

NASA FACTS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MANNED SPACECRAFT CENTER

PUBLIC AFFAIRS OFFICE

Houston, Texas

MOST-ASKED QUESTIONS ABOUT SPACE

Thank you for your letter. Each month we receive 7,500 like it from people all over the world. To respond more quickly to your inquiry, we have listed these most-asked questions with brief answers. More detailed discussion of aspects of manned space flight can be obtained from the Public Affairs Office, Manned Spacecraft Center. Material on space and the solar system also is available in your school or community library.

1. Why explore space? New technology developed to let man work safely and efficiently in space is being applied to let him live better on Earth. Until the space program, the one great stimulus to extensive and rapid technological development was war.

2. Why not spend the money here on Earth? Every penny of space money is spent on Earth — to buy materials and skills to put men and equipment into space. In the late 1960's, about 420,000 Americans worked in the space program. They spent their paychecks on homes, food, cars, education, and entertainment — all here on Earth. And they paid taxes.

3. What about the things you leave in space (on the Moon, etc.)? Space hardware — paid for on Earth with Earth money — is abandoned for several reasons: no feasible way to bring it back, or to increase crew safety, or to replace it with something more valuable scientifically,

4. What does a TV camera cost (or a spacecraft, suit, launch rocket, etc.)? There is no valid way to price a spacecraft or its separate pieces the way a car is priced. A figure can be determined by dividing items built into contract dollars. But included in the contract are intangibles — research, development, and testing — that make costs on single units appear unrealistically high even for "custom built" spacecraft.

5. Then how much does the space program cost? In NASA's first decade (1959-1969), the cost totalled \$35 billion, or about 2-1/2 percent of all federal spending (\$1.4 trillion) over the same period. Apollo, through the first landing on the Moon, cost about \$19 billion; its final cost is set at \$25-26 billion.

6. But what does it cost me as an individual? The 1971 space budget was about 1.6 percent of

the total federal budget or, roughly \$15.00 per person per year. (Americans spend per person: \$400 on health, education and welfare; \$400 on defense; \$35 on alcoholic beverages; \$17 on tobacco; and \$16 on cosmetics.)

7. Why not use the money to feed the hungry (or cure cancer, end pollution, etc.)? Ideally, space-age technology will help such problems. The money, rather than buying food to merely lessen hunger today, will pay for research that could wipe out hunger tomorrow.

8. Why send men into space when unmanned spacecraft are cheaper? Man's ability to observe, reason, and act accordingly, make him important in space. Today's manned flight is largely a proving ground to develop future programs in which man will be essential as a scientist or an astronomer or even a space mechanic who can prolong the useful lives of other orbiting satellites.

9. Will we ever have women astronauts? Probably, but not in the immediate future — after Apollo 15 there are 15 openings on five remaining flights (two more Apollo and three Skylab) and about three times as many astronauts as openings. In recent astronaut recruiting — particularly for scientist astronauts, for whom extensive jet aircraft experience is not required — women were considered. They, and several thousand male applicants, did not make the final selection.

10. How can I become an astronaut? The astronaut of today has a college education beyond a bachelor's degree — often a doctorate — in engineering or a science, has good eyesight and hearing, keeps in shape physically, and does not mind hard work or long hours. Your best preparation is an advanced education. Experience in flying will not hurt. No new astronaut recruiting is pending, but when a call is issued, the specifics will be listed by most news media.

11. What manned programs follow Apollo? Skylab is the only firm follow-on program. Others being studied include: Space Shuttle, featuring reusable launch vehicle and orbiter; several earth orbital photographic missions using spacecraft and launch vehicles left from Apollo; a long-life space station, and some interplanetary missions.

12. What is Skylab? Skylab will use hardware and procedures developed in prior programs to accomplish four basic objectives: scientific investigation, application of space-age techniques to help conserve Earth's resources, study of long-duration spaceflight effects on humans, and extension of manned flight development. Skylab features a workshop and living quarters built into the empty third stage of a Saturn V rocket. It also will carry a telescope for solar observation.

13. When will Skylab fly? Hopefully in early 1973. Current plans call for a 28-day mission by three astronauts, then two separate three-man missions of up to 56 days each. The workshop will be launched unmanned into a 260-mile orbit. The crew will join it later in a modified Apollo command/service module.

14. What about the Space Shuttle? The Space Shuttle is proposed for the late 1970's, so its missions are far from firm yet. Launch vehicle and orbiting spacecraft will be reusable up to 100 times. Some proposed Shuttle missions are: flying a repair shop from which the crew would retrieve a wornout or broken satellite, repair it, and put it back into orbit; assembling and servicing a space station; even launching new satellites and spacecraft.

15. How was the name "Apollo" chosen (or Mercury, etc.)? The way names for almost anything usually are chosen: people in charge of a program consider various names and finally agree on one. Sometimes the names are very descriptive (Skylab, Shuttle, even Gemini, which is Latin for "twins" and refers to the two men in the spacecraft). Other names, such as Mercury and Apollo, are more symbolic than descriptive.

16. What happens to used spacecraft? They undergo a post-flight checkout that yields additional information on the ship's performance. Some then go on public display — the Manned Spacecraft Center has several — and some back into other space programs.

17. Can I have a spacecraft (helmet, moon rock, flight plan, crew insignia patch, etc.)? No. Hardware and other items that have no further direct value to the program usually go to public institutions or museums — the Smithsonian Institution in Washington, D.C., for instance — for display so people all over the world can see a portion of the space program.

18. But can't I buy some space things? Not from NASA. Visitors to Houston or other NASA centers find souvenir items in many stores in the area, and many merchants throughout the country stock articles that pertain to space flight. Charts and booklets on space can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

19. Can I visit the Manned Spacecraft Center? Yes, the center is open to the public from 9 a.m. to 4 p.m. seven days a week except on federal holidays. There is no charge and no need for advance reservations. Guided tours are available to groups on weekdays by advance arrangement with the MSC Office of Public Affairs.

20. Will I see an astronaut? Possibly, but you may not know it unless he is pointed out to you. Astronauts do not walk around the center in space-suits, and they are not much different in appearance from many other busy people you will see.

21. Where do the astronauts live? Anywhere they want to. Most of them choose — along with many other MSC employees — to live within several miles of the center.

22. Can I get an astronaut to speak to my class (club, meeting, convention, etc.)? Astronaut appearances must be limited. Otherwise, crews would have no time to train or to keep up with changes in space technology. Generally an astronaut will take part in national meetings or scientific and technical groups or youth groups, and will make appearances in the astronaut's home town. Requests should be addressed to the Astronaut Office at the Manned Spacecraft Center. Inquiries on talks by other MSC representatives should be sent to the Office of Public Affairs.

23. How much are the astronauts paid for going to the Moon? An astronaut's pay is determined by his civil service grade (a pay scale for government employees) or, if he is in a military service, by his rank. Like other government workers away from home temporarily on official business, the astronaut gets a predetermined food-and-lodging allowance. Since meals and quarters are furnished by the government, the allowance during a flight is just a few dollars a day. He gets no extra pay for space flight.

24. Do the astronauts in space really eat or drink the food the advertisements say they do? The companies that prepare and package food for space also produce food you can buy at the grocery. These companies usually let NASA check their advertisements to be sure they are technically accurate or do not claim NASA uses something it doesn't. This does not necessarily mean the astronauts use such products at home or that they think you should. You have to decide that for yourself.

25. How does an astronaut go to the bathroom in space (or scratch an itch, blow his nose, etc.)? He uses a hose-and-bag device (sometimes called a "motorman's friend" for urinating, and a plastic sack for defecating. The motorman's friend was used by streetcar operators who were unable to make rest stops; the space-age version can empty the collected liquid into space, where it vaporizes. The sealed fecal bags, containing a germicide for sanitation, are stored for disposal back on Earth.

Itch-scratching or nose-blowing in a pressurized suit is not feasible, but the astronaut no longer wears his spacesuit full time.

26. How can I write an astronaut? Address your letter to him at Astronaut Office (CB), Manned Spacecraft Center, Houston, Texas 77058. But please remember that astronauts are very busy and cannot always personally answer as many letters as they would like to.

27. How much does a spacecraft weigh (a launch rocket, back pack, spacesuit, etc.)? In space, everything is weightless; on the Moon, it weighs about 1/6th its Earth weight. The significant question to spacecraft designers is "How can we make it weigh less?" The Saturn V takes about 60 pounds of propellant for each pound of spacecraft it sends to the Moon, so a little extra weight in the spacecraft adds a lot to the launch vehicle.

28. How much propellant does it take to go to the Moon? That's like asking how much gasoline it takes to drive cross-country — what route are you taking, what vehicle are you driving, how fast are you going, and how big a load are you carrying? For a nominal Apollo moon landing flight, launch vehicle and spacecraft weigh about 6,400,000 pounds at liftoff. Some six million pounds of that is propellant.

29. How far from Earth are spacecraft when orbiting? After the burn toward the Moon, most Apollo missions would have reached an apogee (the highest point of an orbit) of about 320,000 miles if there were no gravitational pull from the Moon. Presently, there are no planned manned Earth orbital programs with such extreme orbits. Skylab will be in a 260-mile circular orbit with a lifetime of 3 to 5 years. Studies of six- and 12-man space stations mention a 300-mile, 10-year orbit.

30. What is a launch window? A variety of conditions — most of them remote from the launch site — sometimes restricts a launch to certain days or times of day. This precise period in which lift-off must occur ranges from seconds to hours, depending on the mission, and is called the "launch window." Generally, a launch window is required when a spacecraft is to rendezvous with another object already in orbit.

31. How is the window determined? A rendezvous with the Moon, for example, begins with the lunar landing site. Acceptable sunlighting occurs just 16 hours each month. Figuring backward — calculating the time from the Earth to the Moon gives the day of launch. The hour is determined largely by the azimuth (direction) of launch from Cape Kennedy, and the expected location of the Moon when the spacecraft gets there. The result is a window of about 4 hours twice a day. Other considerations: daytime launch (one of the two daily windows occurs at night), lunar landing phase tracking and communications from Goldstone, Cali-

fornia (only about 12 hours a day), and Earth splash-down in daylight (a function of the Moon landing site).

32. Where have the lunar landing sites been so far? Apollo 11, the first manned landing, was in the Sea of Tranquility at coordinates 0 degrees, 41 minutes, 15 seconds North latitude by 23 degrees, 26 minutes East longitude. Apollo 12 landed in the Ocean of Storms at 3:12:32 South by 23:23:09 West. Apollo 14 landed at Fra Mauro, 3:40:27 South by 17:27:58 West. Apollo 15 landed at Hadley-Apennine at 26.1 North and 3.65 East.

33. How long will the flags left by those flights last? Barring destruction by a meteoroid impact or deterioration from some presently unexpected chemical reaction, they should withstand solar radiation and extreme temperatures for many years. These flags are made of 100 percent nylon.

34. How hot or cold does it get on the Moon (in space)? In the space around the Earth, including the Moon, objects in sunlight heat up to about 250 degrees F, in shadow about minus 250 degrees. An astronaut, in his protective suit or in the spacecraft cabin, experiences a steady 70 to 80 degrees as long as his thermal control systems are in order.

35. Can an astronaut smell anything on the Moon? Even if flowers grew on the Moon, the astronaut would not be able to smell them; he would be isolated from them by his life-sustaining spacesuit.

36. Are there germs or bacteria on the Moon? None have been found so far. An Earth organism — streptococcus mitis — was discovered to have survived 30 months on the Moon in a piece of Surveyor III gear brought back by Apollo 12.

37. Have the Moon rocks told us anything? They have resolved some questions about the Moon: its apparent age, that there was no evidence of water, and that the maria or "seas" were formed by flowing lava. The samples also have stimulated many new questions. Examination of the rocks and of data from experiments left on the Moon will continue for years.

38. Why go to the Moon? The most accessible of the bodies formed at or about the same time as Earth, the Moon may be the best undisturbed record of the solar system's formation and history. Understanding why and how Earth evolved could help man make better use of the world's resources. Or it might tell how life began, knowledge some scientists feel is a major step toward such goals as a cure for cancer.

39. Isn't \$25 billion a lot of money just for a few boxes of rocks, though? Apollo is much more than just a few boxes of rocks. The quest for those rocks forced technological developments that already are contributing to a better life.

40. Just what benefits have we received from the space program? Tangible benefits derived from the space program or that emerge sooner as a result of space activities are too many to list here. These benefits do not include intangibles, such as new technology, stimulus to learning, national pride, world harmony, and potential scientific discoveries. Some you might encounter each day, however, are: fire-proof fabrics and paint, smaller and longer lasting radios and TVs, tougher plastics, stronger glues, hospitals in which larger numbers of patients can be cared for better by fewer nurses, live television coverage of events around the world, safer air traffic control and better ground traffic management, long-range weather forecasting that contributes to saving lives and crops, lightweight super-insulated sleeping bags, a heart monitor inserted through a hypodermic needle rather than by surgery, computer technology, longer-life flashlight batteries, et cetera.

41. Will the United States and Russia explore and colonize other planets? Yes, but not necessarily together. Both nations already have sent various unmanned probes to several planets, but neither has announced any firm program of manned planetary flight. Colonization of the Moon or planets probably is in the distant future. Most likely, it will be a scientific research colony such as maintained in Antarctica, rather than a populating colony intended to start a new world. Questions about Russia's space program should be directed to the Russian Embassy in Washington, D.C.

42. How far away are the planets (Moon, stars, etc.)? This is the type of question you can answer from general or special reference books in your library. Schools often carry texts of varying depths, from an elementary course on the solar system (or physics, rocketry, aeronautics, medicine, etc.) to comprehensive studies at the college level. You can pursue the subject as extensively as you wish.

43. What planets would we investigate? Probably all of them eventually. But only Mars is being considered seriously for manned landing. Conditions on the other planets seem too extreme. One interplanetary flight being considered is the "Grand Tour" of Jupiter, Saturn, Uranus, and Neptune by an unmanned spacecraft. In 1977 and again in 1978, a unique opportunity to fly by all four planets in a single mission will exist. Inquiries should

be made to Jet Propulsion Laboratory at Pasadena, California 91103. JPL develops unmanned lunar and planetary spacecraft. Earth orbiting satellites are developed by Goddard Space Flight Center at Greenbelt, Maryland 20771.

44. Will we use atomic energy on those flights? The Apollo Lunar Surface Experiments Package already uses nuclear energy in the SNAP 27 generator for electrical power to gather scientific data and transmit it to Earth. Nuclear propulsion systems for very long-duration flight have undergone extensive development, as have advanced electric generating systems. Inquiries to: AEC-NASA Space Nuclear Propulsion Office, Washington, D.C. 20545.

45. Will you send animals to the planets first? Maybe. NASA currently uses various insects and animals for in-flight and laboratory experiments. They are handled in accordance with established humane standards. Perhaps the most famous space animal is the chimpanzee Ham, who made a 16-minute suborbital flight in a Mercury spacecraft January 31, 1961. Ten years after that flight, Ham was still alive and well in the National Zoo, Washington, D.C.

46. In space flight so far, have you seen UFOs? Some unidentified objects have been seen, but most later were proven or surmised to be such prosaic items as water droplets, material from the spacecraft or launch vehicle, or man-made satellites. Wally Schirra did report a UFO during his December 1965 flight of Gemini 6, but that turned out to be Santa Claus. No "flying saucer" has been sighted. Inquiries on UFOs: Headquarters, U.S. Air Force (SAFOICC), Pentagon, Washington, D.C. 20330.

47. What was the object I saw in the sky last night? If you are sure it was not an airplane, send time of night, direction of flight, and length of time you observed it to: NORAD (NNPA), Box 19, Ent AFB, Colorado 80912. NORAD charts artificial satellites and space debris orbiting Earth.

48. Will you put me on your regular mailing list? Because so many people are interested in the space program, we try to make best use of our limited funds by restricting our regular distribution of material to places it will be available to many people — school classrooms and libraries in an eight-state region served by the Manned Spacecraft Center in Houston, Texas.