NASA Facts

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771
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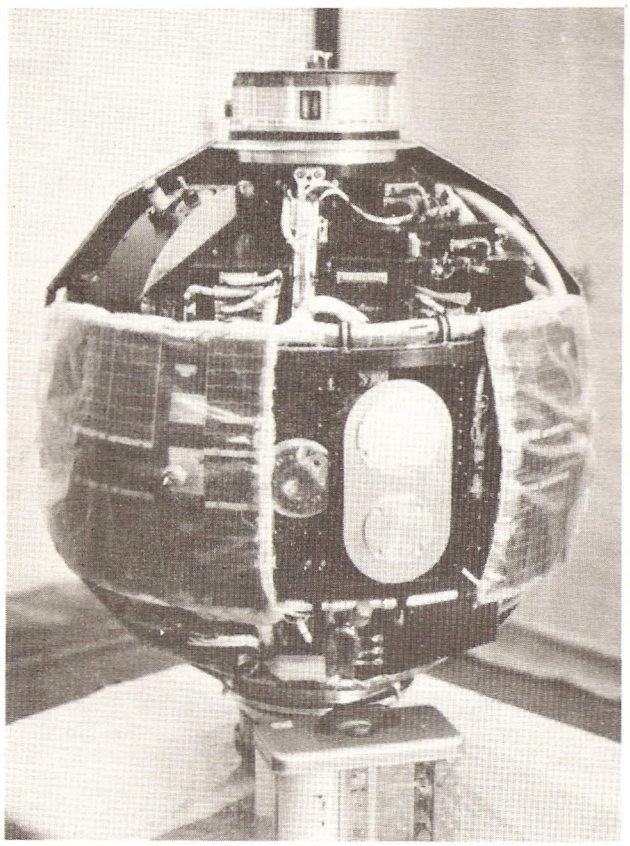
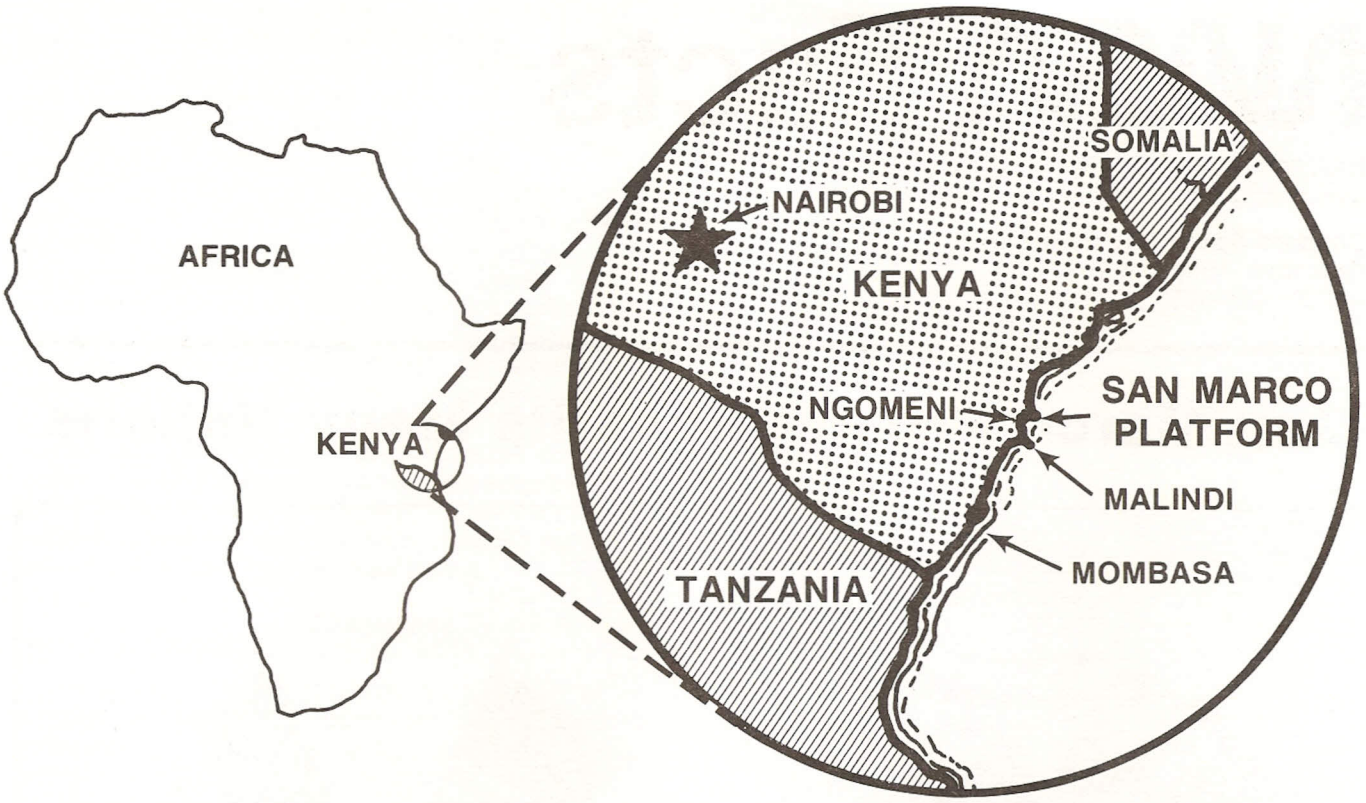
San Marco Project Benefits Many Nations



The San Marco D/L satellite, shown above, is part of the San Marco Project, an international cooperative project which was initiated in 1962 between Italy and the United States.

When the San Marco D/L spacecraft, an international satellite designed to make studies of the lower atmosphere, is placed into orbit in the fall of 1987, the launch will be conducted from the San Marco Equatorial Range in Kenya, Africa, by an Italian Air Force crew. Although launch preparations will take place many miles from the United States, the contributions of NASA employees, especially personnel at the Goddard Space Flight Center, are crucial to the success of this mission.

The San Marco D/L (the L stands for low orbit) spacecraft will be the fifth launch of the San Marco Project, a joint and cooperative space program between NASA and the Centro Ricerche Aerospaziali (CRA) (the Aerospace Research Center of the University of Rome).



San Marco D/L will be launched from the Italian equatorial launch site which is located in Ngwana Bay in the Indian Ocean approximately 90 miles north of Mombasa, Kenya in Africa.

International Cooperative Program

The San Marco Project, which was formalized on May 31, 1962, is part of NASA's international cooperative program. The objective of this program is to pursue space research with the participatory country for the mutual benefit of both by entering into joint scientific programs wherein contributions of space research systems, including their cost and management responsibilities, are shared mutually.

NASA's international activities are planned to provide opportunities for the participation of scientists and agencies of other countries in the task of increasing mankind's understanding and use of the spatial environment. The activities follow guidelines which establish a basis for sound programs of mutual value and contribute to the objectives of international cooperation.

Exploring the Lower Atmosphere

Our interest in solar-terrestrial relationships has centered on studies of the Earth's atmosphere. Many past and future satellites have and will continue to investigate atmospheric changes. While all levels of the atmosphere have been targeted for studies, most of the known phenomena relating solar activity and the atmosphere occur in the thermosphere (the atmospheric layer that begins about 50 miles above the Earth's surface and extends to outer space). Possible relationships between solar activity and meteorological phenomena have been suggested by a multitude of studies, but general acceptance of these relationships is lacking. The potential for great scientific and practical gain from identifying possible relationships in this area and the opportunity for exploitation of new knowledge about the thermosphere provide a motivation for the San Marco Project.

The launching of the San Marco D/L from the San Marco Equatorial Range will allow the satellite to be placed in equatorial orbit 277 by 685 kilometers (185 by 418 statute miles). Its inclination will be 2.9 degrees, and it will circle the Earth every 100 minutes. An equatorial orbit was selected because the greatest solar-terrestrial effects are believed to occur in this region.

The primary objective of the San Marco D/L is to explore the possible relationship between solar activity and meteorological phenomena. A second objective is to determine the solar influence on low atmosphere phenomena through the thermosphere by obtaining simultaneous measurements necessary for the study of dynamic processes occurring in, and possibly linking, the troposphere, stratosphere, and thermosphere.

San Marco Design and Structure

The San Marco D/L was designed and built by the CRA. Its basic design is derived from the San Marco C configuration (launched in April 1971) with changes to accommodate a larger diameter. The use of the 107-cm (42-in.) Scout launch vehicle heat shield allows this larger diameter. These modifications result in a total spacecraft mass of 237 kg (522 lbs.). The San Marco D/L is a 96.5-cm (38-in.) diameter sphere with four canted 48-cm (18-in.) monopole antennas for telemetry and command.

The spacecraft will carry five scientific instruments: one of the instruments is from Italy, one from West Germany, and three are from the United States. The San Marco D/L power supply subsystem consists of a solar cell array split into two sections, two rechargeable nickel-cadmium batteries, and the associated control and regulation circuits.

The Instruments: Collecting Data on the Thermosphere

The five instruments, which the San Marco D/L will carry, are integrated with the housekeeping systems and compatible to the communications subsystem used on the spacecraft.

The Neutral Atmosphere Density (Drag Balance) experiment, the Italian instrument, is designed to measure drag forces on the satellite in orbit. The instrument consists of an inner mass, an elastic element, and an outer shell. The drag balance is the connecting elastic element between the outer light shell and the inner heavy body. This experiment will register any force acting on the outer shell in any direction. These forces, which cause a relative displacement of the shell with respect to the internal body only in the direction of the applied force, will be recorded and examined by scientists.

The West German instrument is the Airglow Solar Spectrometer, sponsored by the Institut fur Physikalische Weltraumforschung (IPW) in Frieburg. The Airglow Solar Spectrometer instrument will measure the solar radiation reflected from the surface and clouds, the solar radiation and the radiation of interplanetary and intergalactic origin reaching the satellite, and the equatorial day and night airglow (observable light that originates in the high atmosphere and is associated with photochemical reactions of gases caused by solar radiation). Airglow is radiated by resonance scattering from atomic hydrogen, helium, and atomic oxygen, and dayglow results from scattering from molecular nitrogen.

Two of the U.S. instruments are from the Goddard Space Flight Center. The Wind and Temperature Spectrometer (WATS) will measure the in-situ neutral winds, neutral particle temperatures, and the concentration of selected gases. The Three-Axis Electric Field Instrument will measure the electric field surrounding the spacecraft in orbit.

The third U.S. instrument is the Ion Velocity Instrument from the University of Texas at Dallas. It will measure the bulk velocities of ambient ions in the spacecraft frame. In addition, the instrument will measure the ambient plasma concentration and the ion temperature. Together with other instruments, the Ion Velocity Instrument will aid in finding the answer to significant questions concerning the nature of equatorial plasma turbulence, the bulk coupling of ion and neutral gas motions, and the sunspot maximum thermal behavior of the ionosphere.

History of the San Marco Project

After successfully establishing an Italian Space Program in 1961, the Italian Space Commission desired to further scientific research in such a way as to train people and to prepare the Italian National Industries for future and more ambitious programs. To achieve these goals, the Italian Space Commission formulated and proposed the San Marco Project.

The San Marco Project would gather previously unavailable measurements of atmospheric properties at altitudes around 231 ki (144 miles) at the Equator by placing the first satellite in equatorial orbit.

To eliminate the cost of performing a dog-leg maneuver to insert a satellite into equatorial orbit, the CRA proposed a seaborne launch platform system in Kenya, Africa.

In October 1961, the Italian Space Commission presented the San Marco Project proposal to NASA, and the project was formalized on May 31, 1962.

On December 15, 1964, the San Marco A was launched from Wallops Island marking the first time in NASA's international cooperative program that a satellite launch operation had been conducted by a team of foreign nationals and the first use of a satellite fully designed and built in Western Europe.

The San Marco B was the first satellite launched from the San Marco Equatorial Range in Kenya and the first one to be placed in equatorial orbit. This occurred on April 26, 1967.

The San Marco C1 was launched on April 24, 1971, and the San Marco C2 was launched on February 18, 1974.

NASA's Role in San Marco Project

In addition to being responsible for three of the instruments aboard the San Marco D/L, NASA also will support this mission by providing equipment and services.

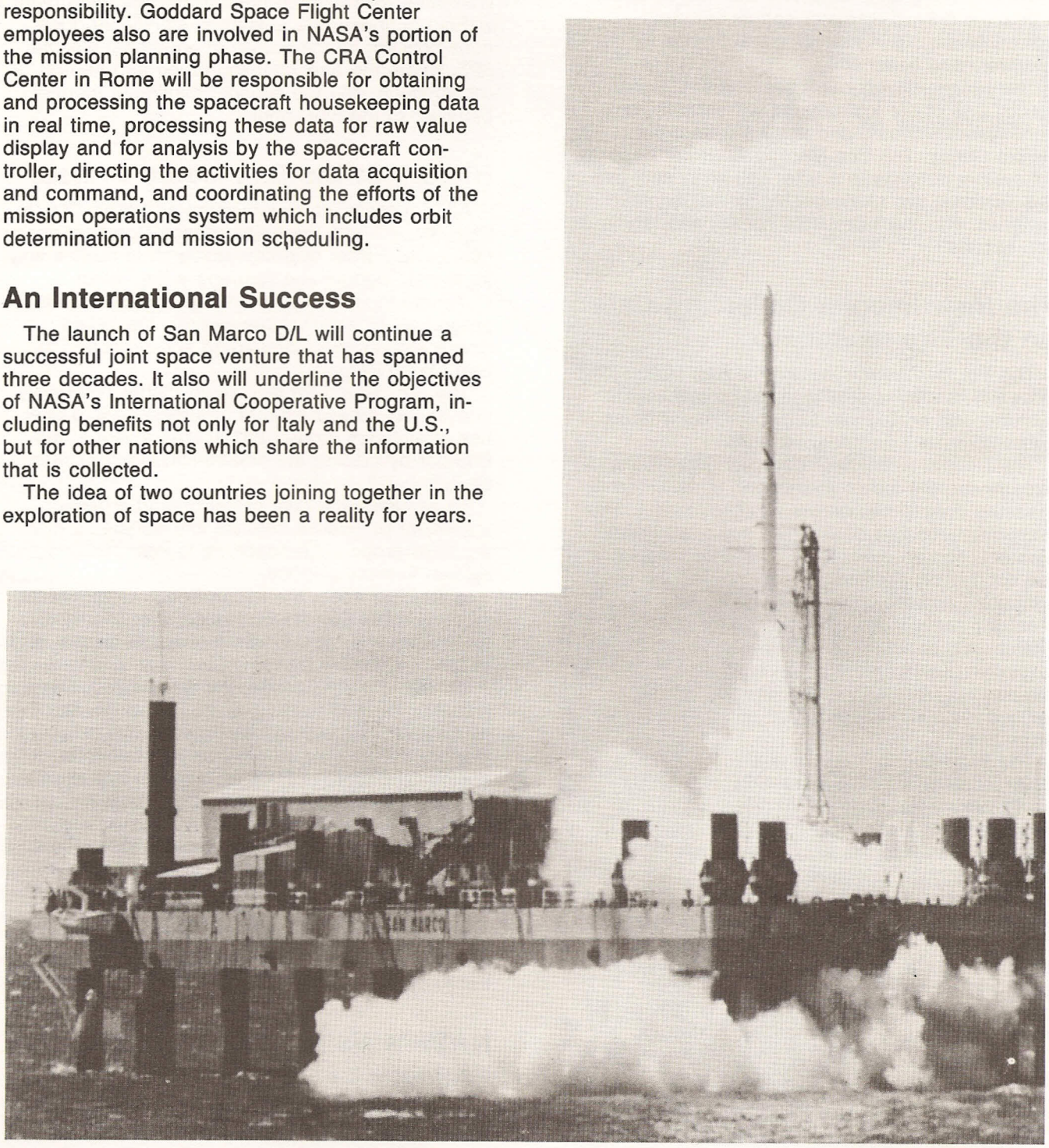
The Langley Research Center will provide the Scout vehicle for the launch, and NASA employees, along with CRA personnel, will support the spacecraft from the San Marco Equatorial Range. The Scout is built by the LTV Aerospace and Defense Company of Dallas, Texas.

A portion of Goddard's Multi-Satellite Operations Control Center (MSOCC) can be used to support the CRA control center which has the prime responsibility. Goddard Space Flight Center employees also are involved in NASA's portion of the mission planning phase. The CRA Control Center in Rome will be responsible for obtaining and processing the spacecraft housekeeping data in real time, processing these data for raw value display and for analysis by the spacecraft controller, directing the activities for data acquisition and command, and coordinating the efforts of the mission operations system which includes orbit determination and mission scheduling.

An International Success

The launch of San Marco D/L will continue a successful joint space venture that has spanned three decades. It also will underline the objectives of NASA's International Cooperative Program, including benefits not only for Italy and the U.S., but for other nations which share the information that is collected.

The idea of two countries joining together in the exploration of space has been a reality for years. Italy and the U.S. both recognize that the information and knowledge gained from joint space exploration can have an effect on the future of all nations, and it is this recognition that ties the two nations together not only as business partners, but also as partners who are making the future of the world their business.



The San Marco B spacecraft was successfully launched from the San Marco platform by a Scout vehicle on April 26, 1967, to become the first satellite to be placed in equatorial orbit.