NASA Facts

National Aeronautics and
Space Administration

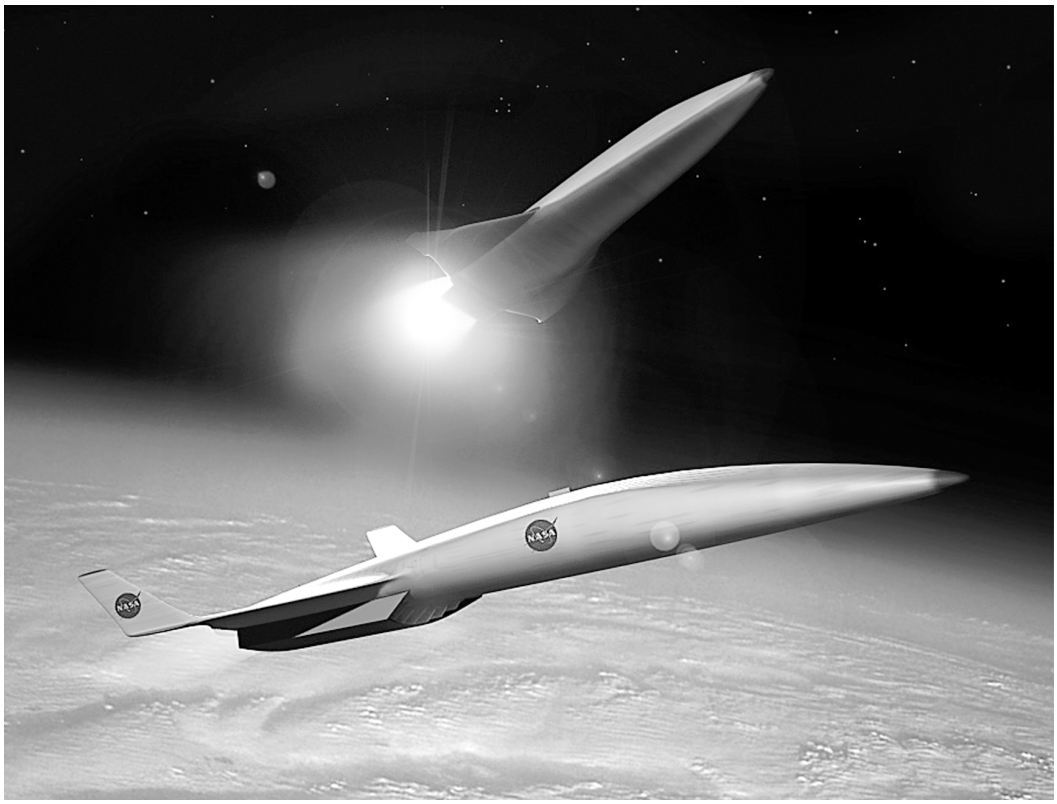
Marshall Space Flight Center
Huntsville, Alabama 35812

FS-2001-06-124-MSFC

June 2001

Marshall Space Flight Center

Exploring the Cosmos, Improving Life on Earth



The Space Launch Initiative, NASA's comprehensive research and technology development effort, is spearheaded by the Marshall Center.

As NASA's lead center for space transportation systems and development, and the center of excellence for space propulsion, the Marshall Space Flight Center in Huntsville, Ala., leads NASA's mission to develop future generations of safe, reliable and affordable space transportation systems. The Center also maintains the highest-standard propulsion systems for America's current space fleet.

In addition, the Marshall Center leads NASA's efforts in microgravity research—experiments conducted in the low gravity inside orbiting spacecraft—as well as in the development of space optics manufacturing technologies. The Center also provides breakthrough advances in Earth and space science research, and delivers practical applications of NASA space research and technologies here on Earth.

Marshall Center scientists, engineers and support teams are dedicated to helping America explore the cosmos, while making life better here on Earth.

The Space Launch Initiative

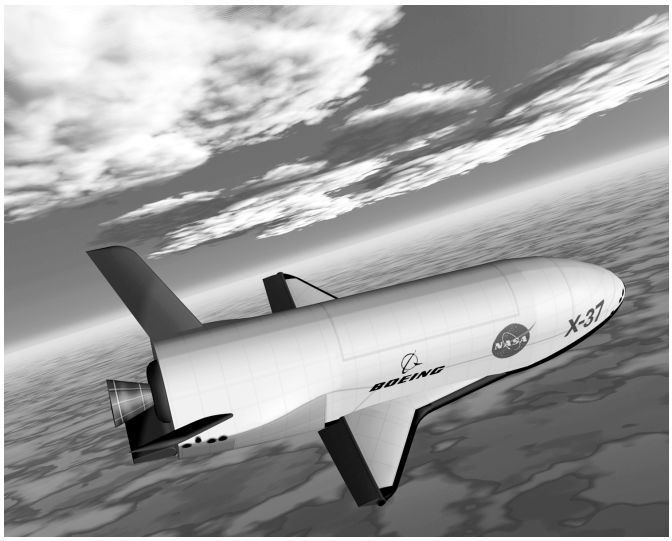
The Marshall Center is managing the Space Launch-Initiative, NASA's comprehensive research and technology development effort to dramatically increase the safety, reliability and affordability of space transportation systems. The Space Launch Initiative is the key to opening the space frontier for commercialization, scientific discovery and economic expansion.

This initiative calls for a focused investment of $4.8 billion through fiscal year 2006 to develop concepts and technologies needed to develop a 2nd generation reusable launch vehicle. These leap-ahead technologies include crew survival, advanced fuel tanks and airframe structures, long-life rocket engines and thermal protection systems. A 2nd generation vehicle is expected to be 10 times cheaper and 100 times safer than today's space launch systems. The ultimate goal of the initiative is to mature technologies that will enable a mid-decade decision regarding development of a versatile space transportation system that could serve both government and commercial needs.

The Marshall Center's Space Transportation Directorate oversees NASA's development of new, innovative propulsion concepts such as the X–43B, an air-breathing rocket-propelled vehicle now being developed by NASA and its industry partners.

The Advanced Space Transportation Program at Marshall looks beyond 2nd generation systems, leading the way in developing technologies needed to fly a 3rd generation reusable launch vehicle by 2025, and a 4th generation vehicle by 2040. The 3rd generation vehicle is expected to make launches 1,000 times safer and 100 times cheaper than today. The 4th generation vehicle is expected to improve safety and reduce cost by yet another order of magnitude, making space travel virtually indistinguishable from modern air travel—10,000 times safer and 1,000 times cheaper than today's rockets.

To reach these goals requires revolutionary aerospace technologies—from magnetic, chemical and propellantless propulsion systems to all-new energy sources such as space solar power or antimatter propulsion. These and other advances are now being studied, developed and tested at Marshall's Propulsion Research Center, as well as at other NASA field centers and partner institutions all over the nation. Innovative materials and processes technologies are also under investigation, as NASA and its partners seek ways to develop safer, stronger and more durable engines, vehicles, structures and components to handle the immense power of these futuristic propulsion systems.



The Marshall Center leads development of the X–37 space plane, designed to travel at 25 times the speed of sound and fly in both orbital and suborbital environments.

The Marshall Center leads NASA's government team in development and testing of the X–37 space plane, which is expected to make history as the first reusable demonstrator to fly in both orbital and reentry environments.

Designed to demonstrate dozens of advanced airframe, avionics and operations technologies that can support various launch vehicle and spacecraft designs, the X–37 will travel up to 25 times the speed of sound. One of its primary goals is to demonstrate advanced, durable thermal protection systems in an environment relevant to future reusable launch vehicles. Thermal systems now in use are fragile and expensive to maintain.

After deployment, the X–37 is designed to remain in orbit up to 21 days, performing a variety of experiments before reentering the atmosphere and landing on a conventional runway.

Space Shuttle Propulsion

In 2001, the Marshall Center helped celebrate the 20th anniversary of the Space Shuttle, for which Marshall manages all propulsion elements, including the Main Engine, External Tank and Solid Rocket Boosters. From inside out, thousands of advances in technology and enhanced designs have been incorporated in the Shuttle since it first launched. A program of evolutionary upgrades will continue to improve its safety and

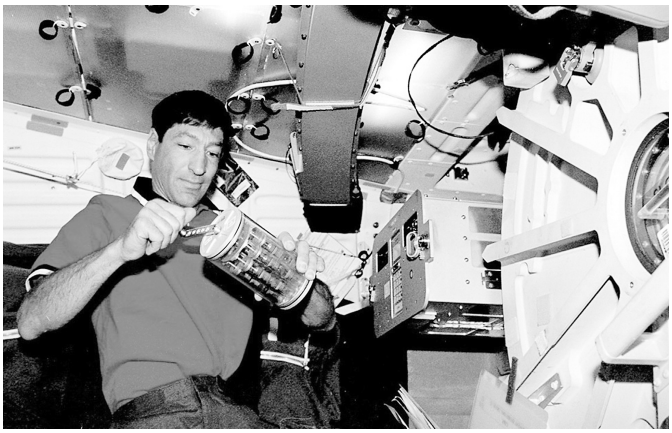
reliability. Planned safety upgrades include an Advanced Health Management System that will monitor the performance of the Shuttle's Main Engines; the use of "friction stir welding"—or friction-derived heat—to bond metal together on the External Tank; and a helium-powered thrust vector control system for the Solid Rocket Boosters.

In 2001, a redesigned Shuttle Main Engine will fly on a Shuttle mission. The updated Block II engine includes a new high-pressure fuel turbopump, modified to eliminate welds using a casting process for the housing and an integral shaft/disk with thin wall blades and ceramic bearings. This modification makes the pump stronger and should increase the number of flights between required overhauls.

Additional upgrades to the Shuttle's propulsion systems are planned for completion by 2005.

Microgravity Research

Marshall scientists and engineers routinely contribute to new processes and technology innovations in areas as diverse as manufacturing, communications and electronics. Microgravity research conducted in Earth orbit furthers our understanding of critical biological, chemical and physical processes, opening doors to commercial development of space.



Microgravity research conducted aboard the Space Station furthers our understanding of critical scientific processes, opening doors to commercial development of space via Marshall's Space Product Development Program.

Until recently, microgravity research was limited to relatively short-duration flights aboard a Space Shuttle. This changed with the addition of the Destiny Laboratory Module to the International Space Station in 2001. One of numerous Space Station elements built and tested at the Marshall Center, Destiny allows for long-duration microgravity experiments and is the premier laboratory for this research.

Before experiments reach the Station, scientists can test their hardware at the Marshall Center's Microgravity Development Laboratory, which provides experiment hardware similar to that found aboard the orbiting facility. The Marshall Center also is home to a NASA Telescience Center, where researchers can remotely command and monitor their experiments aboard the Space Station.

International Space Station Hardware

As Space Station construction continues in orbit, the Marshall Center maintains a key role in hardware development and science operations for the orbiting research outpost. Marshall is overseeing development of Station Nodes 2 and 3—modules that serve as hubs for distribution of water, electrical power and thermal controls for the Space Station—as well as the Station's Environmental Control and Life Support System, a water recycling and oxygen generation system that will eliminate the need to continuously resupply air and water to the Station.

Marshall also oversees development and operation of the Space Station's Multipurpose Logistics Modules. The three pressurized modules—built by the Italian Space Agency and its industry partners and carried aboard the Space Shuttle—will serve as "moving vans" to carry laboratory racks filled with equipment, experiments and supplies to and from the Station.

The Payload Operations Center at Marshall is NASA's primary Space Station science command post, coordinating all scientific experiments on the Station as well as communications between researchers around the world and their on-board experiments. The Marshall Center also is responsible for coordinating and managing all Station microgravity science and commercial research payloads.

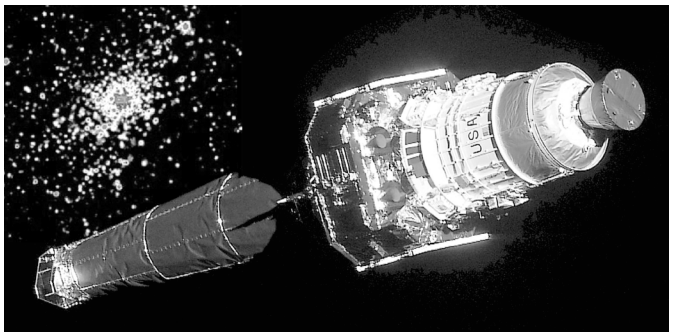
Team members staff the Payload Operations Center at the Marshall Center—NASA's primary Space Station science command post.

Space Optics Manufacturing

With more than 30 years of experience developing sophisticated optical systems for space exploration, the Marshall Center leads NASA's space optics manufacturing technology development, including optics design, fabrication, testing and analysis.

Most recently, the Center designed and developed the world's most powerful X-ray telescope, the Chandra X-ray Observatory. Launched in 1999 under the direction of Marshall lead researchers, Chandra is roughly a billion times more powerful than the first X-ray telescopes—enabling scientists to identify never-before-seen phenomena such as a flare from a brown dwarf star and a small galaxy being cannibalized by a larger one.

The Space Optics Manufacturing Technology Center at Marshall is spearheading NASA's development of advanced, ultra-lightweight optics materials, fabrication technologies, precise measurement standards and state-of-the-art test facilities. This center currently supports NASA's Goddard Space Flight Center by leading optics technology development for the Next Generation Space Telescope, the successor to the Hubble Space Telescope. The center also is developing ultra-lightweight optics for Chandra's successor, the Constellation X-ray mission.



Launched in 1999, the Marshall-managed Chandra X-ray Observatory continues to deliver fascinating, unprecedented imagery from space, such as this breathtaking photo [inset] of a busy region of the Milky Way galaxy some 20,000 light-years from Earth.

National Space Science and Technology Center

The Marshall Center partners with Alabama universities, industry and other federal agencies in the National Space Science and Technology Center. With core facilities which opened in Huntsville in 2001, the center is a collaborative effort that enables scientists, engineers and educators to share research and facilities. Marshall's space science and technology expertise anchors the new center, which focuses on cutting-edge advances in space science, materials science, biotechnology, Earth sciences, propulsion, information technology, optics and other areas that support NASA's mission.

In collaboration with researchers at Stanford University in Palo Alto, Calif., Marshall Center scientists are developing a sophisticated experiment called Gravity Probe B, designed to prove or disprove portions of Albert Einstein's general theory of relativity. Einstein believed space and time are displaced by heavenly bodies such as planets, stars and moons, and theorized that the rotation of these bodies pulls space and time—an effect called frame-dragging. The Gravity Probe B mission is scheduled to launch in late 2002.

Award-winning Research

The Marshall Center's aggressive reach for the stars is intended to do more than advance humanity's exploration of the solar system and the universe beyond. New technologies derived from space science and research offer a wealth of benefits here on Earth, helping industry create new medicines and medical procedures, manufacturing processes, and electronics and communications breakthroughs that have already changed the lives of people all over the world.

Technologies brought about by America's space program are available to private industry, universities and other government agencies through the Marshall Center's Technology Transfer Department. The technology transfer program encourages a broad use of Marshall-developed technologies and expertise by American private enterprise, not only for new product development but also to find solutions to technical problems.

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

For more information about the Marshall Center, visit:

http://www.msfc.nasa.gov/

Or write to us at:
MSFC Public Inquiries
Government and Community Relations Office
CD50, Huntsville, AL 35812