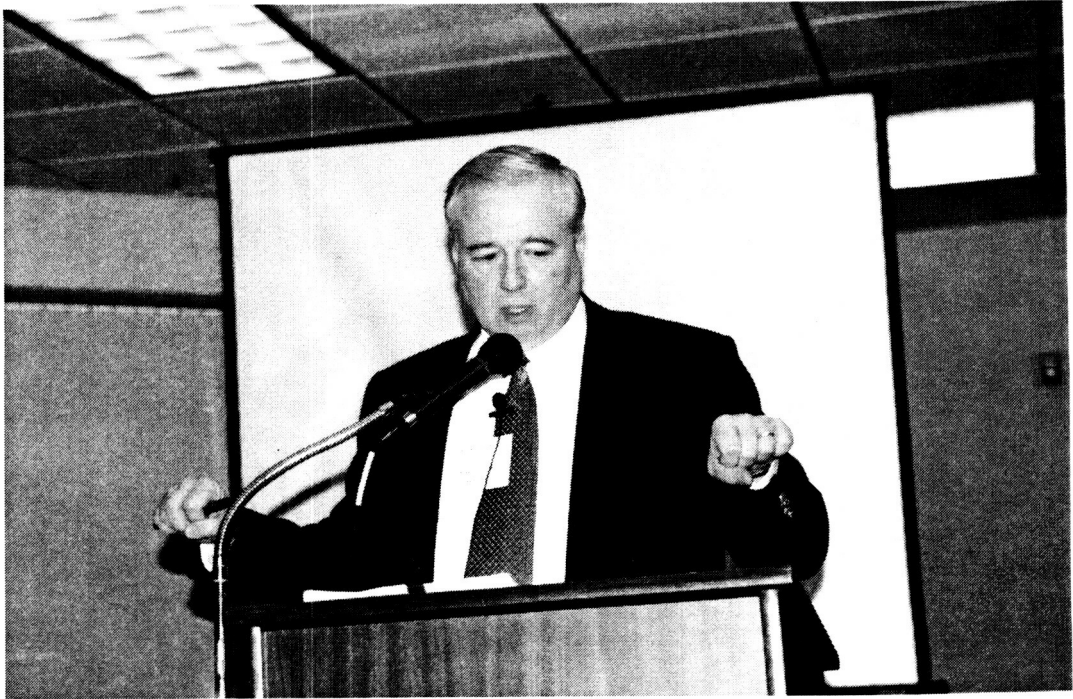


PREVIEW OF NEW:UPDATE WORKSHOP 2003

Edwin J. Prior

Office of Education
NASA Langley Research Center
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Hampton, Virginia 23681-0001

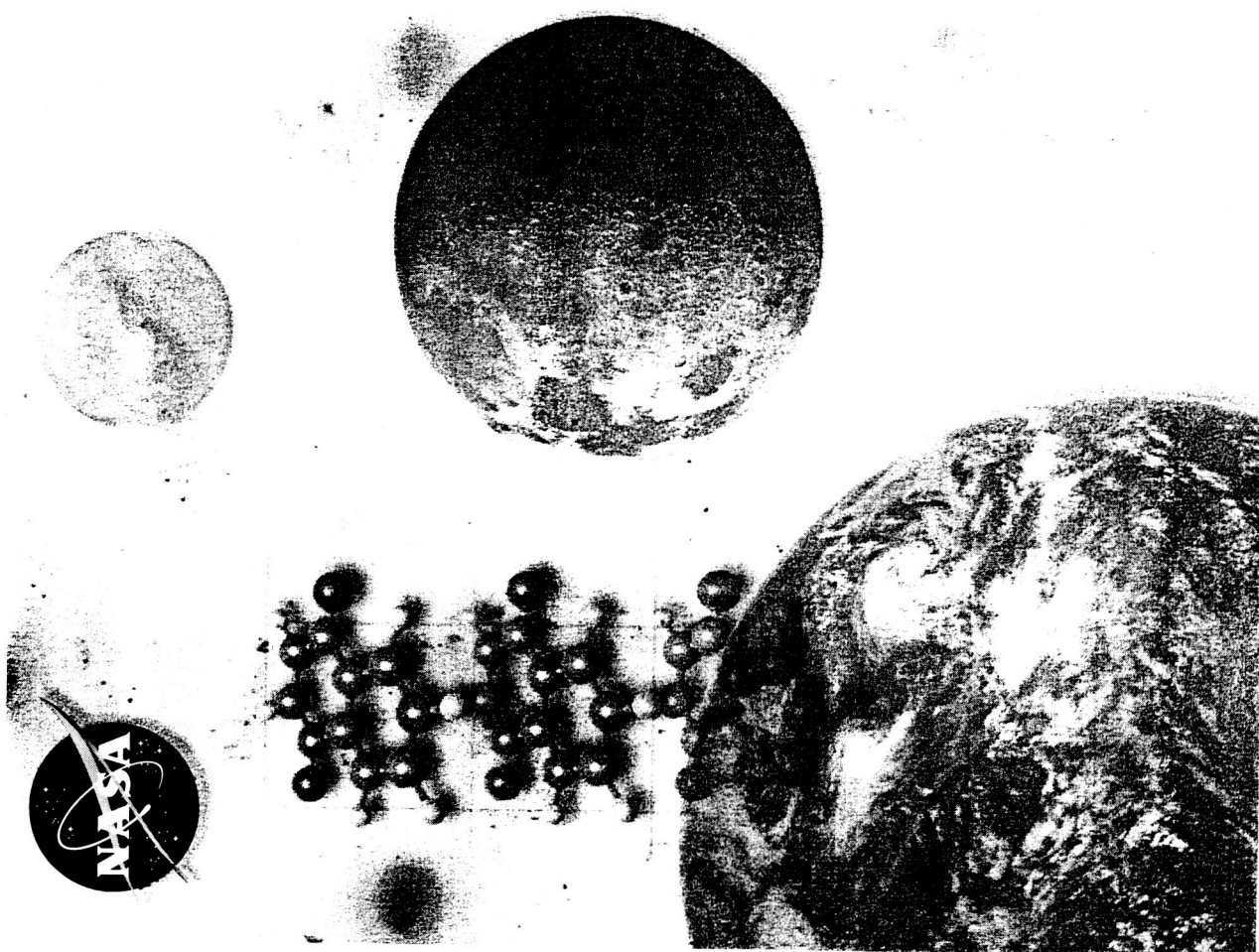
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Edwin J. Prior

NASA Vision

April 2002





The World has Changed

- The Nation faces extraordinary challenges; the Agency has tremendous opportunities
- International terrorism has crossed our borders
- Global climate change may threaten our way of life
- Shortages in U.S. scientists and engineers threaten our economy
- Rapid advances in technology is profoundly affecting business conduct and survival
- Life is pervasive; we believe it must exist beyond our planet

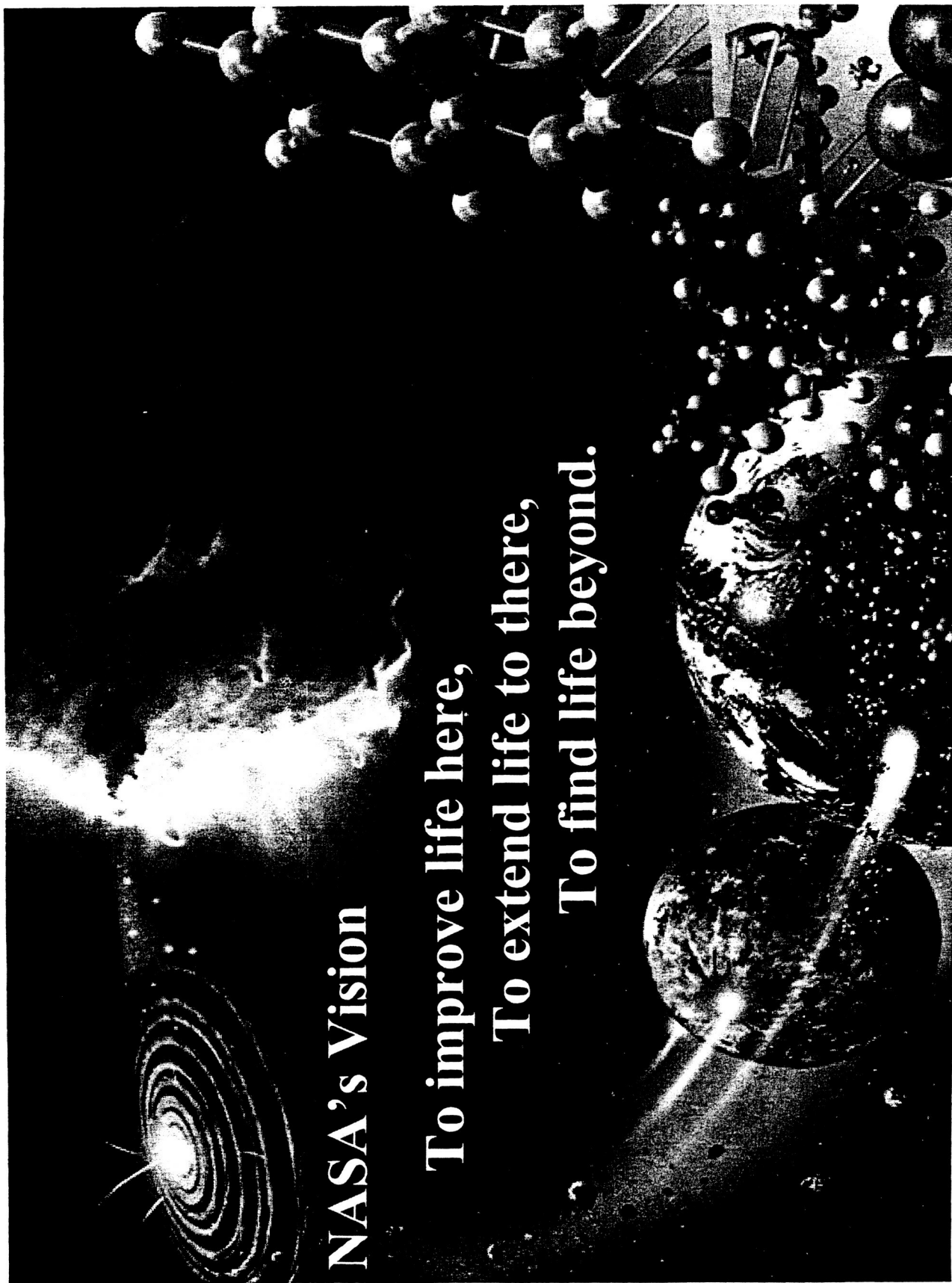
To continue to serve the Nation well, NASA must change.



When the History of the First Quarter of the 21st Century is Written...

- **We have sought life's abodes:** NASA missions have mapped continents on dozens of planets circling nearby stars, some of which show signs of life-supporting atmospheres. Evidence continues to mount for the existence of life on planets within our own Solar System, as revealed by advanced generations of robotic explorers. Humans and their robotic partners assembled complex science facilities in space to unveil even more challenging cosmic questions.
- **We understand our home:** NASA's missions revealed the complex interactions among the Earth's major systems, vastly improving weather, climate, earthquake, and volcanic eruption forecasting – and the impact that our Sun has on our living world.
- **We have connected the world's citizens:** NASA's technologies have resulted in dramatic improvements in air transportation via "green" aircraft, higher-speed international travel, and innovative capabilities to reduce aircraft accidents and delays.
- **We have enabled new commerce:** Low Earth Orbit has become a rapid-growth economic zone, with commercial industries taking advantage of low-gravity, abundant solar energy, low-cost access from the Earth's surface, and a vista that encompasses the entire planet.
- **We share the vision and the experience:** Throughout the world, students in earthbound classrooms are learning the fundamentals of physics, math, and technology as they actively participate with space travelers via "telepresence technology."

And we continue to prepare the way for humanity's greatest adventures.



NASA's Vision

To improve life here,
To extend life to there,
To find life beyond.



The NASA Mission

To understand and protect our home planet

To explore the Universe and search for life

To inspire the next generation of explorers

...as only NASA can.



To Understand and Protect Our Home Planet

- Understanding the Earth's system and its response to natural and human-induced changes
- Enabling a safe, secure, efficient, and environmentally friendly air transportation system
- Investing in technologies and collaborating with others to improve the quality of life and to create a more secure world



To Explore the Universe and Search for Life

- Exploring the Universe and the life within it... enabled by technology, first with robotic trailblazers, and eventually humans... as driven by these compelling scientific questions:
 - How did we get here?
 - Where are we going?
 - Are we alone?



To Inspire the Next Generation of Explorers

- Motivating students to pursue careers in science, math, and engineering
- Providing educators with unique teaching tools and compelling teaching experiences
- Improving our Nation's scientific literacy
- Engaging the public in shaping and sharing the experience of exploration and discovery



Implications for NASA: What is Different?

To Understand and Protect our Home Planet

- Greater emphasis on providing policy-makers and others with timely information, technology, and useful tools that address priority issues of international importance
- A new spirit of cooperation with the national security community
- Greater emphasis on transferring technologies to others

To Explore the Universe and Search for Life

- Decisions are science-driven; not destination-driven
- Human presence beyond low Earth orbit will be enabled – as a means to scientific exploration, not an end in itself
- Investments are justified by their contribution to the long-range vision

To Inspire the Next Generation of Explorers

- Education is part of our core mission
- Education becomes an integral part of our programs
- More citizens and students will participate in our programs

As Only NASA Can

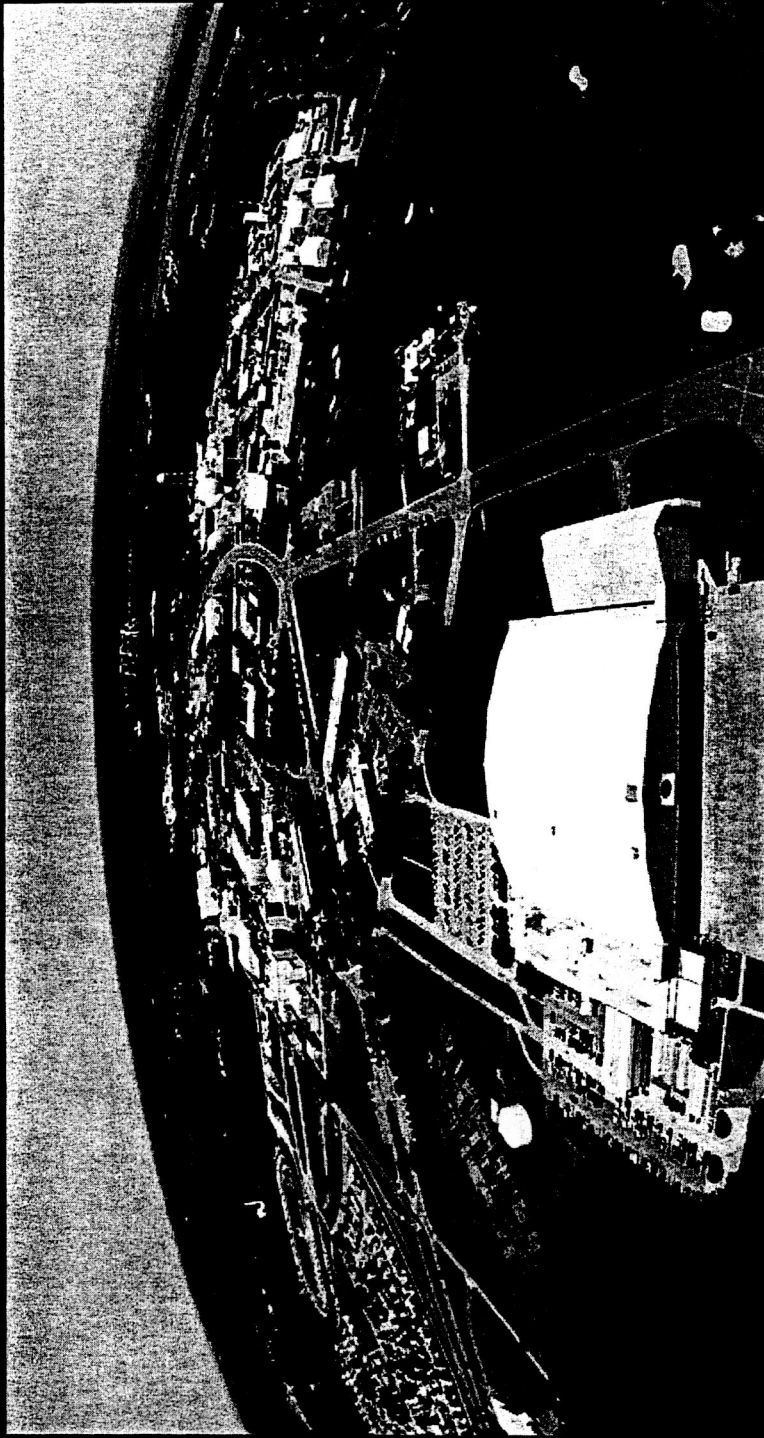
- We will pursue activities unique to our mission in air and space: if NASA did not do them, they would not get done
- Activities will be integrated across the Agency
- Programmatic and budget decisions will be aligned with our mission statement
- We will carry out our mission as a diverse, unified team
- We will use new technologies to move our physical infrastructure beyond brick and mortar, and to leverage the Nation's industrial and intellectual capital



What Does America Gain from NASA?

- A new generation of leaders and explorers ready to expand the frontiers of air and space
- Pioneering technological and scientific research that enables new industries
- A Nation reaching across borders to unite people
- A deeper understanding of life, ourselves, and the universe

NASA Langley Research Center



Founded in 1917

- First civil aeronautical research laboratory

Facilities

- \$4 billion replacement value

Programs

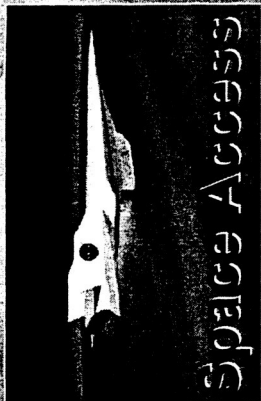
- \$689M total FY 01 budget

People

- 2374 Civil Servants
- 1420 Contractors



Planetary Entry



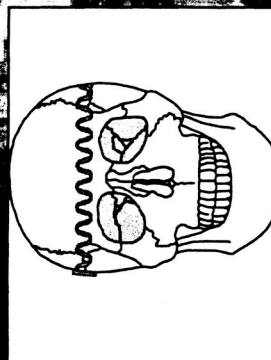
Space Access



Military



Aviation



Non-aerospace
Commercialization



Atmospheric Science

NASA

Langley Roles

LaRC's Contributions to Improve Quality of Life

- Improving the air transportation system - a critical element of the country's infrastructure
- Assuring the pre-eminence of U.S. military aircraft
- Reducing the cost of access to space
- Understanding the composition and evolution of the Earth's atmosphere as an aid to policymakers
- Providing atmospheric flight technologies for planetary exploration missions to extend the space frontier
- Developing innovative technologies for revolutionary aerospace systems
- Providing the benefits of aerospace technology breakthroughs to non-aerospace organizations

NASA Langley Major Aerodynamic Test Facilities Complex

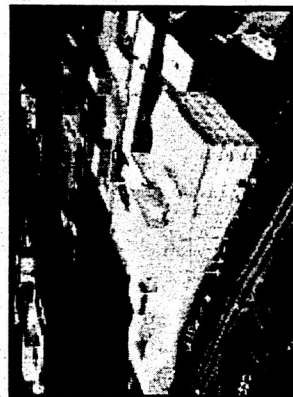
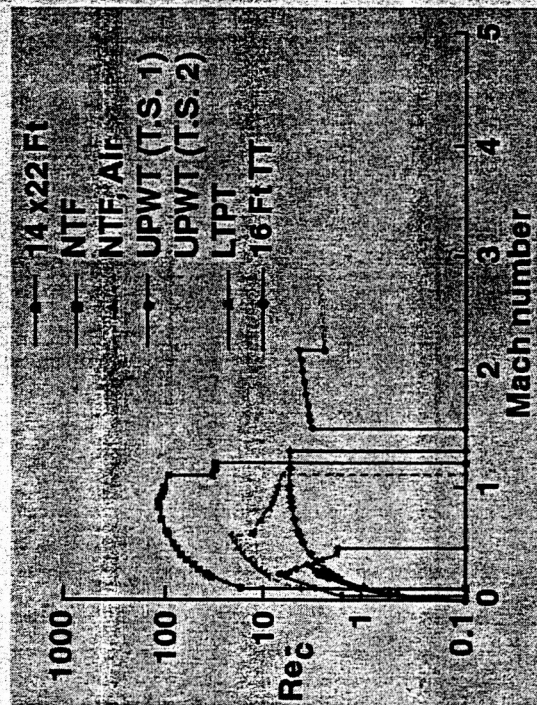
Aero- and Gas-Dynamics Division
Langley Research Center



National Transonic Facility



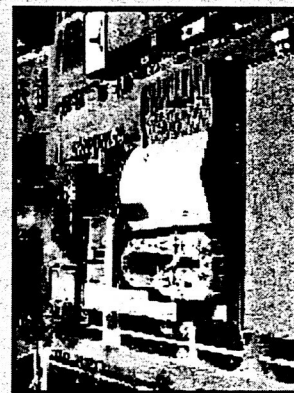
16-Foot Transonic Tunnel



14-by 22-Foot Subsonic Tunnel



Unitary Plan Wind Tunnel



Low Turbulence Pressure Tunnel

NASA Langley Aerothermodynamic Facilities Complex (AFC)

Aero- and Gas-Dynamics Division Langley Research Center

15-Inch Mach 6
Hi Temp. Air



- 2/3 of Nation's conventional - type (as opposed to impulse) hypersonic wind tunnels

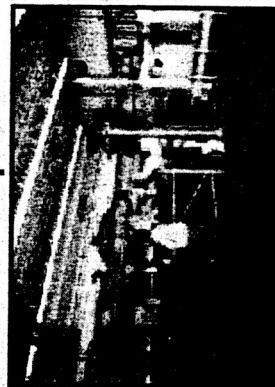
- Unique heavy and light gas test capability
- Provides wide envelope of flight simulation parameters

- Mach number (6 to 20)

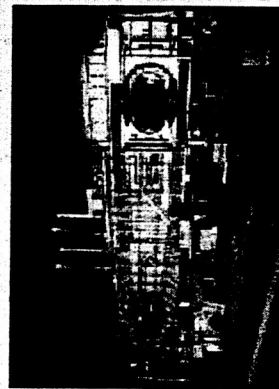
- Reynolds number (0.05 to 20 million per foot)

- Density Ratio (5 to 12); specific heat ratio (1.1 to 1.7)

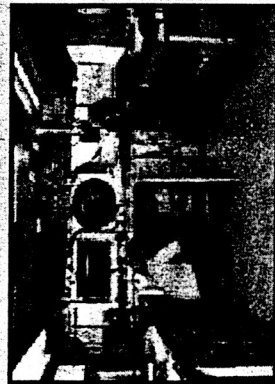
20-Inch Mach 6
CF4



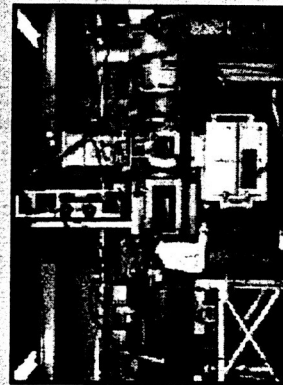
31-Inch Mach 10
Air



20-Inch Mach 6
Air



22-Inch Mach 15/20
Helium



Plus complementary Langley subsonic to supersonic facilities

NASA Langley Scramjet Test Complex

Aero- and Gas-Dynamics Division
Langley Research Center

Combustion Heated STF
 $M_\infty = 3.5 - 6$, T_t , max = 1700K



**Direct-Connect Supersonic
Combustion Test Facility**
 $M_\infty = 4 - 7.5$, T_t , max = 2100K

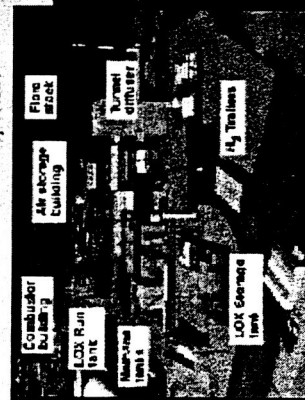


- Flight Mach simulation from 3.5 - 8 (near orbital w/HYPULSE upgrade)
- Engine test facilities (STF):
 - Active since mid 70's
 - >3200 tests of 18 scramjet designs
- Engine flowpath and components tests, inlets, nozzles, fuel injection, mixing and combustion
- Established and confirmed design, and analysis methods

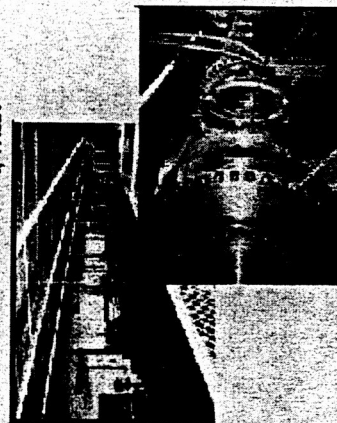
Arc Heated STF
 $M_\infty = 4.7 - 8$, T_t , max = 2850K



8 -Ft High Temperature Tunnel
 $M_\infty = 4 - 7$, T_t , max = 2000K



Hypersonic Pulse Facility
 $M_\infty = 12 - 19$ (SET), T_t , max = 9000K
 $M_\infty = 7 - 10$ (RST), T_t , max = 4200K



Structures & Materials Capabilities

From Materials Synthesis to Large Structures Testing

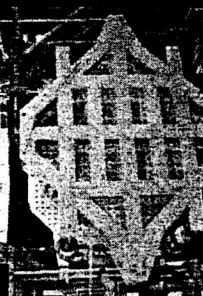
Polymer
Synthesis



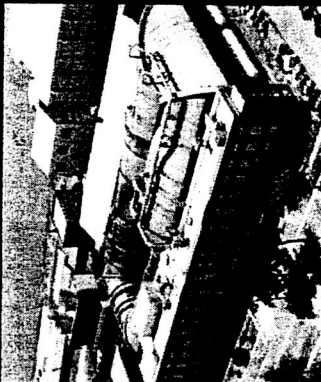
Materials
Characterization



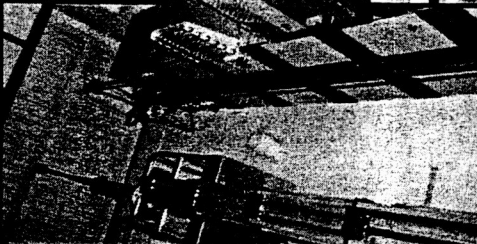
Structural Concepts Tests



Optical Fiber Draw Tower



Transonic
Dynamics
Tunnel

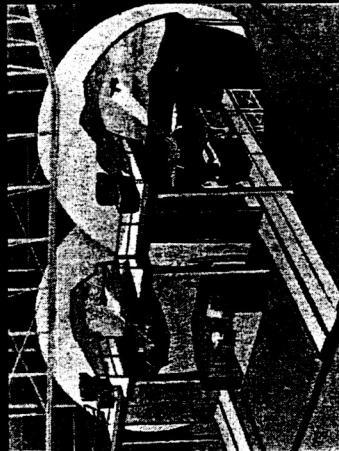
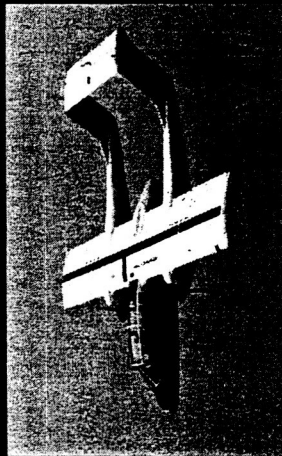
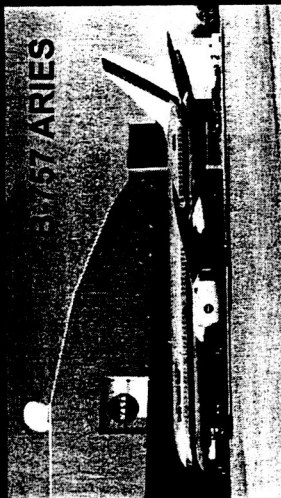


Landing
Dynamics Test

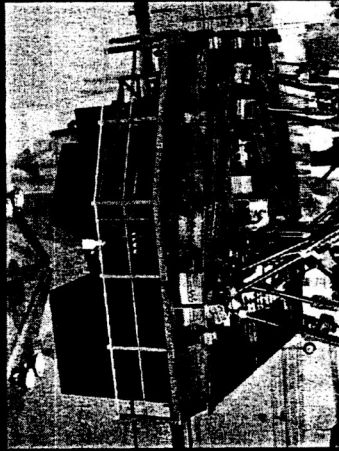


SAF Facilities

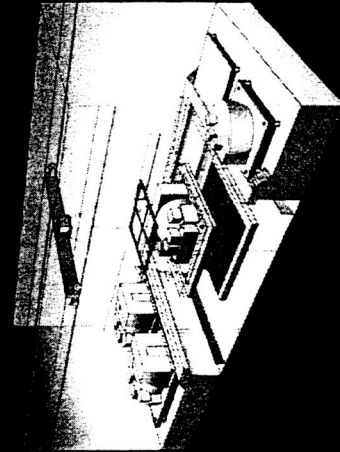
Research Aircraft and Research Simulators



Differential Motion Simulator
(DMS)

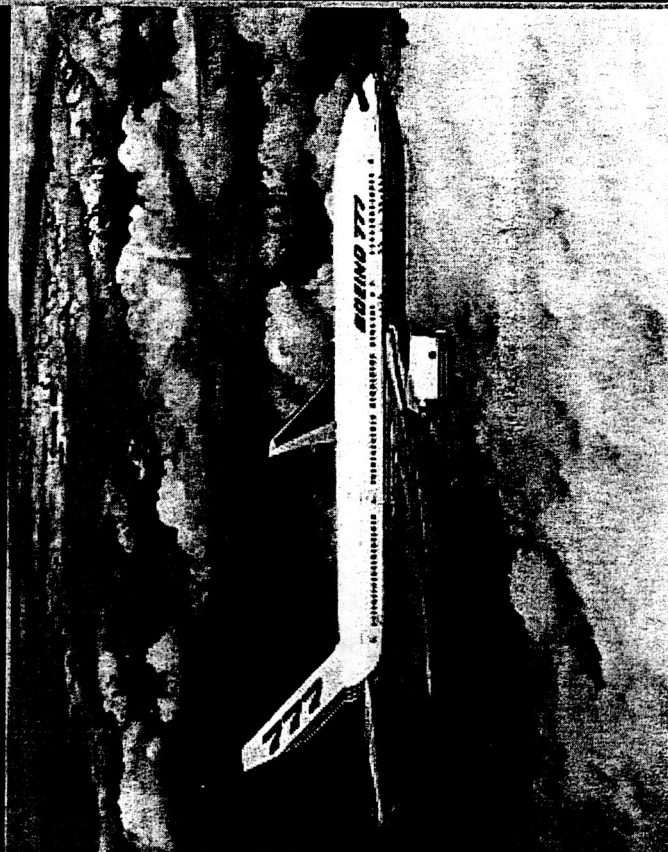


Visual Motion Simulator
(VMS)



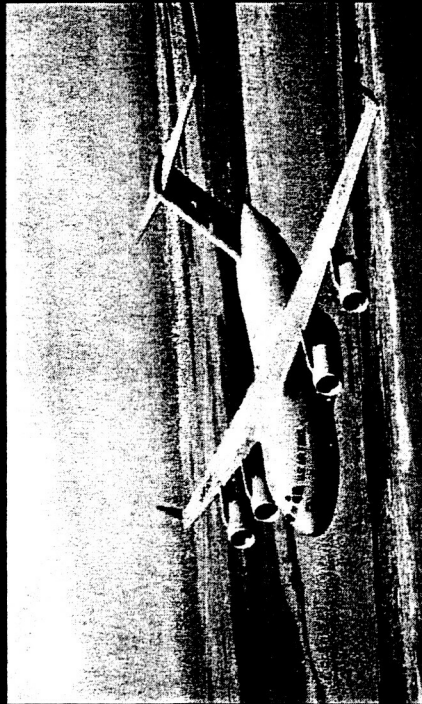
Cockpit Motion Facility (CMF)

Langley Contributions to the Boeing 777



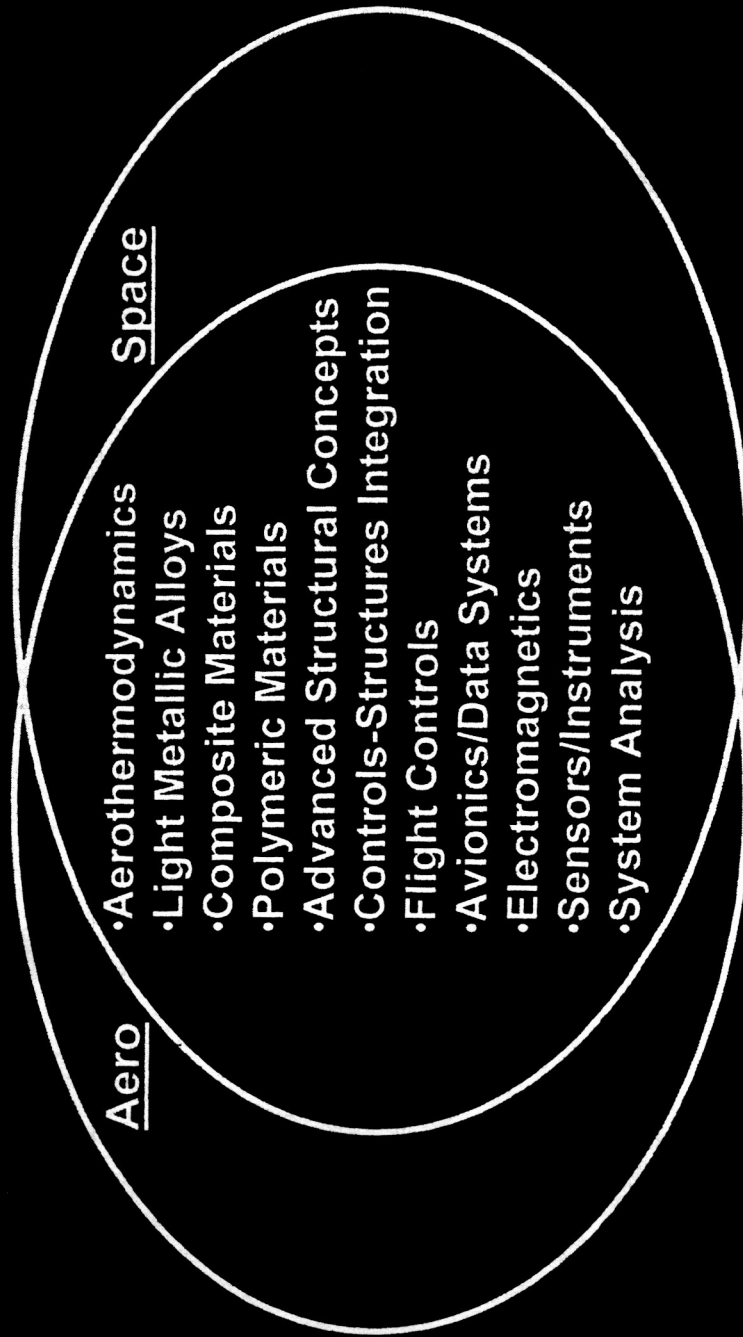
- Computational aerodynamic methods
- Wind-tunnel tests for performance analysis
- Flutter clearance tests
- Advanced flight deck
- Digital data system
- Fly-by-wire flight controls
- Lightweight composite structures
- Tire durability testing

Langley Contributions to the C-17



- Externally blown flap concept
- Winglets
- Supercritical wing
- Advanced flight deck
- Composite materials
- Fly-by-wire flight controls
- “T-tail deep stall” avoidance

Space Access and Technology Synergy with Aeronautics



MAJOR TECHNICAL AREAS OF EXCELLENCE AT LANGLEY

(where we are publishing/making a “value-added” contribution as opposed to managing programs or conducting tests for others)

Strong Areas

- Polymer chemistry/matrices for composites etc.
- Crack propagation/growth/stress inducement
- Solid state lasers
- Instrumentation development/deployment/utilization--
atmospheric science measurements from space/aircraft
- Aerothermodynamics
- Scramjets
- High reliability software
- Aeroacoustics
- Unsteady aero/aeroelasticity/TDI
- Controls including smart structures/materials
- Materials technology
- Computational sciences
- Radiation effects/shielding

TECHNOLOGIES CRITICAL TO FUTURE OF NASA/LARC

- Structures/materials
e.g. nanotechnology, fullerene carbons, metal-matrix composites, diamond coatings, fabrication-by-light
- Multidisciplinary optimization from “cradle-to-grave”
e.g. minimization of total life cycle costs, nonlinear “all up: systems analysis
- Intelligent agents--conversion of information/data to (targeted) knowledge, 3-D multisensory “visualization”
- Miniature/micro instrumentation/sensors/actuators with application to “health monitoring,” brilliant materials and atmospheric sciences
- In computational sciences - orders of magnitude reductions in overall solution time (problem formulation to result analysis)
- Software “surety” (security, reliability, safety, etc.)
- Creativity/invention