NASA
National Aeronautics and Space Administration
Goddard Space Flight Center

Goddard News

Greenbelt, Maryland and Wallops Island, Virginia

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Problems Postpone TDRS-B Launch

Problems associated with the Tracking and Data Relay Satellite (TDRS-B) have resulted in a decision to cancel the March 7 flight of the Space Shuttle Challenger.

In addition to repairing the previously announced problem with one cell of TDRS' 24-cell flight battery, NASA officials have determined that it also is necessary to remove the TDRS from the Shuttle cargo bay to repair a timing problem. This problem came to light during recent testing of the TDRS-1, a similar satellite now in orbit.

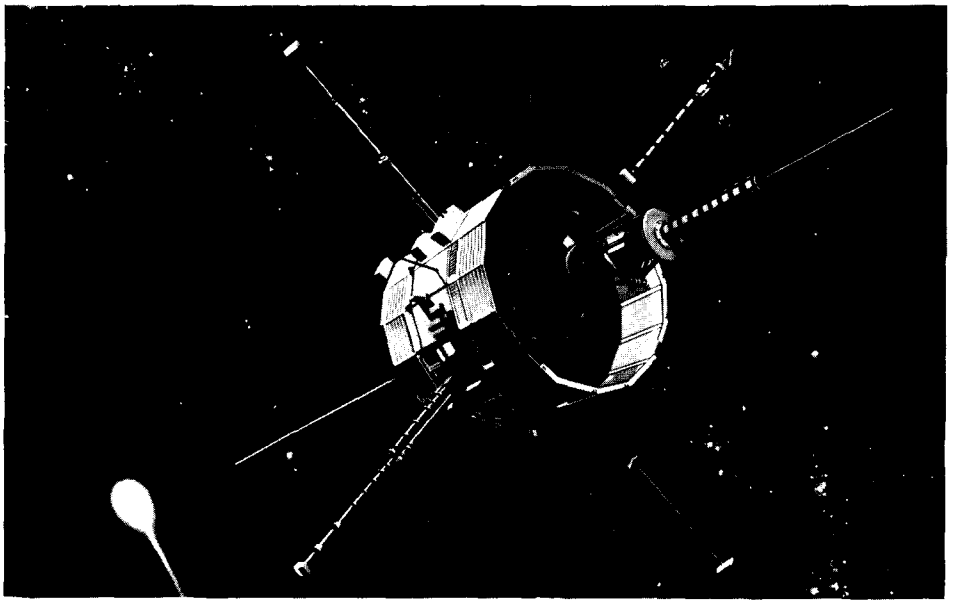
Under certain operational conditions the timing circuits could cause errors in the system switching sequences. These errors in turn would unacceptably interrupt user support. This problem was confirmed in tests run at the spacecraft contractor facilities on February 27 and 28.

NASA and its contractors are presently evaluating the spacecraft modifications necessary for TDRS-B and subsequent spacecraft. Operational procedures have been developed to satisfactorily operate the single on-orbit spacecraft (TDRS-1). However, this approach is not acceptable for multiple spacecraft operations.

The TDRS spacecraft has encryption devices installed to protect the system from interfering signals. It is therefore impossible to provide further technical detail regarding the problem without exposing the nature of the protection system.

It is expected that a delay of several weeks will be necessary to make modifications. As soon as a definite schedule for the spacecraft modification is determined, TDRS-B will be remanifested.

The Anik-C (Telesat-I) satellite from the STS 51-E mission will be placed aboard the Discovery orbiter and deployed on the STS 51-D mission along with a Hughes Syncom satellite. The Long Duration Exposure Facility (LDEF) which was to have been retrieved on the 51-D mission will remain in orbit and will be retrieved on a future Shuttle mission.



ICE SPACECRAFT—Above is an artist's concept of the International Cometary Explorer (ICE) satellite. ICE will encounter with Comet Giacobini-Zinner this September 11.

International Cometary Explorer

First Space Probe To Comet Now Halfway To Target

The first space probe to attempt to fly through a comet's tail is streaking towards an encounter with Comet Giacobini-Zinner this September 11 at 7:00 AM EDT.

The space probe, the International Cometary Explorer (ICE) is now half the distance to its target. Previously, the spacecraft launched in 1978 was known as the International Sun-Earth Explorer 3 (ISEE-3).

With a delicate series of trim burns, beginning with a major course correction May 16, controllers will refine the space probe's trajectory to intercept the comet as the two bodies close at a relative velocity of 21 kilometers per second (13 statute miles per second).

"This is one of the tougher bull's eyes a spacecraft has tried to hit," says Dr. Robert Farquhar, the Goddard flight director for the misson. "The comet is constantly varying slightly within its orbital path as material outgasses from its nucleus."

First Encounter

The bull's eye is a point in the tail about 10,000 kilometers (6,200 statute miles) from the comet's head, as near as the space probe dares go without risking damage from cometary debris. If the intercept succeeds, it will provide scientists with their first on-the-spot opportunity ever to study a comet's tail.

"With ICE we should get our first direct sampling of the important features of a cometary tail," says ICE Project Scientist Dr. Tycho Von Rosenvinge. "These features include the magnetic fields which define the tail's shape and the plasma of electrified gases making up its content."

At the same time, the scientists will have the chance to see how the tail interacts with the solar wind (the flow of charged par-

Continued on page two

Applications Technology Satellite Completes 18 Years Service

by Carter Dove

After more than 18 years in orbit, the Applications Technology Satellite (ATS-1) is literally running out of gas.

Robert O. Wales, ATS project operations director at NASA's Goddard Space Flight Center, has reported that "the ground control station at Hawaii no longer can keep ATS-1 on station and she will likely drift out of a useful orbit in the next 6 months."

The problem: The satellite appears close to exhausting its hydrogen peroxide gas for orbital maneuvering.

Launched in December, 1966 — with an expected lifespan of 3 years — ATS-1 is currently providing voice and data communications service to several educational networks in the Pacific Basin.

Wales indicated that project officials, until recently, had believed that ATS-1 had enough fuel on board for proper station-keeping (positioning in orbit) to provide useful service for another 5-10 years from its geostationary position over the Gilbert Islands of the western Pacific (165° east longitude).

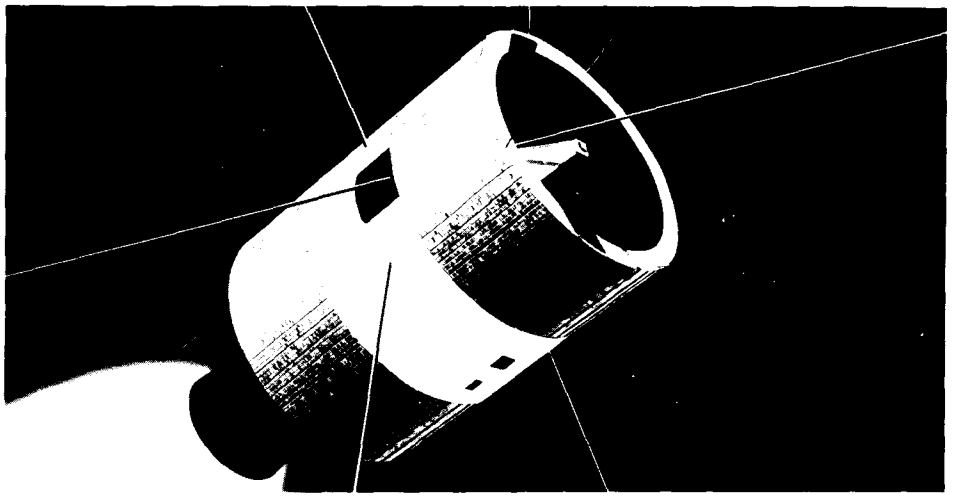
During its lifetime, ATS-1 has compiled a notable record. A few of the highlights are:

- First transmission of full Earth cloud cover pictures from synchronous orbit — forerunner of TV weather pictures (1967).
- First transmission of real time television pictures of the Apollo IV splashdown, transmissions beamed around the world (1967).
- Transmission of Electrocardiographs (EKG) from Hawaii to New Zealand and from Alaska to the University of Washington, 1973.
- Link-up between US and USSR scientists during an experiment with atmospheric, sea and ice conditions in the Bering Sea. 1971.
- Presentation of medical conferences over "PEACESAT" network consisting of 12 nations in conjunction with the University of Hawaii, 1971-78.
- Completion of 2-way communication tests involving airlines in normal flights and maneuvers to determine aircraft orientation effects on satellite communications. (Performed with the Dept. of Transportation, Federal Aviation Admin. and the airlines, 1967-68.)

One of the unique services of ATS-1 was its Alaskan "Doctor Call", considered by the medical world as the first innovative approach to rural medicine in this country. Through ATS-1, Public Health Service physicians were able to communicate every day with "health aides" — chosen by the village councils of the Alaskan bush and trained as paramedics for 6 weeks in the VA hospital at Fairbanks.

Loss of the ATS-1 will effectively dissolve the major user of the system, the PEACESAT network. PEACESAT (Pan Pacific Education and Communication Experiments by Satellite) currently reaches 23 autonomous terminals located in Honolulu, New Zealand, Cook Islands, Mariana Islands, Caroline Islands, Western and American Samoa, the Marshall Islands, Melanesia and Australia. PEACESAT programming covers educational, health, research, technology and community services projects.

The loss of ATS-1 will leave one other comparable satellite, ATS-3, launched November, 1967 in operation. Positioned at 105° west longitude (over the Pacific south of Mexico) the ATS-3 covers the U.S., most of the Atlantic and a large part of the Pacific, including Hawaii.



ATS-1 LAUNCH—An artist's conception of ATS-1 going into geostationary orbit at the time of its launch in 1966.

Cometary Explorer

Continued from page one

ticles and energy streaming from the Sun outward through the solar system).

"Both areas of study," notes Goddard's ICE Cometary Scientist Dr. Jack Brandt, "will complement the multi-national probes to Halley's comet in March 1986."

Scientists To Visit

A number of the world's most distinguished space scientists are expected to visit Goddard during the encounter to share the excitement. The NASA Headquarter's Planetary Office has invited members of the Inter-Agency Consultative Group (including scientists from Europe, Japan, the U.S.S.R. and the U.S.) to the Center while they attend meetings in Washington, D.C.

The ICE mission is considered remarkable because of its daring orbital mechanics, which, among other things, took the spacecraft skimming by the moon on five different occasions. ICE also has made headlines as one of the world's least expensive space missions.

"The spacecraft originally was launched in 1978 to study the Sun-Earth environment by orbiting a libration point in space between the two bodies," says ICE Project Manager Pat Corrigan. "It already has paid for itself once by completing that assignment."

Goddard controllers redirected the spacecraft on a two-part target-of-opportunity mission in 1982: first to study the Earth's geomagnetic tail and now to encounter Comet Giacobini-Zinner.

Get Away Special Program To Launch First Satellites

NASA plans to launch two, small experimental satellites from Get Away Special (GAS) containers mounted in the cargo bay of the Orbiter Discovery during the STS 51-B mission, scheduled for no earlier than April 30, 1985.

The spacecraft, the Global Low Orbiting Message Relay (GLOMR) and the NUSAT, Northern Utah Satellite, will be launched for $10,000 each under the GAS program, managed by the Goddard Space Flight Center. Officials hope to establish an inexpensive way to launch small satellites during routine Shuttle operations.

The 51-B mission will be the first attempt at launching satellites from GAS containers.

The GAS containers have been upgraded with ejection systems for the 51-B mission, according to Clarke Prouty, technical liaison officer for the GAS program at Goddard.

"We also developed a motorized door for the can similar to the one first flown on STS-7, which allowed the GAS payload to be exposed to space. The new design is called the Full Diameter Motorized Door Assembly (FDMDA)."

Prouty said the FDMDA enables the GAS container to be insulated before and after the satellite is launched; and, it provides a means for retaining the satellite in the container in case of a malfunction. He explained that the spacecraft separation system used in the Delta rocket program had been adapted for these ejection systems.

While the first two satellites are "roughly 19-inch spheres," Prouty said, future GAS satellites may measure up to 48 cm (19 inches) in diameter, 52 cm (20½) inches in length and weigh 68 kg (150 pounds). They will be launched into 320 km (200 mi), 57 degree orbits, the same orbital parameters the Shuttle will be operating at during the mission.

The GLOMR satellite is a data relay, communication spacecraft and is expected to remain in orbit for approximately one year. It was designed and built by Defense Systems Inc. (DSI), McLean, VA. Project Manager is Dr. George S. Sebestyen, president, DSI.

NUSAT is an air traffic control radar system calibrator. It will measure antenna patterns for ground-based radars operated in the U.S. and in member countries of the International Civil Aviation Organization. NUSAT has an expected lifetime of approximately six months, and was designed, built and tested by Weber State College, Ogden, Utah, in coordination with the Federal Aviation Administration. Project Manager is Dr. Rex Megill of the Center for Atmospheric and Space Science, Utah State University, Logan, Utah.

The two satellites will be launched at the end of the Spacelab III science activities on the sixth day of the seven-day 51-B mission. NUSAT is scheduled to be ejected first, and GLOMR shortly thereafter. Satellite operations following ejection from the orbiter will be controlled from independent user ground stations.

The GAS program is available to anyone who wishes to fly a small experiment aboard the Shuttle. Space is made available in 2½- and 5-cubic feet containers, and experiments must be of a scientific research and development nature.

1985 Launch Schedule

Vehicle	Crew	Duration	Date	Payload
51-D Discovery	7	5	Apr	ANIK C-1 comsat/Telesat Canada; Continuous Flow Electrophoresis System; and LEASAT-3 comsat/Hughes Comm.
Atlas Centaur-63	—	—	April	INTELSAT V-A comsat
51-B Challenger	7	7	4-30	SPACELAB 3: Long Module and Special Structure
51-G Discovery	5	7	June	TELSTAR 3-D comsat for AT&T MORELOS-A comsat for Mexico ARABSAT-A comsat/Saudia Arabia SPARTAN-1 special structure French medical experiments
51-F Challenger	7	7	7-9	SPACELAB 2 w/3 pallets, igloo/Instrument Pointing System
Atlas Centaur-64	—	—	Jul	INTELSAT V-A comsat
51I 51J			Aug —	Dedicated DOD mission
Atlas Centaur-65	—	—	Oct-Nov	FLTSATCOM comsat/U.S. Navy
Delta	—	—	Oct-Dec	GOES-5 metsat for NOAA

Astronauts Train For GRO Mission

Astronauts have begun training on a mockup of the Gamma Ray Observatory (GRO) in the huge water tank at Johnson Space Center, according to project officials at Goddard.

The mockup of the spacecraft was shipped from the TRW plant at Redondo Beach, CA, by truck to the Houston facility, officials said. Astronauts participating included George Nelson and James vanHoften, both of whom flew on the STS 41-C mission that repaired the Solar Maximum Mission satellite.

GRO is a Goddard project. It is scheduled for launch in 1988.

Wallops Hosts Meteorological Instruments Comparison Tests

By Joyce Milliner

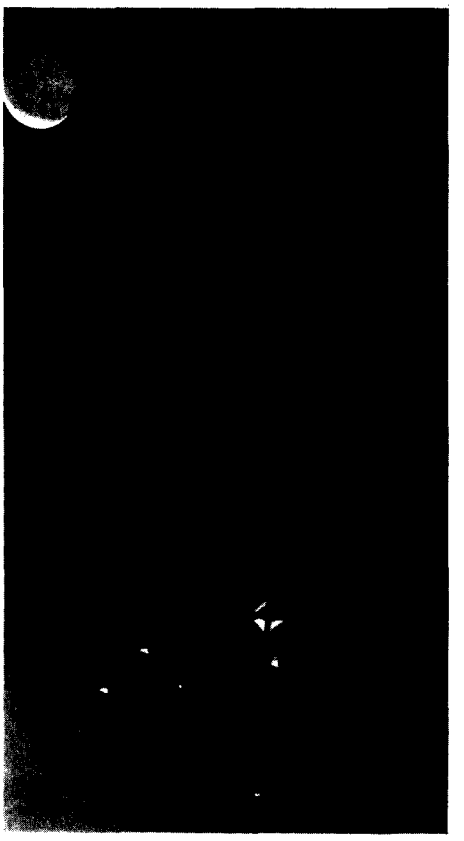
Technical/scientific teams from four countries—Australia, India, Finland and the United States—met recently at Wallops to compare radiosonde instruments used worldwide. This six week meeting, which began February 4, ended this week.

The radiosonde is a low-cost, mass produced instrument designed for measuring atmospheric pressure, temperature, relative humidity and wind while ascending on a small balloon. It is a small device, measuring only a few inches square and weighing less than two pounds.

Measurements are generally made between the Earth's surface and approximately 25 kilometers (15 miles) above the Earth, although an increasingly large number of measurements are now exceeding 30 kilometers (18 miles) altitude. These data are used by worldwide weather services for forecasting, as an aid to aviation, and for research.

Currently, there are 17 manufacturers of radiosondes, including the United Kingdom, France, the USSR, and others, in addition to those tested at Wallops Island. Because differences occur occasionally in the measurements made from these instruments comparisons are desirable from time to time.

In November 1982, a Working Group concerned with the quality of meteorological data met at the World Meteorological Organization's (WMO) Headquarters in Geneva, Switzerland, and agreed that two tests, or phases, because of the large number of potential participants, were necessary. The United Kingdom Meteorological Office hosted the first phase in 1984. During that meeting, held at Beaufort Park, United Kingdom, 106 balloons were released which obtained comparisons of the radiosondes of the United Kingdom, Finland, Federal Republic of Germany and the United States. Participants at Wallops Flight Facility launch four balloons a day, five days a week, weather permitting, for Phase 2 of the tests. Each balloon carried four or more instruments. About 100 balloon flights were scheduled, and the data received are to be related with Phase 1 results. Analysis of the data will take about a year.

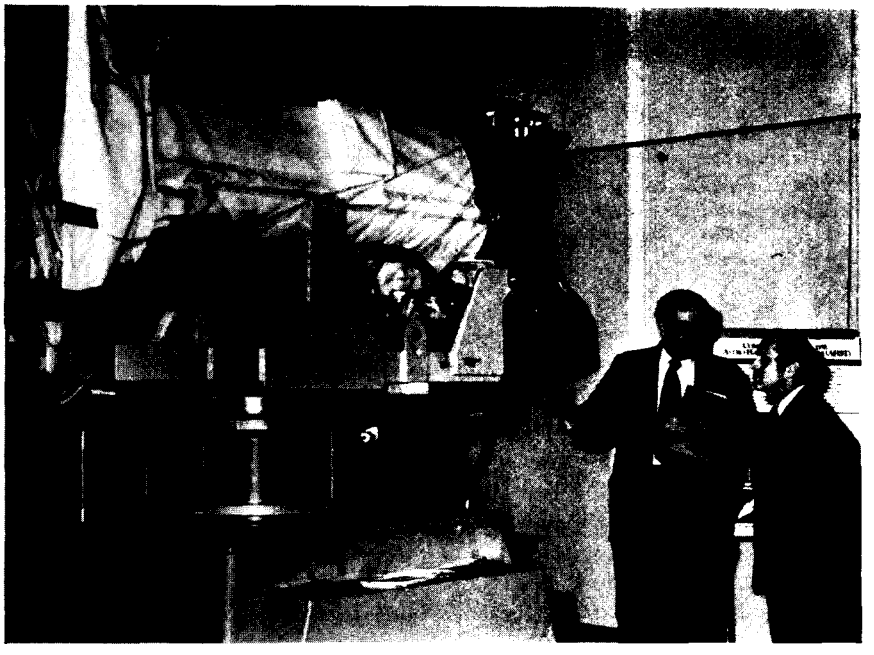


INSTRUMENT TEST—a radiosonde goes aloft as part of an international meeting on the quality of meteorological data held at Wallops in February.

The Project Leader for the Wallops phase is Francis J. Schmidlin. Other leaders are Robert J. Frostrom and Dempsey Bruton, site preparation and operational scheduling, and Riley Bull, balloon preparation and launch.

Data preparation and preliminary analysis is the responsibility of Bill Michel, of the University of Dayton Research Institute, and Ronald Taylor and E. Thomas Northam, of EG&G Washington Analytical Services Center, Inc.

The team leaders for the four countries participating are: J. Stickland, Bureau of Meteorology, Melbourne, Australia; V. Antikainen, Helsinki, Finland; N. Seshadri, India Meterological Dept., New Delhi, India, and W. Winkert, National Weather Service, Washington, DC.



ASTRO CHECK-OUT—Goddard's Dr. Theodore Gull, Astro Mission Scientist (left), shows the University of Wisconsin's Ultraviolet Photopolarimetry Experiment to Dr. Burton I. Edelson, Associate Administrator for Space Science and Applications (right), during instrument check-out at Goddard. The experiment is one of three ultraviolet telescopes composing the Astro observatory, scheduled to fly aboard the Space Shuttle for the first time in March 1986. The observatory, which also includes the Hopkins Ultraviolet Telescope (Johns Hopkins University) and the Ultraviolet Imaging Telescope (Goddard) will observe stellar objects in the ultraviolet during three flights at eight month intervals.

Tektites Revisited

Did These Earth Rocks Come From The Moon?

by David Thomas

Recent chemical analyses of the surface of a Moon rock indicate its close resemblance to a certain type of glass found on Earth. Some scientists believe this glass could have caused the extinctions of the dinosaurs and many other animals, and, therefore, its origin is of wide interest in geological studies.

The close resemblance of the surface of Lunar Sample 14425 to high-magnesium microtektites, therefore, is a major breakthrough, according to Goddard's Dr. John A. O'Keefe, regarding the ongoing debate on the origin of tektites. But the results from the analyses fall short of proving that the sample is, indeed, a tektite.

Though scientists worldwide have debated the origin of tektites for over 200 years, uncertainty still exists as to their source.

The recent analyses of the surface of Lunar Sample 14425, however, are the best evidence so far for the idea that these rare substances come from lunar volcanoes, according to O'Keefe.

Analyses Conducted

The analyses were conducted by Goddard's Materials Control and Applications Branch and the University of Delaware's Geology Department.

Tektites, in general, are small, glassy pebbles found in various parts of the world; microtektites have a related composition, but are no larger than a grain of sand.

O'Keefe, of Goddard's Laboratory for Astronomy and Solar Physics, and Professor B. P. Glass, of the University of Delaware reported on the results of the analyses in "Lunar Sample 14425: Characterization and Resemblance to High-Magnesium Microtektites," which appeared in the February 1 issue of "Science," the prominent journal published by the American Association for the Advancement of Science.

According to O'Keefe, the report lends more credence to the hypothesis that tektites were ejected from volcanoes on Earth's Moon, one of the two primary possibilities. The second possibility, that a meteorite impact on Earth created the substance, is the most widely held view, and also is held by Professor Glass.

But O'Keefe points out that of all the returned lunar samples, which characteristically are composed of crystals, the glassy surface of 14425, the largest sample of lunar glass, is distinctly different.

Origin Dispute

Nevertheless, O'Keefe says the dispute over the origin of tektites is the same as the question of "what killed the dinosaurs?" Whatever caused their extinction, he contends, probably came from the sky.

Dr. John A. O'Keefe

In view of both possibilities of tektite origin and their relation to extinctions, the report said:

"If tektites are terrestrial, the extinctions may have been caused by dust clouds in the atmosphere, thrown up by an impact event.

"If, however, they are of lunar origin, then it would be expected that the ash particles that missed Earth would have formed into Saturn-like rings around Earth. These rings would have been quantitatively sufficient to make significant climatic changes."

Either possibility could have blocked out the Sun, the primary source of energy for life on Earth.

O'Keefe said efforts currently are being made to conduct more extensive analyses of Lunar Sample 14425. More data on age, isotopic composition and trace element abundances are required before the sample can be establishecd as a tektite.

Goddard Goals: Second Goal

Goddard has developed six goals that, essentially, have become its charter and its framework for day-to-day decisions. These goals provide guidance for structuring the organization and lead to the development of specific objectives against which the Center can measure progress. The first goal concerned space and Earth sciences and was published in the previous issue of the GODDARD NEWS. Goal number two concerns space flight projects.

A primary responsibility of the Goddard Space Flight Center is to serve as the NASA focal point for the planning and execution of near-Earth space flight projects for science and applications research.

Our goal is to manage these projects in the most productive manner possible, achieving maximum returns, within budgetary constraits, on the investment of unique Goddard resources, — our people and facilities. To reach this goal, we will:

- apply systems management concepts to the total project, starting with conceptual studies and proceeding through design and development of spacecraft and instruments, mission operations, and data acquisition, processing, distribution, analysis, and archiving.
- provide for essential research, space flight experiment development, and training for future space scientists and engineers by managing and enhancing low-cost projects using aircraft, balloons, and sounding rockets.
- increase the productivity of the Space Transportation System for research through development and implementation of techniques for in-flight maintenance and repair of spacecraft and for their ground refurbishment, and by development of innovative payload carriers such as Get Away Specials, Shuttle Payloads of Opportunity, and SPARTAN using Goddard's low-cost project experience.
- as a national resource, share our expertise and manage space flight projects for other government agencies where appropriate and beneficial.

You Remember Rusty, Sr., Now Meet Rusty, Jr.

By Carter Dove

". . .he wasn't around all that often for months before the mission. . . . he used to bring home huge bags of leftover astronaut food. . . ."

That was a recollection of Russell ("Rusty") B. Schweickart, a 24-year-old engineer for Code 732 (Thermal Engineering Branch) as he reminisced about his father Russell L. Schweickart — a member of the 1969 Apollo 9 crew, the first U.S. civilian to fly as an astronaut, and the original "Rusty" of the family.

Other than the astronaut food, the younger Schweickart's memory of the Apollo 9 mission is in the form of somewhat blurred images from his TV viewing as an 8-year-old boy in Houston, Texas.

He vividly remembers, however, that "Dad was sure dedicated to his work. He believed in it and himself and that rubbed off on us five kids." The "kids" were a twin brother and three sisters, now ranging in age from 20-25.

Although his dad did not pressure him into the advanced schooling he later earned, Schweickart acknowledges, "It took me a while to convince myself that I was doing it for myself instead of for him". The listener quickly senses that the younger Schweickart is moved by an intrinsic motivation as he explains:

"What I do is use the computer to mathematically solve thermal design problems. In turn, I can then figure out the extremes of hot and cold that the different spacecraft surfaces can stand. With that information, I can change the surface thermal properties — the color and material — to assure the temperatures stay within the bounds that the PI (principal investigator) calls for."

The modest and unassuming engineer makes the complex sound quite simple. But then he's had a lot of practice: early interest in space — influenced by his dad's involvement in the Apollo program — and later intellectual shaping at California Institute of Technology (CalTech), Pasadena, CA where he completed his undergraduate studies in thermal and aeronautical engineering in 1983. A year later, Schweickart finished his masters in thermal engineering and fluid dynamics at Stanford University.

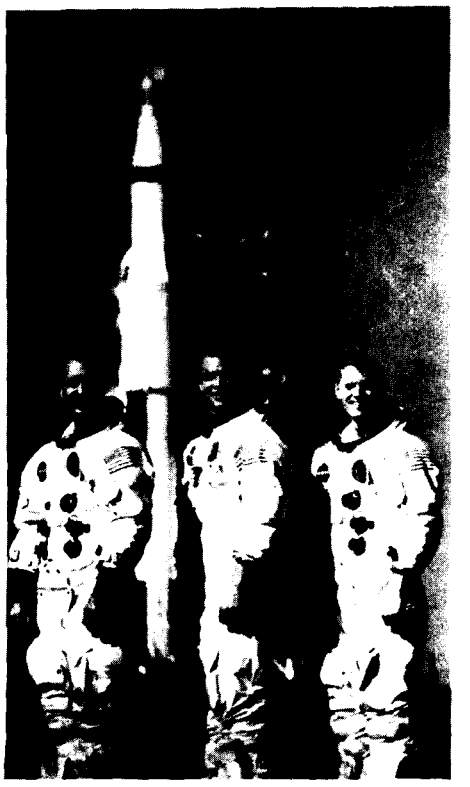
"At this one class in Stanford, we got into spacecraft design," he said. "That really whetted my interest in satellites, and it hasn't changed. I knew that Goddard had a major role in the space program, and I wanted to be part of it."

He smiles easily, explaining "I even turned down several jobs with California firms — systems engineering and propulsion jobs — to get here."

Schweickart's enthusiasm shines through again: "Right now I'm working on the Solar Optical Bench, an attitude control sensor on the Spartan-Halley spacecraft due for Shuttle launch in 1986. We've got to come up with thermal coatings to keep the instrument temps (temperatures) below 40° so the optics can work properly."

The young engineer, a member of Goddard's Professional Intern Program (PIP), sees himself in the solution of spacecraft thermal design problems at Goddard for years to come and is "glad to be here" to accept the challenge.

"Rusty" Schweickart has arrived and is in touch with the hot and cold realities of space.



SCHWEICKART SENIOR—Against the backdrop of the Saturn V rocket which later took them into space from Cape Kennedy on March 3, 1969, the three crewmembers of Apollo 9 strike a confident pose. Left to right: James A. McDivitt, Commander; David R. Scott, Command Module Pilot; and Russell L. Schweickart, Lunar Module Pilot, and father of Goddard's "Rusty" Schweickart of Code 732.

SCHWEICKART JUNIOR—Russell ("Rusty") B. Schweickart, an engineer for the Thermal Engineering Branch (Code 732) at Goddard, discusses with an off-camera co-worker a blueprint of the Spartan-Halley Solar Optical Bench. Rusty will determine parameters necessary for the thermal computer programs.

NACA Plans Third Reunion

Former employees of the National Advisory Committee for Aeronautics (NACA) — the Federal research group that became the nucleus of the National Aeronautics and Space Administration (NASA) in 1985 — hold their third reunion at Stouffer's Inn on the Square in Cleveland, Ohio, on September 6-8, 1985.

Expected to attend are more than 1000 veterans of the organization which helped advance America's aeronautics technology from 1915 when NACA was formed until it became part of NASA 43 years later.

This year is especially appropriate for the reunion since the combination of NACA and NASA marks 70 years of aeronautics and space progress. Reunion Chairman James J. Modarelli, former Lewis Research Center Management Services Chief, asked that reservation details and other information be requested by sending a self-addressed stamped envelope to:

. . . expected to attend are more than 1,000 veterans of the organization . . .

NACA Reunion Committee
NASA Lewis Research Center
21000 Brookpark Road., MS 60-1
Cleveland, Ohio 44135

Reunion activities will include a visit to NASA's Lewis Research Center, visits to Cleveland's famous attractions, views of the City atop of the Terminal Tower, plus a Saturday evening of elegant dining and "Big Band" dancing. Previous NACA reunions were held in 1976 in Asheville, North Carolina, and in 1982 in Williamsburg, Virginia.

Blood Mobile Visit

People should donate blood because it is both difficult to get and most necessary to have. A single donation sustains more than one life.

The next bloodmobile at GSFC is scheduled for Wednesday, March 27, from 8:30 a.m. to 2:30 p.m. in building 8 auditorium. Please take the time from your busy schedule to donate what you have and we need so desperately.

Gil Bullock: Translating Space Into Spanish

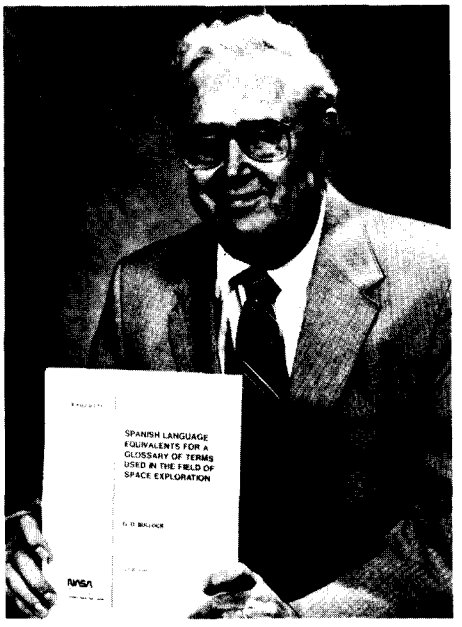
By David Thomas

How do you say "space" in Spanish?

Or, more interesting, why would you need to say the Spanish equivalent of "space"?

The "how" can be answered by thumbing through a Goddard publication that lists the Spanish equivalents of some 700 terms used in space exploration.

The answer to why you might need to speak space lingo in Spanish lies with Gilbert Bullock, author of "Spanish Language Equivalents For A Glossary of Terms Used In The Field Of Space Exploration."



ESPANOL ANYONE?—Gilbert Bullock shows the Spanish language glossary of terms used in space exploration. Goddard employee develops material to fill a need.

Bullock, a data manager of the Orbiting Satellites Project at Goddard said "the glossary evolved more by chance than by plan."

"I have been asked to address groups of Spanish speaking visitors to Goddard on several occasions," Bullock explained. "Each time, preparing the material to be presented was difficult — first because of a limited technical vocabulary in Spanish and second, because of the lack of a general reference."

Bullock said that each time a term to be used required research, he added it to his personal reference list. He said the list grew until, eventually, "it was apparent that a comprehensive compilation of Spanish space terms could be published."

Before the glossary was published in 1982, copies of it were sent to potential users who were asked to provide comments. Bullock said the overall response was "substantial and enthusiastic."

Currently, 150 to 200 copies of the final draft are in circulation.

All the sites in NASA's worldwide Space flight Tracking and Data Network (STDN) have received copies, as well as the United Nations, the Foreign Press Corps., the U.S. Information Agency (USIA), and "just about anybody who's heard about it and made a request," Bullock said.

"The glossary comes in handy to many employees who sometimes have to make presentations to Hispanic groups," Bullock said. "And I've been told by a USIA employee that the book's been a boon in helping translate information that is to be disseminated to Spanish-speaking countries."

Bullock is not of Hispanic ancestry, but served for 20 months as the NASA representative for the Applications Technology Satellite (ATS-6, launched in 1974) at the Madrid, Spain STDN site. His wife, however, is from Spain.

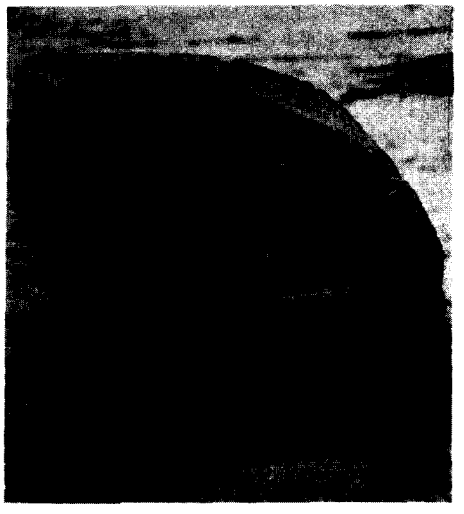
He says the book serves not only as a source for Spanish/English translations, but, also as an excellent resource for defining terms. He said the glossary is far from complete and some of the translations may not jibe with those used in all Spanish speaking countries, "but it's a good start."

Wallops Launches From Greenland

By Joyce Milliner

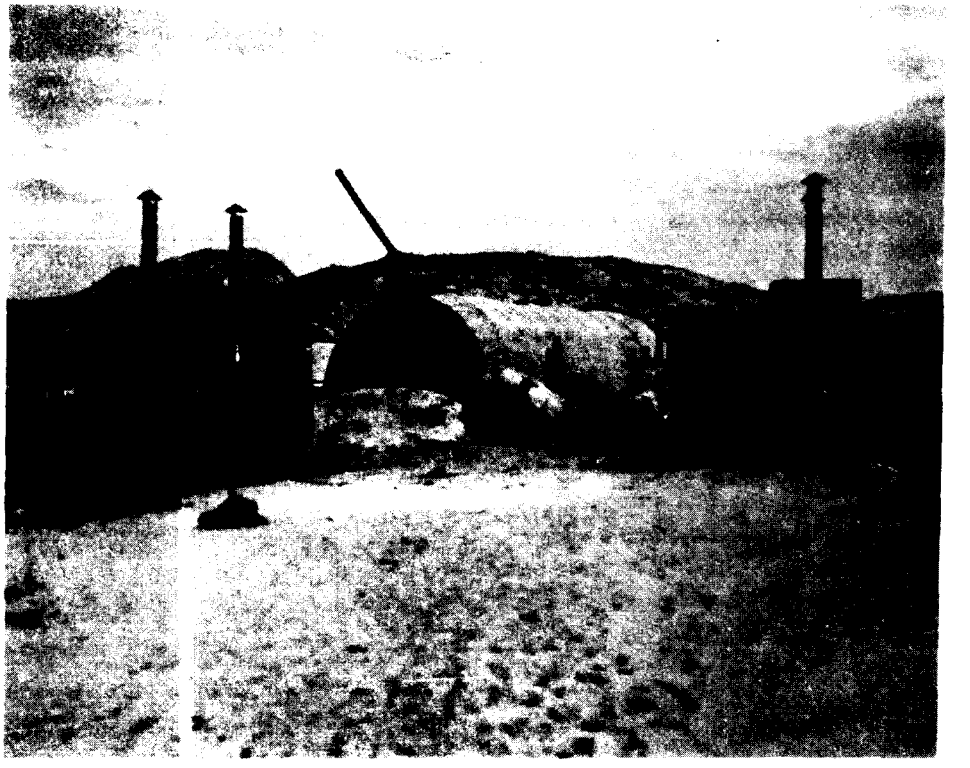
An international space science campaign of sounding rocket research was conducted in Greenland this winter to gather new knowledge about the solar-Earth relationship, according to officials at NASA/ Goddard Space Flight Center's Wallops Flight Facility.

The campaign, which includes studies of polar cap turbulence and electrodynamics, auroral zone turbulence, neutral atmosphere coupling and polar ionospheric



irregularities, was conducted by scientists from the NASA Wallops Island, VA., facility in cooperation with the Air Force Geophysics Laboratory (AFGL) in Hanscom AFB, MA. and the Danish Meteorological Institute (DMI) in Copenhagen, Denmark.

The 1985 Cooperative Observations of Polar Electrodynamics (COPE) Project consisted of scientific rocket and ground-based measurements, officials said. Greenland, they explained, is unique for these scientific investigations because of its access to the Auroral Oval, Polar Cap and Polar Cusp; existing rocket range at Greenland; support from the Sondre Stomfjord incoherent scatter radar; support from the spacecraft; support from the extensive array of scientific ground observing stations in Scandinavia and North America, and a broad choice of launch azimuths.



PROJECT COPE—an international team set up camp in Greenland this winter for sounding rocket research into the solar-Earth relationship.

Nine suborbital rockets were scheduled for launch from the Danish Meteorological Institute's Sondre Stomfjord Rocket Launch Facility. Payload experimenters are from NASA, AFGL, DMI, Cornell University, University of California, Utah State University, University of New Hampshire, University of Minnesota, and the University of Bergen (Norway).

NASA had seven flights—two Black Brant X's, two Terrier-Malemutes, a Taurus-Orion, a Nike-Tomahawk, and a Taurus-Tomahawk. AFGL had two missions, one with a Black Brant VIII and another with a Black Brant IX.

NASA National Aeronautics and Space Administration
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Executive Editor ..... James C. Elliott
Managing Editor ..... Charles Recknagel
Senior Editors ..... Carter Dove and Joyce Milliner (Wallops),

Retirees

The following have decided to say goodbye to Goddard. May they all be blessed with good health in their retirement year. Their names and codes are as follows. Good luck to all.

Thomas E. Clements	831
Edward J. Devine	716.2
Robert E. Jones	564
Marvin W. McGoogan	800
Hamlyn H. Mills	151.2
Philip Snyder	503