Questions & Answers about Aeronautics and Space.

National Aeronautics and Space Administration, Washington, D.C.

Answers to 27 questions about aeronautics, space, and the National Aeronautics and Space Administration (NASA) are provided in this pamphlet. Among the topics dealt with in these questions are: costs of the space program; NASA's role in aeronautics; benefits received from the space program; why the United States hasn't developed means of rescuing individuals who are in trouble on space missions; how to write to an astronaut or receive an astronaut's autograph; courses that should be taken in school in order to become a NASA astronaut or scientist; how to obtain NASA educational materials; and NASA activities with elementary and secondary schools. Current addresses for obtaining materials and/or additional information are included when applicable. (JN)
Why explore space?

The exploration of space is producing practical benefits in the form of:

- Knowledge — Exploration advances scientific and technical knowledge and contributes to improvements in everyday life.
- Applications — Spacecraft are already in constant service for communications, television transmissions, navigation, weather observations, and Earth environment surveys.
- Technology — Progress stimulated by the space program is contributing to advances in medicine, transportation, electronics, automation, and other fields — in fact, nearly every form of human activity.
- Economics — The space program helps expand our technological base, stimulating the development of improved products and processes that increase our ability to compete in world markets. In this way, the program makes a significant contribution to the export, or jobs, of our balance of trade.

What does the space program cost me as an individual?

Less than one cent of each federal tax dollar goes to the NASA space program. To divert funds from the space program would not add significantly to the budget for other government programs, but it would be a severe blow to the advances in technology, the growth of knowledge, the economic advantages, and the continued benefit to the space program. And it is important to recognize that technological progress pays a vital role in the solution of social problems, as well as in developing an extended tax base to increase support of social programs.

What benefits have we received from the space program?

Benefits are both tangible and intangible. The latter includes such things as the stimulus to scientific discovery, new technologies, national pride, and improved international relations.

Some tangible and direct benefits now taken for granted are a global weather satellite system making possible more accurate weather forecasts to help save lives and crops, and a worldwide satellite communications system. We also have airplane communications and ocean navigation satellites that provide increased safety in the air and on the sea, as well as additional economic benefits.

Practical everyday benefits include: fire-resistant fabrics and paint, smaller and longer lasting radios and TVs, tougher plastics, stronger adhesives, equipment that makes it possible for more hospital patients to receive better care with fewer nurses, a heart monitor inserted through a hypodermic needle rather than by surgery, improved computer technology, and a host of others.

What is NASA's role in aeronautics?

Basically it is to assure that the nation maintains its lead in the development of military and commercial aircraft technology. For this reason NASA does advanced research in subsonic, supersonic, and hypersonic aircraft. However, new concepts and designs are studied for all manner of aircraft, including those that function in general aviation. Other focal points of NASA's aeronautical work include improving aircraft fuel economy and air safety, and reducing bothersome aircraft noise.

How does the United States cooperate with other countries in space projects?

The United States has made considerable efforts to develop international cooperation in space science and technology.

The first international manned rendezvous and docking in space took place in July 1975, during the historic joint U.S./Soviet mission, the Apollo-Soyuz Test Project.

World-wide interest in Space Shuttle capabilities and a planned Space Station has prompted NASA to consider opening the space program to other nations.

The European Space Agency, composed of 11 member nations, invested more than $750 million to construct Spacelab, a reusable spaceborne laboratory that is transported into orbit by the Space Shuttle and remains at tached inside the orbiter's cargo bay.

The Canadian government funded and built a remote manipulator arm. Installed in the orbiter's cargo bay, the robot arm plucks out space debris out of the path of the other shuttles. It is the first independent development. The arm also retrieves payloads from space, and can aid in space construction projects.

Over the years, the U.S. has engaged in cooperative space ventures, in one form or another, with over 40 nations around the world.

Why hasn't the United States developed means of rescuing men who are in trouble on missions?

The United States had no rescue capability at the time of the Apollo missions. There may be more than one reason, including why only astronauts who were highly skilled engineers and test pilots, trained to meet the rigors of space travel, were chosen as astronauts.

Today's astronauts are just as skilled, but their talents cover a wider range of scientific and engineering disciplines. Several of the new astronauts selected for the Space Shuttle program are medical doctors, and have been developing techniques for dealing with medical emergencies in an artificial environment.

Also, the United States will eventually have a small fleet of Shuttle orbiters, each of which could be used by astronauts to aid or rescue the crew of a disabled ship.

Are there plans for a manned mission to Mars? What about the other planets? Are we making plans to explore them?

NASA has no present plans for a manned mission to Mars, or to any other planet. Knowledge about planets other than Earth is being acquired through unmanned spacecrafts.

Unmanned Pioneers have returned close-up observations of Jupiter and Saturn, and Mariners of Mars, Venus, and Mercury. In 1974, two Viking spacecraft soft landed on Mars and conducted an intensive search for life. None was found, but a tremendous amount of data was gathered. In 1976 a Pioneer Venus Multiprobe sent four shielded scientific capsules down through the Venustian atmosphere. In 1977 the Voyager Orbi-ter flew by Jupiter, obtaining radar profiles that led to the first map of the planet's surface. Two Voyager spacecraft examined Jupiter and five of its moons in 1979 and Saturn and eight of its moons in November 1980 and August 1981.

The second one is heading for an encounter with Uranus in 1986 and possibly Neptune in 1989.

NASA has very long-range plans for returning to the Moon, but not for many years. The Space Shuttle does not provide the ability to carry humans out of Earth orbit, and other vehicles must be developed before this will again become possible.

When will NASA have a permanent space station in orbit?

President Reagan in early 1984 directed NASA to build and man a permanent orbiting space station "within a decade." Studies are now being carried out on site selection, and construction of the hardware will start within two or three years. Most of the ten-year period will be required to design, plan, and build the station on the ground. Carrying the component parts into orbit and assembling them there would probably take a year or less.

How much does a spacecraft weigh in space?

In an orbit Earth is said to be in a state of weightlessness, also called zero-gravity, or zero-g. Weightlessness does not mean that the people or objects on Earth have disappeared. Rather, it means that the forward velocity imparted by the spacecraft's launch vehicle balances the downward pull of gravity. Put another way, gravity and motion interact in such a way that the spacecraft is not attracted toward the Earth, but with the curved surface below moving further away at a rate equal to the amount of fall. Everything in the spacecraft is in a state of free fall; anything which remains stationary is also moving. Gravity is nothing more than an apparent force.

How much does a spacecraft cost to build?

The cost of building a spacecraft is inordinately high. A normal orbiting space station would cost about $750 million to construct. A small fleet of Shuttle orbiters, each of which could be used by astronauts to aid or rescue the crew of a disabled ship.

How much does it cost to send a man into space?

A man in space costs $12 million to launch. The cost can be reduced if a vehicle can be designed which can be paired and reused for six years or more. It would be a severe budgetary blow to the space program if a manned mission were suspended for any reason.

How much does a space station cost to build?

The space station is estimated to cost $30 billion to build and $1 billion a year to operate and maintain it. It will be a project of the future, taking about 20 years to complete. Some of the years would be spent planning, designing, and constructing the hardware will start within two or three years. Most of the ten-year period will be required to design, plan, and build the station on the ground. Carrying the component parts into orbit and assembling them there would probably take a year or less.

How much does it cost to put a man into orbit?

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The Space Shuttle orbiter contains a common module and urinal that can be used by both men and women. Designed to be as Earth-like as possible, it substitutes airflow for water and gravity. This airflow draws the waste into storage compartments, which are emptied upon return to Earth. The air is filtered to remove dirt, bacteria, and odor and returned to the orbiter cabin. While in orbit, the common module is vented to space vacuum to deactivate bacteria and thus prevent odor formation.

Nose-blowing in a pressurized suit is not feasible. However a small piece of rough cloth inside the helmet now makes it possible for an astronaut to scratch his nose.

What is a launch window?

The precise period in which lift-off must occur is called the "launch window." For example, a preset launch time is required when a spacecraft is to rendezvous with another object already in orbit, whether this be the Moon, a planet, or another spacecraft. Calculation of the launch window for rendezvous with the Moon, for example, included taking into account the lunar landing site, sunlight, and the Moon's phase.

How were the NASA program names (such as Mercury, Gemini, and Apollo) chosen?

Officials considered various suggested names and finally agreed on one. Sometimes the names were descriptive, such as Skylab and Space Shuttle. Gemini — Latin for twins — refers to the fact that the Gemini spacecraft held two astronauts. Names such as Mercury and Apollo are much more symbolic than descriptive.

What are the names of the Shuttle orbiters?

The first one constructed, which was not designed for space flight, was named Enterprise. Columbia was NASA's second orbiter and the first to operate in space. Number three, Challenger, was originally built as a vibration test article and later transformed into a fully operational spacecraft. The last two are Discovery and Atlantis.

Whatever happened to Enterprise?

After completion of the Shuttle Approach and Landing Tests in 1977, Enterprise was used to check for mechanical and electrical compatibility with facilities and equipment at the Shuttle launch site at Kennedy Space Center. Since then, it has been used extensively as a testbed for weight and balance tests, vibration tests and failure detection experiments, and even been "canalized" for spare parts for orbiter Columbia. It was taken to Europe aboard the 747 carrier aircraft for a tour in 1983, and stayed at New Orleans throughout the World's Fair in 1984.

How can I obtain NASA educational materials?

NASA educational and informational publications may be purchased from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Some NASA centers provide free materials on request.

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How can I obtain space items from NASA?

No. Hardware and other items that have no further direct value to the space program usually go to public institutions or museums for display so that people from all over the world may see them. Moon rocks, moon dust, samples of space food, telescopes, binoculars, lasers, old space suits, Shuttle thermal protection tiles or pieces of tile, and other space artifacts are not available. Blueprints, flight plans, designs, transcripts, and other printed materials are prepared in limited quantity for distribution only to engineers, analysts, and other required personnel. Some items are made available to the news media.

Visitors to the Kennedy Space Center may purchase souvenir items from the gift shop operated by a concessionaire at the visitors center, Spaceport USA. Models of spacecraft and launch vehicles, and the badges, decals, and other items that represent various space missions, may be purchased here or by mail from:

TW Services, Inc.
Visitors Center-TWS
Kennedy Space Center, FL 32899

The NASA Exchange
Johnson Space Center
Houston, TX 77058

Model rockets (models that contain propellant and can be launched) are available at some toy and hobby stores.

Can engineers at the Kennedy Space Center evaluate my inventions (drawings or plans)?

Sorry, we do not have the workforce available to handle the tremendous number of requests we receive. And since it would be unfair to process some and not others, we therefore do not handle any.

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Can I obtain space photographs from NASA?

Color photographs are so costly NASA cannot provide them free of charge. If the NASA installation nearest you has a Visitors Center with a souvenir shop, photographs may be purchased there for one or two dollars each. They are also available through the mail from a private contractor, though this is somewhat more expensive. Serious inquiries (preferably on letterhead stationary) should be addressed to: Space Photographs, PO Box 486, Bladensburg, MD 20710.

Photographs of geographical areas of the United States, taken from space by LANDSAT spacecraft, are available for purchase. For information write or telephone: U.S. Geological Survey, (605) 594-5611 User Services Unit EROS Data Center Sioux Falls, SD 57198

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