NASA Facts

National Aeronautics and
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Goddard Space Flight Center
Greenbelt, Maryland 20771

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EXPLORERS: SEARCHING THE UNIVERSE FORTY YEARS LATER

Evolution of the Explorer Missions

From the days of the early explorers like Christopher Columbus and Magellan, there has always been an inherent desire in humanity to explore his surroundings. From the exploits of those early knowledge seekers, many incredible discoveries were made. So it is fitting and understandable that the first spacecraft launched by the Army Ballistic Missile Agency on Jan. 31, 1958 was named “Explorer”.

Since the first mission more than 70 U.S. and cooperative international scientific space missions have been part of the much celebrated Explorer program. Explorer satellites have made impressive discoveries: Earth’s magnetosphere and gravity field; the solar wind; micrometeoroids; ultraviolet, cosmic, and X-rays; ionospheric physics; solar plasma; energetic particles; and atmospheric physics. They’ve also investigated air density, radio astronomy, geodesy, and gamma ray astronomy. Some Explorer spacecraft have traveled to other planets, and some have monitored the Sun.

The mission of the Explorers Program is to provide frequent flight opportunities for scientific investigations from space. The Explorers Program enables the definition, development and implementation of mission concepts through a variety of modes to meet the needs of the scientific community and the NASA space science enterprise.

The First Decade: 1958-1967

During this period a total of 35 Explorer missions were successfully launched, leading to many wonderful discoveries. The mysterious saturation of the Explorer 1 radiation counters at 600 miles above the Earth’s surface led Professor James A. Van Allen to suggest the existence of a dense belt of radiation around the Earth. This, of course, became the now well known Van Allen Radiation Belt.

Drs. Van Allen, Pickering and Von Braun holding model of Explorer 1

Explorer 6 (1959) took the first photograph of Earth from space and Explorer 8 (1960) made confirmation of the existence of a helium layer in the upper atmosphere. Within the next 3 years other Explorer missions determined that the interplanetary magnetic field near earth is mainly an extension of the Sun's magnetic field; identified the Van Allen Belt as magnetosphere; discovered a belt of neutral helium atoms around the earth; and confirmed the existence of solar wind shock wave on the magnetosphere.

In Oct. 1964 the first use of ground based laser tracking for tracking and geodetic studies was accomplished with Explorer 22. Explorers 24 and 25, launched in Nov. 1964, represented the first dual launch of satellites ever.

Explorer 35, also known as IMP E, was launched in July 1967, and was the last Explorer of the decade. It provided a detailed study of earth's magnetosphere and discovered a large, empty, cavity or solar wind void behind the moon and away from the sun.

The Second Decade: 1968-1977

From Jan. 1968 to Oct. 1977, 20 successful Explorer launches occurred. Missions with acronyms such as GEOS, SOLRAD, RAE, IMP, SAS, SSS, MTS and AE were included. During this decade, Explorers helped to further expand our knowledge of space.

Explorer 38 (RAE-A) monitored strong, sporadic radio bursts from Jupiter while Explorer 42 (SAS-A) developed a catalog of celestial x-ray sources and discovered a "black hole".

Explorer 43 (IMP-I, 1971) provided the first observations of a quiet-time interplanetary electron component in the 20 KeV to 2 MeV energy range. In 1972, the MTS (Explorer 46) satellite measured meteoroid penetration rates in a protected target and obtained meteoroid velocity and impact flux data.

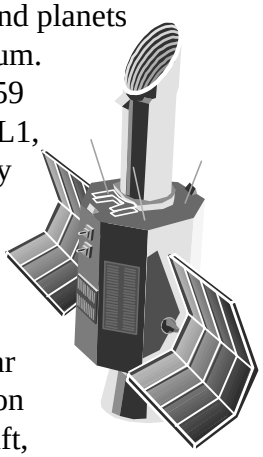
In Nov. 1972 the SAS-B spacecraft (Explorer 48) carried the most sensitive gamma ray detector orbited to date. It performed a sky survey of high energy gamma radiation from the celestial spheres.

As the decade drew to a close NASA launched Explorer 55 (AE-E) in order to measure ozone in the upper atmosphere with an eye toward determination of ozone depletion from man-made causes. Then, after a hiatus of 2 years the last Explorer mission of the decade, Explorer 56 (ISEE-1) was launched in Oct. 1977.

The Third Decade: 1978-1987

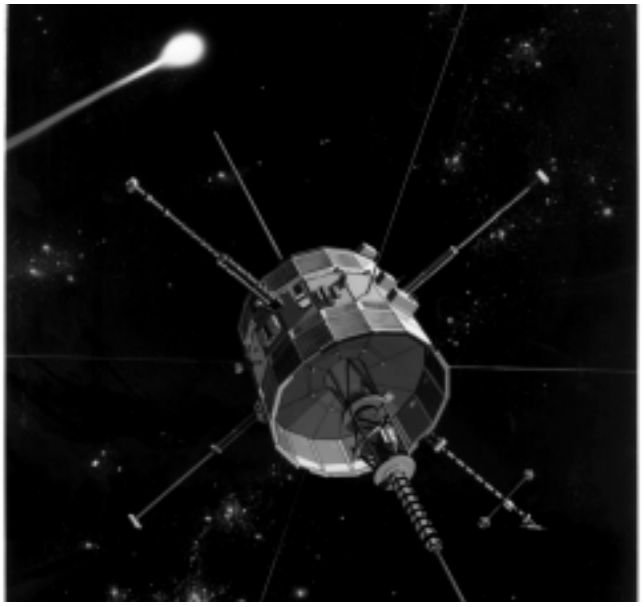
The Explorer flight rate was reduced significantly during this period. Three launches occurred in 1978, two in 1979, three in 1981 and one in 1984. This did not mean, however, that the science produced by these missions was diminished in any way.

The Explorer 57 mission (IUE-A) was launched in Jan. 1978 and successfully obtained high-resolution data on stars and planets in the UV region of the spectrum. Seven months later, Explorer 59 (ISEE-3) was launched to the L1, libration point in order to study the solar wind and solar-terrestrial relationships. After successfully completing this part of its mission ISEE-3 did a series of maneuvers and lunar flybys, then was commanded on a new trajectory. The spacecraft, now known as ICE, encountered Comet Giacobini-Zinner in 1985. It also provided long range observations of Comet Halley in 1986. ICE is due to return to the vicinity of Earth in the year 2014, when it might be recaptured and returned home. If so, ICE will reside in the Smithsonian Air and Space Museum.


IUE Spacecraft

Explorer 61, known as MAGSAT, was launched in Oct. 1979. During its short (planned) seven month lifetime MAGSAT provided the most accurate measurements of the global field ever obtained, and the first measurements of the vector field in low-earth orbit.

Another dual launch occurred in Aug. 1981 when NASA launched the Dynamic Explorers (Explorers 62 and 63). These satellites acquired the first global images of the aurora.



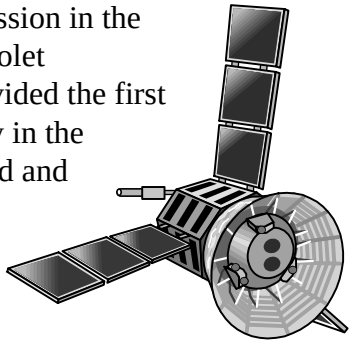
Artist concept of ISEE 3 in Orbit

The last flight of the decade occurred in Aug. 1984 when the Active Magnetospheric Particle Tracer Explorer (AMPTE) mission was launched. The U.S. Charge Composition Explorer (Explorer 65) was one of three spacecraft simultaneously launched on a Delta rocket. The other spacecraft were from the Federal Republic of Germany and the U.K. AMPTE was a real time, interactive, experiment that studied the access of solar-wind ions to the magnetosphere, the convective-diffusive transport and energization of magneto-spheric particles, and the interactions of plasmas in space. It was the first mission to create an artificial comet.

The Fourth Decade: 1988-1997

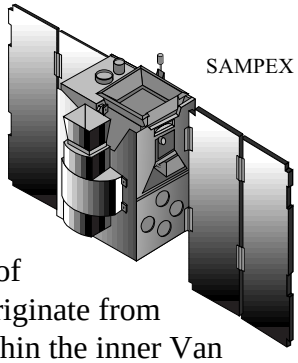
The first Explorer to be launched in this decade was Explorer 66, the Cosmic Background Explorer (COBE) in Nov. 1989. COBE revolutionized the field of cosmology by providing strong evidence in support of the "Big Bang" theory of the creation of the Universe. Recent results from COBE have resulted in assembly of the first definitive detection of a background infrared glow across the sky produced by dust warmed by all the stars that have existed since the beginning of time.

Explorer 67, the Extreme Ultraviolet Explorer (EUVE), was launched in June 1992. It was NASA's first major mission in the field of extreme ultraviolet astronomy. EUVE provided the first complete all sky survey in the extreme ultraviolet band and is still providing valuable data.



COBE Satellite

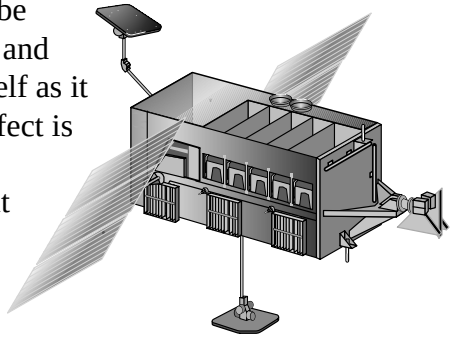
Explorer 68 was the first of NASA's new Small Explorer (SMEX) program. SMEX missions are designed to be small, quickly put together and relatively inexpensive. The Solar Anomalous and Magneto-spheric Particle Explorer (SAMPEX) was launched on a Scout rocket and has already confirmed the existence of a newly discovered belt, composed of trapped heavy nuclei that originate from the interstellar medium, within the inner Van Allen belt.



SAMPEX

The Rossi X-Ray Timing Explorer (Explorer 69) was launched in Dec. 95.

It has already made a number of significant discoveries including observation of a black hole that appears to be dragging space and time around itself as it rotates! This effect is called "frame dragging" and it is something that Einstein's Theory of Relativity predicts. This is the first time that physical evidence to support this aspect of Einstein's 1918 theory has been available.

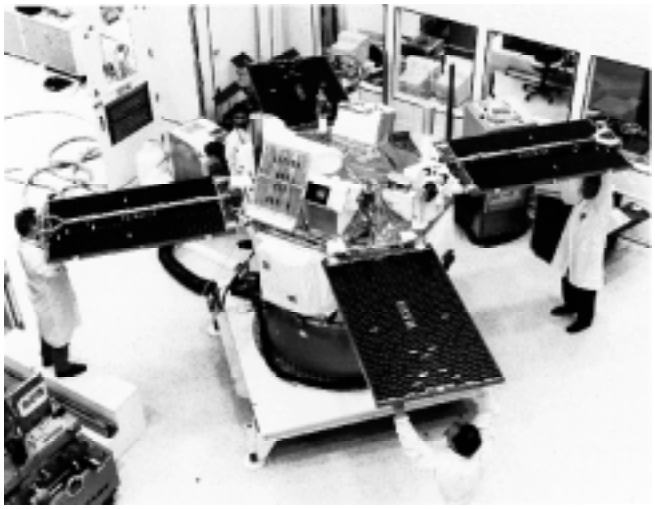


Rossi X-Ray Timing Explorer

The second of the SMEX series was launched as Explorer 70 in Aug. 1996. The Fast Auroral Snapshot Explorer (FAST) is designed to make observations of the Earth's auroras.

In Aug. 1997, Explorer 71, NASA's Advanced Composition Explorer (ACE) was launched toward a station at the L1, libration, point where it

will provide data that will help us understand the origin of the matter in our bodies, the Earth, and the universe as a whole. In addition, data will be provided to NOAA on a real time, continuous, basis in order to provide for the first ever Real Time Solar Wind (RTSW) monitor of space weather. NOAA recently put RTSW on-line.



Advanced Composition Explorer

The next Decade: 1998-2007

The Explorer Program continues to be active. The year 1998 will be a particularly active launch year, with no less than four launches planned. The Student Nitric Oxide Explorer (SNOE) and the Transition Region and Coronal Explorer (TRACE) missions have already been launched. Other 1998 missions are the Tomographic Experiment using Radiative Recombinative Ionospheric EUV and Radio Sources (TERRIERS) and the Wide-Field Infrared Explorer (WIRE). The Far Ultraviolet Spectroscopic Explorer (FUSE) and the Submillimeter Wave Astronomy Satellite (SWAS) will be launched early in 1999 capping a particularly productive period in recent Explorer history. The SNOE and TERRIERS missions are the precursors of the very small University Explorers (UNEX) class missions. TRACE, WIRE and SWAS are continuations of the highly successful SMEX class missions. FUSE is the first of the medium sized (MIDEX) missions.

In development at this time are the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) mission, the Microwave Anisotropy Probe (MAP) mission, the High Energy Solar Spectroscopic Imager (HESSI) SMEX mission and the Galaxy Evolution Explorer (GALEX) SMEX mission. The next decade promises to be every bit as productive as the decades preceding it.

Management

The Explorers Program Office at Goddard Space Flight Center in Greenbelt, Md. Provides management of the multiple scientific exploration missions in the Explorer space flight program. The missions are characterized by relatively moderate cost, and by small to medium sized missions that are capable of being built, tested and launched in a short time interval compared to the large observatories.

Web Sites

ACE: http://www.gsfc.nasa.gov/ace/ace.html
EUVE:http://www.cea.berkeley.edu
FAST: http://sunland.gsfc.nasa.gov/smex/fast/
FUSE: http://fuse.pha.jhu.edu
GALEX: http://www.srl.caltech.edu/galex/
HESSI: http://hesperia.gsfc.nasa.gov
HETE-II: http://space.mit.edu/HETE/
IMAGE: http://image.gsfc.nasa.gov/
MAP: http://map.gsfc.nasa.gov/
MIDEX: http://midex.gsfc.nasa.gov/
RXTE: http://heasarc.gsfc.nasa.gov/docs/xte/xte_1st.html
SAMPEX: http://lepsam.gsfc.nasa.gov/www/sampex.html
SMEX: http://sunland.gsfc.nasa.gov/smex
SNOE: http://lasp.colorado.edu/snoe/home.html
SWAS: http://sunland.gsfc.nasa.gov/smex/swas/
TERRIERS: http://net.bu.edu/terriers/terriers.html
TRACE: http://sunland.gsfc.nasa.gov/smex/trace/index.html
WIRE: http://sunland.gsfc.nasa.gov/smex/wire/