National Aeronautics and Space Administration (NASA)

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The National Aeronautics and Space Administration (NASA) is an independent agency of the executive branch of the United States federal government responsible for the civilian space program, as well as aeronautics and aerospace research.

- Established under **the National Aeronautics and Space Act 1958**
- **Headquarters:** Washington, DC, USA

How did NASA come to be Established?

- Following World War II, the United States was in direct competition with the erstwhile Soviet Union (the superpower that was disbanded into several sovereign nations including the Russian Federation, Kazakhstan, the Ukraine, etc. in 1991). That period was called “Cold War”.
- It was the Soviet Union’s **launch of Sputnik on October 4, 1957,** that **first put an object into orbit around Earth.**
    - It was followed in November by the even larger Sputnik II, which carried the **dog Laika.**
- Only in late January 1958, the United States could launch **Explorer 1,** hoisted aloft by the Army’s rocket team, using rocket technology developed from World War II.
    - Though a small spacecraft weighing only 30 pounds, it discovered what are now known as the **Van Allen radiation belts,** named for the University of Iowa scientist Dr. James Van Allen, **launching the new discipline of space science.**
    - Explorer 1 was followed in March, 1958 by the Navy’s **Vanguard** 1, 6 inches in diameter and weighing only 3 pounds.
- NASA’s birth was directly related to the launch of the Sputniks and the ensuing race **to demonstrate technological superiority in space.**
- **Driven by the competition of the Cold War,** on **July 29, 1958,** President Dwight D. Eisenhower signed the **National Aeronautics and Space Act**, providing for research into the problems of flight within Earth’s atmosphere and in space.
- After a protracted debate over **military versus civilian control of space,** the act inaugurated a new **civilian agency designated** the National Aeronautics and Space Administration **(NASA).**

What are the Objectives of NASA?

- To expand human knowledge of space
- To lead the world in space-related technological innovation
- To develop vehicles that can carry both equipment and living organisms into space
- To coordinate with international space agencies to achieve the greatest possible scientific advancements.

What are the Different Missions of NASA?

- Over the last 60 years, the NASA has achieved every one of the aforesaid goals through various missions some of which are given below, and it continues to seek answers to some of the biggest mysteries in science as it evolves with a changing world.

Mission	Detail
Advanced Composition Explorer (ACE) Launched: 1997	▪ Observes particles of solar, interplanetary, interstellar, and galactic origins, spanning the energy range from solar wind ions to galactic cosmic ray nuclei.
The Aeronomy of Ice in the Mesosphere satellite (AIM) Launched: 2007	▪ Strange Clouds- Astronauts on board the International Space Station have been observing electric blue "noctilucent" clouds from Earth-orbit. ▪ Noctilucent or "night-shining" clouds (NLCs) are also known as Polar Mesospheric Clouds (PMC). ▪ The AIM satellite will orbit Earth at an altitude of 550 km. ▪ AIM will take wide angle photos of NLCs, measure their temperatures and chemical abundances, monitor dusty aerosols, and count meteoroids raining down on Earth.
The Apollo Missions Launched: 1968	▪ It resulted in American astronauts making a total of 11 space flights and walking on the moon. ▪ The first Apollo flight happened in 1968. The first moon landing took place in 1969. The last moon landing was in 1972.
Apollo-Soyuz: An Orbital Partnership Begins Launched: 1975	▪ The Apollo-Soyuz Test Project was the first international human spaceflight. ◦ This mission brought together two former spaceflight rivals: the United States and the Soviet Union. ▪ The Americans sent up an Apollo command module, while the Russians launched a Soyuz spacecraft.
Aqua Launched: 2002	▪ Aqua is an Earth Science satellite mission that collects information on our water systems. ▪ The satellite has six different Earth-observing instruments on board and streams approximately 89 gigabytes of data per day.
Aquarius Mission Operation: 2011 to 2015	▪ The joint U.S./Argentinian Aquarius /Satélite de Aplicaciones Científicas (SAC)-D mission was launched June 10, 2011, and ended on June 8, 2015, when an essential part of the power and attitude control system for the spacecraft stopped operating. ▪ Aquarius/SAC-D mapped the salinity (the concentration of dissolved salt) at the ocean surface, information critical to improving our understanding of two major components of Earth's climate system: the water cycle and ocean circulation. ▪ By measuring ocean salinity from space, Aquarius provided new insights into how the massive natural exchange of freshwater between the ocean, atmosphere and sea ice influences ocean circulation, weather and climate.
Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS) Operated: March 2, 2008 to April 20, 2008	▪ The Arctic is undergoing significant environmental changes related to global climate change. ▪ NASA is extensively studying the role of air pollution in this climate-sensitive region as part of the ARCTAS field campaign, the largest airborne experiment ever to do so.
Artemis Lunar Program Launched: May 2019	▪ The Artemis program, unveiled by NASA, aims to put astronauts on the lunar surface in 2024 — and give us the first female moonwalker. ▪ The initiative comes as the nation prepares to celebrate the 50th anniversary of the Apollo 11 landing in 1969, which made Neil Armstrong and Buzz Aldrin the first people to set foot on another world. ▪ The Greek god who became the namesake of NASA's Apollo program in the 1960s and ’70s had a twin sister named Artemis, will lead humans back to the moon.
Airborne Tropical	▪ Despite its low concentration, stratospheric water vapor has large impacts

TRopopause EXperiment (ATTREX) Launched: 2014	on the earth’s energy budget and climate. ▪ Recent studies suggest that even small changes in stratospheric humidity may have climate impacts that are significant compared to those of decadal increases in greenhouse gases. ▪ The ATTREX will perform a series of measurement campaigns using the long-range NASA Global Hawk (GH) unmanned aircraft system (UAS) to directly address these problems.
Aura - Understanding and Protecting the Air We Breathe Launched: 2004	▪ Aura (Latin for breeze) is a program dedicated to monitoring the complex interactions that affect the globe using NASA satellites and data systems. ▪ Aura's measurements will enable to investigate questions about ozone trends, air quality changes and their linkage to climate change.
BARREL (Balloon Array for Radiation-belt Relativistic Electron Losses- 2013 and 2014)	▪ It is a balloon-based Mission that seeks to measure the precipitation of relativistic electrons from the radiation belts during two multi-balloon campaigns, operated in the southern hemisphere (option for third northern hemisphere campaign). ▪ The BARREL consists of two Antarctic balloon campaigns conducted in Austral summers of 2013 and 2014.
CALIPSO (The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation): 2006	▪ The CALIPSO satellite provides new insight into the role that clouds and atmospheric aerosols (airborne particles) play in regulating Earth's weather, climate, and air quality. ▪ It was launched on April 28, 2006 with the cloud profiling radar system on the CloudSat satellite.
Cassini-Huygens Operation: 1997 to 2017	▪ The Cassini mission to Saturn is one of the most ambitious efforts in planetary space exploration ever mounted. ▪ A joint endeavor of NASA, the European Space Agency (ESA) and the Italian space agency, Agenzia Spaziale Italiana (ASI), Cassini is a sophisticated robotic spacecraft orbiting the ringed planet and studying the Saturnian system in detail. ▪ Cassini also carried a probe called Huygens, which parachuted to the surface of Saturn’s largest moon, Titan, in January 2005 and returned spectacular results. ▪ It entered Saturn's atmosphere on Sept. 15, 2017 and lost communication with NASA.
Chandra X-Ray Observatory Launched: By Space Shuttle Columbia in 1999.	▪ The Chandra X-ray Observatory is part of NASA's fleet of "Great Observatories" along with the Hubble Space Telescope, Spitzer Space Telescope and the now deorbited Compton Gamma Ray Observatory. ▪ Chandra allows scientists from around the world to obtain X-ray images of exotic environments to help understand the structure and evolution of the universe. ▪ It was named in honor of the late Indian-American Nobel Laureate, Subrahmanyan Chandrasekhar. Known to the world as Chandra (which means "moon" or "luminous" in Sanskrit), he was widely regarded as one of the foremost astrophysicists of the twentieth century.
CINDI: Coupled Ion Neutral Dynamic Investigation Operation: The C/NOFS satellite, which carried NASA's CINDI investigation was launched in 2008 and ended in 2015	▪ The CINDI studied the elements that influence space weather near Earth’s equator. ▪ The CINDI investigation is a key component of the science objectives of the Communication/Navigation Outage Forecast System (C/NOFS) undertaken by the Air Force Research Laboratory and the Space and Missile Command Test and Evaluation Directorate.
Clementine Operation: January 25, 1994 to 21 July 1994	▪ Clementine was a joint project between the U.S. Ballistic Missile Defense Organization and NASA. ▪ It was designed to test sensors and spacecraft components under extended exposure to the space environment and to make scientific observations of the Moon and the near-Earth asteroid 1620 Geographos.

Cloud-Aerosol Transport System (CATS) Operation: 2015 to 2017	▪ The CATS, is a lidar remote-sensing instrument that measured atmospheric aerosols and clouds from the International Space Station (ISS).
CloudSat: 2006	▪ The CloudSat is an experimental satellite that uses radar to observe clouds and precipitation from space.
Cluster ESA (European Space Agency)/NASA Mission: 1996	▪ Cluster is currently investigating the Earth's magnetic environment and its interaction with the solar wind in three dimensions.
Commercial Crew	▪ NASA's Commercial Crew Program is a partnership to develop and fly human space transportation systems.
The CGRO Mission (1991 - 2000)	▪ The Compton Gamma Ray Observatory (GRO) was a sophisticated satellite observatory dedicated to observing the high-energy Universe. ▪ Compton, at 17 tons, was the heaviest astrophysical payload ever flown at the time of its launch on April 5, 1991 aboard the space shuttle Atlantis. ▪ Compton was safely deorbited and re-entered the Earth's atmosphere on June 4, 2000.
COBE Operation: 1989 to 1993	▪ The purpose of the Cosmic Background Explorer (COBE) mission was to take precise measurements of the diffuse radiation between 1 micrometer and 1 cm over the whole celestial sphere.
Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) Launched: 2003	▪ The CHIPS is a NASA astrophysics spacecraft that targets the hot and diffuse nebulae at about a million degrees temperature.
CubeSats	▪ CubeSats are a class of research spacecraft called nanosatellites. ▪ CubeSats are built to standard dimensions (Units or “U”) of 10 cm x 10 cm x 10 cm. ◦ They can be 1U, 2U, 3U, or 6U in size, and typically weigh less than 1.33 kg (3 lbs) per U.
Curiosity: 2011	▪ A rover named Curiosity is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the red planet. ▪ Curiosity was designed to assess whether Mars ever had an environment able to support small life forms called microbes. ◦ In other words, its mission is to determine the planet's "habitability."
Cyclone Global Navigation Satellite System (CYGNSS) Launched: 2016	▪ The CYGNSS mission will use eight micro-satellites to measure wind speeds over Earth's oceans, increasing the ability of scientists to understand and predict hurricanes. ▪ Each satellite will take information based on the signals from GPS satellites.
Double Asteroid Redirection Test (DART) Mission Launched: 2021	▪ The DART is a planetary defense-driven test of technologies for preventing an impact of Earth by a hazardous asteroid.
The Dawn Operation: 2007 to 2018	▪ The Dawn was a mission to the two most massive bodies in the main asteroid belt – Vesta and Ceres. ▪ Vesta is rocky, while dwarf planet Ceres is icy. ◦ Each followed a very different evolutionary path, constrained by the diversity of processes that operated during the first few million years of the solar system. ▪ When Dawn visited Ceres and Vesta, the spacecraft brought us back in solar system time.

Earth Radiation Budget Satellite (ERBS) Operation: 1984 to 2005	▪ The ERBS was designed to investigate how energy from the Sun is absorbed and re-radiated by the Earth. ▪ Understanding this process helps reveal patterns in Earth's weather. It was launched on the Space Shuttle Challenger.
Ecosystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) Launched: 2018	▪ The ECOSTRESS measures the temperature of plants and use that information to better understand how much water plants need and how they respond to stress. ◦ It uses a multispectral thermal infrared radiometer to measure the surface temperature. ▪ The radiometer was deployed on the International Space Station in 2018. The radiometer will acquire the most detailed temperature images of the surface ever acquired from space and will be able to measure the temperature of an individual farmers field.
FAST (the Fast Auroral Snapshot Explorer) Operation: 1996 to 2009	▪ The FAST investigated the behavior of ionized gas, called plasma, and particles during auroras. ▪ As the FAST flew over the poles—the most common regions where auroras form—it took quick, high-resolution bursts of data on particles, electric and magnetic fields, and plasma.
Galileo Operation: 1989 to 2003	▪ The Galileo spacecraft orbited Jupiter for almost eight years, and made close passes by all its major moons. ▪ Its camera and nine other instruments sent back reports that allowed scientists to determine, among other things, that Jupiter's icy moon Europa probably has a subsurface ocean with more water than the total amount found on Earth.
Hubble Space Telescope Launched: 1990	▪ The NASA named the world's first space-based optical telescope after American astronomer Edwin P. Hubble (1889-1953). ◦ Dr. Hubble confirmed an "expanding" universe, which provided the foundation for the big-bang theory. ▪ The observatory is the **first major optical telescope** to be placed in space and has made groundbreaking discoveries in the field of astronomy since its launch (into **Low Earth orbit** in 1990). ◦ It is said to be the "most significant advance in astronomy since **Galileo's telescope."** ▪ It is a part of **NASA's Great Observatories Program** - a family of four space-based observatories, each observing the Universe in a different kind of light. ◦ The other missions in the program include the visible-light **Spitzer Space Telescope**, Compton **Gamma-Ray Observatory (CGRO**), and the **Chandra X-Ray Observatory (CXO)**.
IceBridge Mission Launched: 2009	▪ The IceBridge is the **largest airborne survey of Earth's polar ice** ever flown. ▪ It yields an unprecedented three-dimensional view of Arctic and Antarctic ice sheets, ice shelves and sea ice. ▪ Data collected during IceBridge will help scientists **bridge the gap in polar observations** between NASA's Ice, Cloud and Land Elevation Satellite (ICESat) - launched in 2003 and de-orbited in 2010 and ICESat-2, launched in 2018.
International Space Station (IIS)	▪ The ISS is a **multi-nation construction project** that is the largest single structure humans ever put into space. ▪ Its main construction was completed between 1998 and 2011, although the station continually evolves to include new missions and experiments. ▪ The NASA , Roscosmos (Russia) and the European Space Agency are the major partners of the space station.
The James Webb Space Telescope Launched: 2021	▪ The James Webb Space Telescope (sometimes called JWST or Webb) will be a large infrared telescope with a 6.5-meter primary mirror. ◦ It was **launched in December 2021.** ▪ It will find the first galaxies that formed in the early universe and peer

	through dusty clouds to see stars forming planetary systems.
Mars 2020 Rover Launching: 2020	▪ The rover will **search for signs of habitable conditions on Mars** in the ancient past and for signs of past microbial life itself.
Orion spacecraft: Underdevelopment	▪ The Orion is a new NASA spacecraft for astronauts. ▪ The spacecraft will play an important part in the journey to Mars. ▪ Orion will serve as the **exploration vehicle that will carry the crew to space, provide emergency abort capability, sustain the crew during the space travel, and provide safe re-entry from deep space return velocities.**
PACE (Plankton, Aerosol, Cloud, ocean Ecosystem) Launching: 2022	▪ The PACE is NASA's **Plankton, Aerosol, Cloud, ocean Ecosystem mission**, currently in the design phase of mission development. ▪ It will extend and improve NASA's over 20-year record of satellite observations of global ocean biology, aerosols (tiny particles suspended in the atmosphere), and clouds.
Rosetta Operation: 2004 to 2016	▪ Rosetta was a spacecraft on a ten-year mission **to catch the comet "67P/Churyumov-Gerasimenko" (C-G)** and answer some of our questions about comets. ▪ This was a European Space Agency mission with support and instruments from NASA. ▪ Rosetta was the first spacecraft to soft-land a robot on a comet.

- In March 2022, the **National Aeronautics and Space Administration (NASA)** rolled out its **Artemis I moon mission** to the launchpad for testing at the **Kennedy Space Centre in Florida, United States.**