

In **1965** the IBM guidance computers on Gemini 6 and 7, successfully guided the two craft nose to nose 185 miles over Hawaii. NASA's real-time computer system

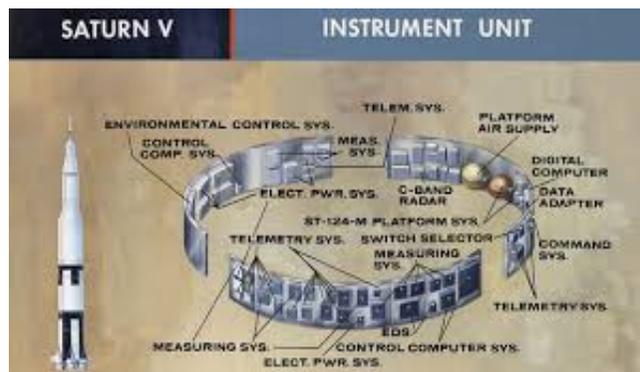


now comprised five linked **IBM 7094s**, five **IBM 2361 Core Storage Units**, and two **IBM 1460s**. The **IBM 2361** was the largest computer memory ever built by the company and consisted of nearly **20 million doughnut-shaped ferrite cores**, capable of storing 2.6 megabytes of data.

In **1966** NASA replaced their 7094s with the new **IBM System/360 Model 75s** to meet the increased demands of the Apollo programme.

In **1968** the **IBM-assembled Instrument Unit**, weighing two tons and 21ft high, guided the Saturn rocket and Apollo 8 on the first flight round the moon.

The Instrument Unit is located at the top of the third stage and is the upper most black ring on the rocket on the title page of this pamphlet.



The five **IBM 360/75** computers in NASA control monitored everything in real-time.

Also in **1968** NASA was the first customer to receive an **IBM System/360 model 91**, the fastest and most powerful ever in user operation at the time.

In **1969** the **Apollo 11** astronauts landed on the moon, a moment in history made possible by the IBM Instrument Unit guiding the Saturn V rocket into the correct orbit, and ground-based IBM computers and IBM personnel monitoring the flight all the way.

In **1970** IBM computers in Houston assisted flight controllers in the dramatic rescue of the Apollo 13, after an oxygen tank exploded in the Service module.

In **1971** Apollo 14 and Apollo 15 landed on the moon with guidance from IBM computers and personnel.

In **1972** the final two moon landings, Apollo 16 and Apollo 17 took place with guidance from IBM computers and personnel.

In **1973** IBM received a contract to support the Apollo-Soyuz joint U.S.-Soviet space venture, and also contracts to provide computers, displays and programs for NASA's Space Shuttle

In **1975** a successful Apollo-Soyuz mission, supported by IBM equipment, concluded NASA's Apollo series of space flights.

From 1975, focus changed to the Space Shuttle programme.

More information about IBM and the Apollo program is available at <https://www.ibm.com/thought-leadership/the-apollo-missions/>

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IBM and the path to Apollo



IBM's Involvement in Apollo

Landing the first two astronauts on the Moon in July of 1969 ranks as one of the great engineering achievements in human history, and one in which IBM employees played a big part:

- Four thousand IBM employees, most of them from the company's **Federal Systems Division**, built the computers and wrote many complex software programs that launched the Apollo missions and guided them safely to and from Earth.
- IBM engineers and technicians at the **George Marshall Space Flight Center** in Huntsville, Alabama, built the guiding Instrument Unit embedded in the giant Saturn rockets.
- At **Cape Kennedy**, now Cape Canaveral, in Florida, they performed final system tests and helped launch the 3000-ton Saturn V rocket with its 40-ton payload.
- At NASA's **Manned Spacecraft Center** (now called the Johnson Space Center) in Houston, Texas, IBM employees sat at consoles beside the NASA flight directors, making the minute-by-minute analyses needed to navigate the spacecraft from Earth orbit to lunar orbit and back.
- IBM employees at the **Goddard Space Flight Center** near Washington, DC, developed the worldwide network of relay stations and ships to track, and communicate with, the spacecraft.
- IBM employees in **Owego**, NY, and other locations invented and built the miniaturised integrated circuitry used to shrink the equivalent of an IBM System/360 mainframe down from the size of a refrigerator to that of a suitcase, and made it rugged enough to blast into space.

The Path to Apollo

IBM acquired the skills and invented the tools needed for space flight over a 30-year span stretching back to the 1940s.

The company's involvement with rockets and missiles

began in **1944** when it helped design and build the **Automatic Sequence Controlled Calculator**, for Harvard University, which was used by US Navy scientists to prepare ballistic tables.

In the early **1950s** the **IBM Card Programmed Calculator (CPC)** was the first digital computer used in the space program. It was used in the



development of the US Army Redstone missile. The **IBM CPC** was also used by the National Advisory Committee for Aeronautics (a forerunner of NASA) in their studies of multi-stage, solid fuel rockets.

In **1955** the US Army's Computational Laboratory in the Guided Missile Division, which later became part of the NASA Marshall Space Flight Center, used two **IBM 650** computers to design the Jupiter C (Composite Re-entry Test Vehicle), which consisted of a modified Redstone missile and upper stages.

In **1956** the US Navy announced that an **IBM 704**



computer would receive telemetry data from the planned Vanguard satellite, a 20-inch sphere, and use the data to calculate and predict the orbit. Today we take for granted that computers manage most of our equipment, but in the 1950s it was a new concept.

1957 saw the launch of the first artificial Earth satellite, Sputnik 1, which was monitored and tracked by two **IBM 704** computers.

In **1958** an **IBM 705** aided the launch and tracking of Explorer 1, the first US satellite, and IBM developed the

ASC-15 guidance computer for the US Air Force Titan II missile computer.

In **1959** an **IBM 709** was used to aid and track the launch of the first monkeys into space.



In **1960** an **IBM 7090** was used to perform design and development calculations for the Saturn rocket project. The IBM 7090 provided data from storage in 2.18 millionths of a second and added 13,740,000 figures a minute.

In **1962 John Glenn** became the first American to orbit the earth. His flight was monitored in real-time by IBM computers, which calculated the flight path and indicated when retro-rockets should be fired for the return to earth.

Also in **1962**, IBM began work on the guidance computers for the Gemini program. When the capsules were in flight the system would handle over **25 Billion calculations** a day. IBM also got the contract for the first Saturn rocket (on the front cover) guidance computer.

In **1963** IBM employees and computers helped NASA track the 22-orbit flight of Mercury astronaut Gordon Cooper in Faith 7.

In **1964** a 99-pound **IBM computer** became the first on-board computer to guide a vehicle from launch into space. Mounted on-board the Saturn SA-6 rocket, the IBM computer successfully compensated for an emergency engine shut-down, and calculated mid-course adjustments for the Ranger VI satellite, which televised the first close up pictures of the moon.

IBM's Federal Systems Division was awarded a contract for part of the Saturn launch vehicles, the largest space contract in company's history to date.