



# Astronaut Selection and Training

NASAfacts



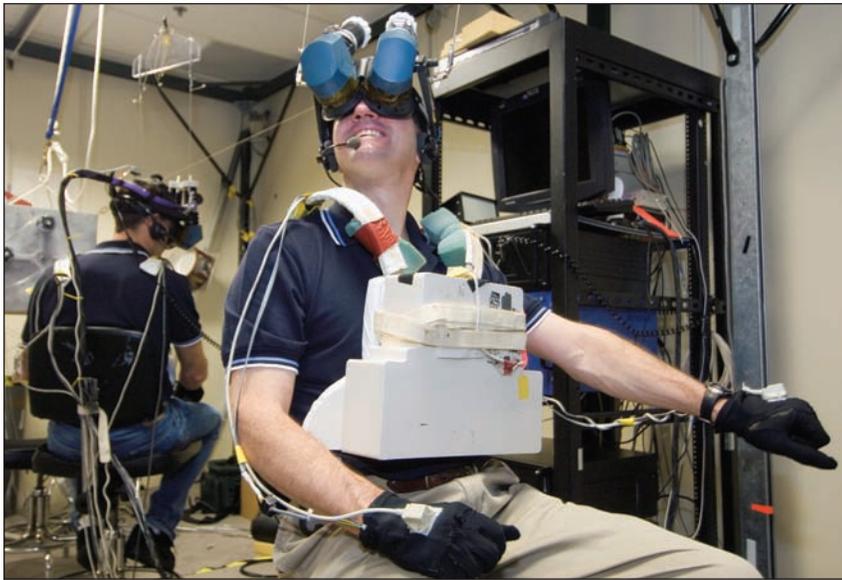
## History of Astronaut Selection

Man's scope of space exploration has broadened since the first U.S. manned space flight in 1961. But the nation can never forget the original seven pilots who focused our vision on the stars. In 1959, NASA asked the military services to list their members who met specific qualifications. In seeking its first astronauts, NASA required jet aircraft flight experience and engineering training. Height could be no more than 5 feet 11 inches because of limited cabin space available in the Mercury space capsule being designed. After many intense physical and psychological screenings, NASA selected seven men from an original field of 500 candidates. They were Air Force Captains L. Gordon Cooper, Jr., Virgil "Gus" Grissom, and Donald K. "Deke"

Slayton; Marine Lieutenant Colonel John H. Glenn, Jr., Navy Lieutenant M. Scott Carpenter, and Navy Lieutenant Commanders Walter M. Schirra, Jr., and Alan B. Shepard, Jr.

By 1964, prime emphasis had shifted away from flight experience and toward superior academic qualifications. Applicants were invited on the basis of educational background alone. These were the scientist astronauts, so called because, as a minimum, applicants were required to have a doctorate level degree or equivalent experience in the natural sciences, medicine or engineering.

Since the selection of the first class of astronauts, many men and women have pursued and realized their dreams of flying in space. They all began by submitting their applications to become astronauts.



include a bachelor's degree from an accredited institution in engineering, biological science, physical science, or mathematics. An advanced degree is desirable. And at least 1,000 hours pilot-in-command time in jet aircraft. Flight test experience is highly desirable. Additional requirements include the ability to pass the NASA long-duration space flight physical, which includes the following specific requirements: distant and near visual acuity must be correctable to 20/20 in each eye, blood pressure is not to exceed 140/90 measured in a sitting position, and the candidate must have a standing height between 62 and 75 inches.

Applicants for the Astronaut Candidate Program must meet the basic education requirements for NASA engineering and scientific positions, specifically, successful completion of standard professional curriculum in an accredited college or university leading to at least a bachelor's

degree with major study in an appropriate field of engineering, biological science, physical science, or mathematics. The following degree fields, while related to engineering and the sciences, are not considered qualifying: degrees in technology (engineering technology, aviation technology, medical technology, etc.); degrees in psychology (except for clinical psychology, physiological psychology, or experimental psychology, which are qualifying); degrees in nursing; degrees in exercise physiology or similar fields; degrees in social sciences (geography, anthropology, archaeology, etc.); and degrees in aviation, aviation management or similar fields.

### Basic Qualification Requirements

The Astronaut Candidate selection process was developed to select highly qualified individuals for human space programs. Astronaut Candidates are selected on an as needed basis. Both civilian and military personnel are considered for the program. Applicants must meet a series of minimum requirements.

The requirements for non-piloting Astronaut Candidates are a bachelor's degree from an accredited institution in engineering, biological science, physical science, or mathematics, followed by at least 3 years of related, progressively responsible, professional experience. An advanced degree is desirable and may be substituted for experience as follows: master's degree = 1 year of experience, doctoral degree = 3 years of experience. Teaching experience, including experience at the K-12 levels, is considered to be qualifying experience for the Astronaut Candidate position. Additional requirements include the ability to pass the NASA long-duration space flight physical, which includes the following specific requirements: distant and near visual acuity must be correctable to 20/20 in each eye, blood pressure is not to exceed 140/90 measured in a sitting position, and the candidate must have a standing height between 62 and 75 inches.

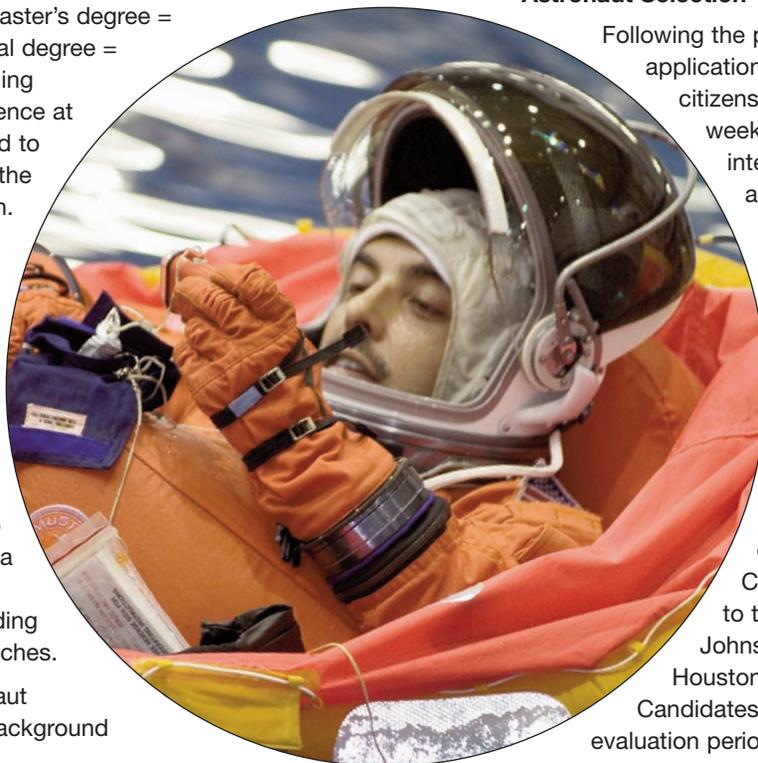
The requirements for Astronaut Candidates with a piloting background

### Astronaut Selection

Following the preliminary screening of applications, all of whom must be citizens of the United States, a week-long process of personal interviews, medical screening, and orientation are required for both civilian and military applicants under final consideration. Once final selections have been made, all applicants are notified of the outcome.

### Astronaut Candidate Training

Selected applicants are designated Astronaut Candidates and are assigned to the Astronaut Office at the Johnson Space Center (JSC) in Houston, Texas. The Astronaut Candidates undergo a training and evaluation period lasting approximately



2 years. During this time they will participate in the basic Astronaut Candidate training program, which is designated to develop the knowledge and skills required for formal mission training upon selection for a flight. Astronaut Candidates with a piloting background maintain proficiency in NASA aircraft during their candidate period.

As part of the Astronaut Candidate training program, Astronaut Candidates are required to complete military water survival before beginning their flying syllabus, and become SCUBA qualified to prepare them for spacewalk training. Consequently, all Astronaut Candidates are required to pass a swimming test during their first month of training. They must swim 3 lengths of a 25-M pool without stopping, and then swim 3 lengths of the pool in a flight suit and tennis shoes with no time limit. They must also tread water continuously for 10 minutes wearing a flight suit.

Candidates are also exposed to the problems associated with high (hyperbaric) and low (hypobaric) atmospheric pressures in the altitude chambers and learn to deal with emergencies associated with these conditions. In addition, Astronaut Candidates are given exposure to the microgravity of space flight. A modified C-9 jet aircraft performs parabolic maneuvers that produce periods of weightlessness for about 20 seconds. During this brief period, astronauts experience the feeling of microgravity. The aircraft then returns to the original altitude and the sequence is repeated up to 40 times in a day.

Final selection as an astronaut depends upon satisfactory completion of the training and evaluation period. Civilian candidates who successfully complete the training and evaluation and are selected as astronauts become permanent Federal employees and are expected to remain with NASA for a period of at least 5 years. Civilian candidates who are not selected as astronauts may be placed in other positions within NASA, depending upon agency requirements and labor constraints at that time. NASA has an affirmative action program goal of having qualified minorities and women among those selected as Astronaut Candidates.

### **Pay and Benefits**

Salaries for civilian Astronaut Candidates are based on the Federal Government's General Schedule pay scales for



grades GS-11 through GS-14, and are set in accordance with each individual's academic achievements and experience. Selected military personnel will be detailed to JSC, but will remain in an active duty status for pay, benefits, leave, and other similar military matters.

### **Astronaut Responsibilities**

Astronauts are involved in all aspects of on-orbit operations of the International Space Station (ISS). This includes extravehicular activities, robotics operations using the remote manipulator system, experiment operations, and onboard maintenance tasks. Astronauts are required to have a detailed knowledge of the ISS systems, as well as detailed knowledge of the operational characteristics, mission requirements and objectives, and supporting systems and equipment for each experiment on their assigned missions.

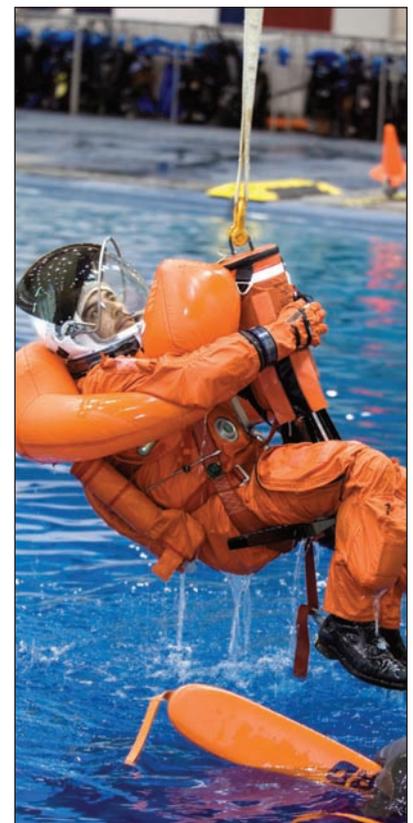
Long-duration missions aboard the ISS generally last from 3 to 6 months. Training for long-duration missions is arduous and takes approximately 2 to 3 years beyond the initial training and evaluation period. This training requires extensive travel, including long periods in other countries training with our International partners. Following the retirement of the shuttle fleet, trips to and from the ISS will be aboard the Russian Soyuz vehicle.

### **Astronaut Formal Training**

The astronauts begin their formal training program during their year of candidacy by reading manuals and by taking computer-based training lessons on the various vehicle systems.

The next step in the training process involves the spacecraft systems trainers. The astronauts are trained to operate each system, to recognize malfunctions, and to perform corrective actions if needed.

The Sonny Carter Training Facility, or Neutral Buoyancy Laboratory (NBL), provides controlled neutral buoyancy operations in the facility water tank to simulate the zero-g or weightless condition that is experienced by the spacecraft and crew during space flight. It is an essential tool for the design,





testing, and development of the ISS and future NASA programs. For the astronaut, the facility provides important pre-flight training in becoming familiar with planned crew activities and with the dynamics of body motion under weightless conditions in order to perform spacewalks.

Several full-scale mockups and trainers are also used to train astronauts. These mockups and trainers are used for onboard systems orientation and habitability training. Astronauts practice meal preparation, equipment stowage, trash management, use of cameras, and experiment operations.

The manipulator development facility is a full-scale mockup of the payload bay with a full-scale hydraulically-operated remote manipulator system, the mechanical arm that is used to move astronauts and equipment around in space.

Astronauts, who are pilots maintain flying proficiency by flying 15 hours per month in NASA's fleet of two-seat T-38 jets. Non-pilot astronauts fly a minimum of 4 hours per month. The T-38, which can fly to heights of 50,000 feet, is used for aerobatic maneuvers to help the astronauts become adjusted to the flight environment, including the g-forces experienced on launch.

The astronaut training is designed to prepare personnel for space flight on the ISS, Russian Soyuz spacecraft and NASA's Orion Crew Exploration Vehicle.

### **International Space Station Program Description**

The ISS is the largest international scientific and technological endeavor ever undertaken. It is a test bed for technologies for the future as we learn more about living and working in space. Aboard the international laboratory, crews conduct

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medical research in space; develop new materials and processes to benefit industries on Earth; and accelerate breakthroughs in technology and engineering that will have immediate, practical applications for life on Earth. When completed, the ISS will be 356 feet across and 290 feet long, and will weigh about 940,000 pounds.

### **Constellation Program Description**

The nation's next major human space flight program is NASA's Constellation Program, which is currently developing spacecraft and launch systems for a new generation of explorers that will go back to the moon, and continue to Mars and beyond. Initial flights of the new Orion spacecraft will be to the ISS in low-Earth orbit, but by 2020 it will support the development of an outpost on the moon. Early lunar missions will be about a week long, but

eventually stays on the lunar surface are expected to last about 6 months, similar in length to current ISS missions.

For additional information about the Astronaut Candidate Program, please go to the Astronaut Selection site [www.nasajobs.nasa.gov/astronauts](http://www.nasajobs.nasa.gov/astronauts).

