NASA
National Aeronautics and Space Administration
Goddard Space Flight Center

Goddard News

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***THE STS 51-L CREW*—(Back row, left to right, Mission Specialist El Onizuka, Teacher in Space Participant, S. Christa McAuliffe, Payload Specialist Greg Jarvis, and Mission Specialist Judy Resnik; (front row, left to right) Pilot Mike Smith, Commander Dick Scobee, and Mission Specialist Ron McNair.**

Shuttle Mission 51-L Ends Tragically During Launch

The Tuesday, January 28 launch of the Space Shuttle Challenger (STS 51-L) began as an apparent routine flight from Kennedy Space Center, FL and ended 1 minute and 15 seconds later in a devastating space disaster.

The crew of seven aboard the Challenger perished when the orbiter, on its 10th flight, disintegrated from an explosion of unknown origin.

NASA has appointed a special board to investigate the cause of the explosion.

This ill-fated flight of the Challenger was its 10th into space and the 25th Space Shuttle mission.

Its 11:38 a.m. (EST) liftoff marked the first use of Pad 39-B, last used for the Apollo Soyuz Test Project in July 1975, for a Shuttle launch at Kennedy Space Center. The mission also carried America's first private citizen to fly on the Shuttle, Teacher in Space participant Christa McAuliffe, a high school teacher from New Hampshire.

A memorial service for the Challenger's crew was held at the Johnson Space Center, Houston, TX on Friday, Jan. 31. President and Mrs. Reagan were in attendance.

STS 51-L carried a science payload consisting of the Goddard-managed Spartan-Halley spacecraft and Tracking and Data Relay Satellite (TDRS-B). The Spartan-Halley, designed for deployment from the Challenger, was programmed for 45 hours of Comet Halley observations; the TDRS-B was to have joined TDRS-1, launched in 1983, in geosynchronous orbit to provide high-capacity communications and data links between Earth and orbiting spacecraft, including the Space Shuttle.

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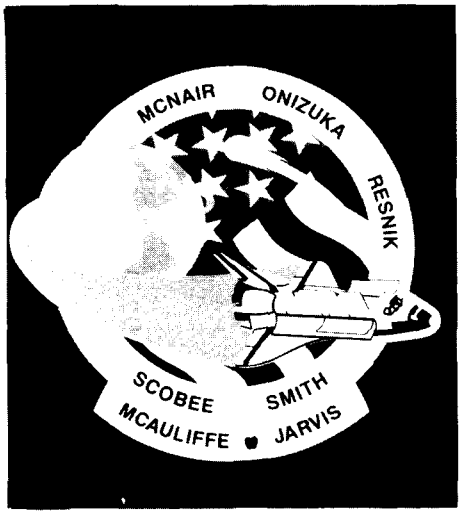
President Reagan Mourns U.S. Loss

In a televised address to the Nation, President Reagan commented on the impact of the STS 51-L crew's loss:

". . . Today is a day for mourning and remembering. Nancy and I are pained to the core over the tragedy of the Shuttle Challenger. We know we share this pain with all of the people of our country. This is truly a national loss. Nineteen years ago, almost to the day, we lost 3 astronauts in a terrible accident on the ground. But, we've never lost an astronaut in flight. We've never had a tragedy like this. And, perhaps we've forgotten the courage it took for the crew of the Shuttle. But, they, the Challenger Seven were aware of the dangers and overcame them and did their jobs brilliantly. We mourn seven heroes. Michael Smith, Dick Scobee, Judith Resnik, Ronald McNair, Ellison Onizuka, Gregory Jarvis and Christa McAuliffe. We mourn their loss as a Nation together. To the families of the seven, we cannot bear as you do the full impact of this tragedy, but we feel the loss and we're thinking about you so very much. Your loved ones were daring and brave and they had that special grace, that special spirit that says give me a challenge and I'll meet it with joy. They had a hunger to explore the universe and discover it's truths. They wished to serve and they did. They served all of us. We've grown used to wonders in this century, it's hard to dazzle us. But for 25 years the United States Space Program has been doing just that. We've grown used to the idea of space and perhaps we forget that we've only just begun. We're still pioneers. They, the members of the Challenger crew were pioneers. And I want to say something to the school children of America who were watching the live coverage of the Shuttle's takeoff. I know it's hard to understand, but sometimes painful things like this happen. It's all part of the process of exploration and discovery. It's all part of taking a chance and expanding Man's horizons. The future does not belong to the faint hearted. It belongs to the brave. The Challenger crew was pulling us into the future and we'll continue to follow them! I've always had great faith in and respect for our space program and what happened today does nothing to diminish it. We don't hide our Space Program, we won't keep secrets and cover things up. We do it all up front and in public. That's the way freedom is and we wouldn't change it for a minute. We'll continue our quest in space. There will be more shuttle flights and more shuttle crews and yes, more volunteers, more civilians, more teachers in space. Nothing ends here. Our hopes about journeys continue. I want to add that I wish I could talk to every man and woman who works for NASA, or who worked on this mission, and tell them, your dedication and professionalism have moved and impressed us for decades, and we know of your anguish. We share it. There's a coincidence today. On this day 390 years ago the great explorer, Sir Frances Drake, died aboard ship off the coast of Panama. In his lifetime, the great frontiers were the oceans. And an historian later said he lived by the sea, died on it, and was buried in it. Where today, we can say of the Challenger crew, their dedication was like Drake's, complete. The crew of the Space Shuttle Challenger honored us by the manner in which they lived their lives. We will never forget them, nor the last time we saw them this morning, as they prepared for their journey and waved good bye, and slipped the surly bonds of Earth to touch the face of God. Thank you."

". . . I know it's hard to understand, but sometimes painful things like this happen. It's all part of the process of exploration and discovery . . ."

". . . The crew of the Space Shuttle Challenger honored us by the manner in which they lived their lives. We will never forget them . . . "



NASA Studies Cause

Immediately following the STS 51-L tragedy, NASA Associate Administrator of Space Flight Jesse Moore announced the following plans to investigate and find the causes of the launch accident: "I have taken immediate action to form an Interim Investigating Board to implement early activities in this tragedy. Data from all the Shuttle instrumentation, photographs, launch pad systems, hardware, cargo, ground support systems, and even notes made by any member of the launch team and flight ops team are being impounded for study. A formal board will be established by the acting administrator very, very shortly. Subsequent reports on this tragedy will be made by this formal review board. I am aware, and have seen, the media showing footage of the launch today from the NASA Select system. We will not speculate as to the specific cause of the explosion based on that footage. It will take all the data, careful review of that data, before we can draw any conclusions on this national tragedy."

STS 51-L

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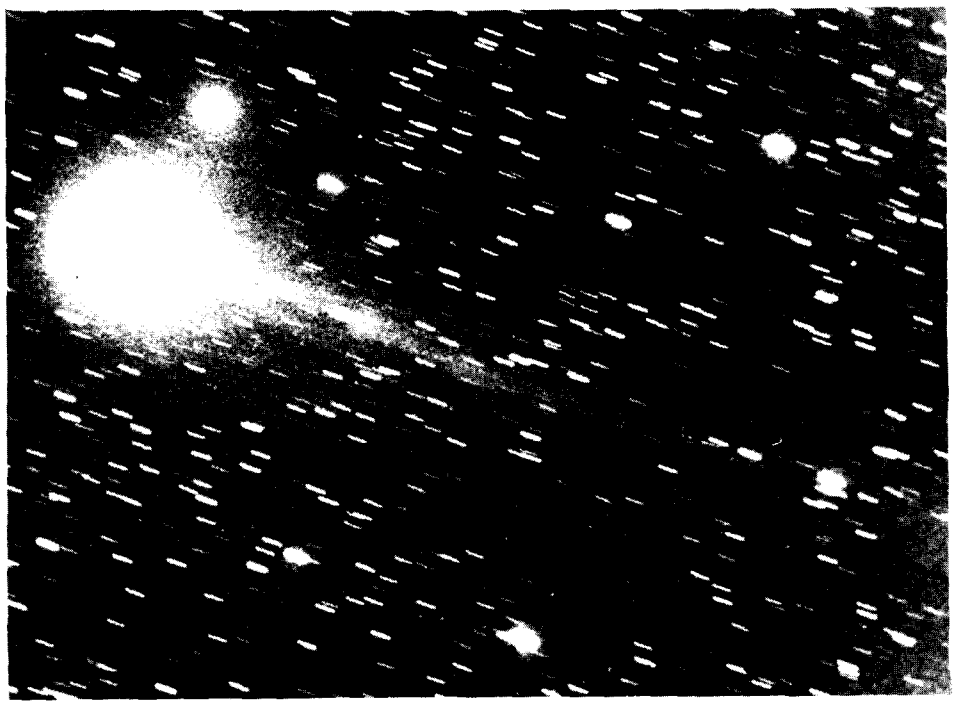
Among several middeck experiments on the Challenger were those associated with the Teacher in Space project and three student experiments: a study of chicken embryo development in space, research on how microgravity affects a titanium alloy and an experiment in crystal growth.

Perhaps the most unique and highly anticipated experiments were those of teacher Christa McAuliffe to demonstrate the effects of microgravity on hydroponics, magnetism, Newton's laws, effervescence, chromatography and the operation of simple machines.

NASA, Goddard To Study Comet Halley

As Comet halley moves closer to the Earth, NASA has mobilized a broad array of missions to observe the one-in-every-76 years visitor. The missions are part of the most extensive international space and ground-based study ever performed of a comet.

The Space missions include one European, two Russian, and two Japanese spacecraft which will fly close to Halley's Comet in March. NASA will observe the comet from the Goddard-managed International Cometary Explorer (ICE), International Ultraviolet Explorer (IUE) and Solar Maximum Mission satellites, the Ames-managed Pioneer 12 Venus Orbiter, and the NASA Hubble Space Telescope.



APPROACHING STEADILY—**Halley's Comet, as photographed December 5, 1985 by the Joint Observatory for Cometary Research (JOCR) near Socorro, NM. JOCR is administered jointly by Goddard and the New Mexico Institute of Mining and Technology.**

International Cometary Explorer

The International Cometary Explorer (ICE) will pass within 30 million kilometers (19 million miles) of Comet Halley in March, having already completed the first-ever spacecraft cometary encounter at Giacobini-Zinner in September.

In March, ICE will be aligned between the Sun and Halley's Comet so that the satellite's magnetometer, solar wind plasma instrument, and plasma composition instrument can report conditions in the solar wind about one day before it reaches the comet. ICE thus will permit astronomers on Earth to determine exactly how the comet's head and tail respond to given solar wind effects. ICE has been in alignment between the Sun and the comet once before on October 31, but at a greater distance from the comet.

International Ultraviolet Explorer

The International Ultraviolet Explorer (IUE) is observing the comet in ultraviolet light to study the chemical composition of its nucleus, the long-term evolution of the coma and tail, and the comet's dust and gas environment. The first IUE observations were made in September. Others were made in October, November and December. More are scheduled for March.

Solar Maximum Mission

The Solar Maximum Mission (SMM) satellite will observe Comet Halley, if engineers can repair its onboard computer, during the first quarter of 1986. The spacecraft suffered damage to its memory on January 9, limiting its experimentation. The satellite's coronagraph-polarimeter will provide direct imaging, and the ultraviolet spectrometer-polarimeter may be used for studying atomic and molecular species. The SMM was repaired by a Space Shuttle crew in March 1984.

Pioneer 12

Pioneer 12, in orbit around Venus since December 1978, will conduct long-range observations of Halley and the solar wind in early 1986. On February 4, just five days before Halley's closest approach to the sun, the comet passed some 40 million kilometers (25 million miles) from Venus. The Pioneer's ultraviolet spectrometer will characterize the comet's gas composition, water vaporization rate and gas-to-dust ratio. Other sensors will monitor the solar wind to study its interaction with the comet.

Hubble Space Telescope

The Hubble Space Telescope, scheduled for launch in late 1986, is expected to track Halley on its way back out of the inner solar system, perhaps all the way to its greatest distance from the Sun (about 3.28 billion miles or 5.27 billion kilometers).

International Halley Watch

On the ground, about 100 observatories and more than 900 professional astronomers representing 47 countries are participating in an International Halley Watch to coordinate their telescope observations. Another 700 amateur astronomers also are observing for the international watch, which is led by NASA's Jet Propulsion Laboratory in Pasadena, CA, and the Astronomical Institute of the University of Erlangen-Nurnberg, W. Germany.

Joint Observatory

Among the participating observatories is the world's only professional observatory dedicated to cometary research. Known as the Joint Observatory for Cometary Research (JOCR) and located in Socorro, New Mexico, it is jointly operated by Goddard and the New Mexico Institute of Mining and Technology at Socorro.

Because of its exclusive dedication to cometary studies and its location on one of the last truly dark mountaintops in the continental U.S., the JOCR is expected to be the 'flagship' of the International Halley Watch's Large Scale Phenomena Discipline. The discipline is collecting, archiving and studying images of Comet Halley taken at observatories around the world.

Goddard Scientists Study Uranus

Twenty-three scientists from Goddard conducted observations with six of the eleven scientific instruments aboard NASA's Voyager 2 spacecraft during its late January encounter with the planet Uranus.

The first spacecraft ever to reach the planet, Voyager 2 is helping unmask the mysterious giant, its five known satellites (moons) and nine rings. The spacecraft also looked for a planetary magnetic field, new moons and rings.

The Voyager's closest approach to Uranus took place at 1 p.m. (EST) Jan. 24, 1986. (The signals from this encounter required 2 hrs. 45 min to reach Earth). At that time, the NASA spacecraft was flying 81,500 kilometers (50,600 mi) above the cloud tops of the planet.

The Goddard scientists include two principal investigators, Dr. Rudolf A. Hanel and Norman F. Ness.

Hanel is the key scientist for a very specialized camera with a sensor that sees infrared light (light below the red light our eyes can see). On the one hand, Hanel's instrument is a very sophisticated thermometer which will ultimately determine if Uranus is generating heat in its interior; on the other, it is a device to analyze the composition of the Uranian atmosphere.

Ness is the principal investigator for an experiment to: find out if Uranus has a magnetic field and, if so, determine its characteristics; record the interaction of any magnetic field with Uranus' moons; and study the interplanetary magnetic fields in the vicinity of Uranus.

Goddard co-investigators also are playing an important role in a total of six experiments aboard Voyager 2.

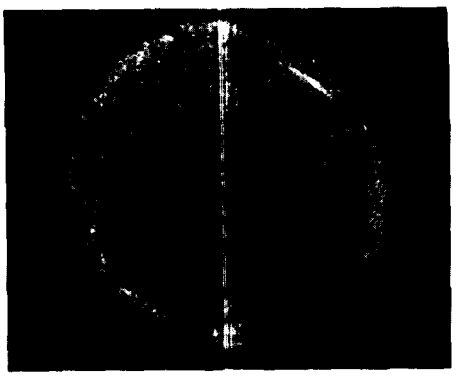
Co-Investigators Named

Hanel's co-investigators are Drs. Barney Conrath, F. Michael Flasar, William Maguire, John Pearl, Joseph Pirraglia, Robert Samuelson and Mr. Virgil Kunde; the Goddard co-investigators on Ness' team are Drs. Mario Acuna, Ken W. Behannon, Len F. Burlaga, Jack Connerney and Ron P. Lepping. (Another member of the team, Dr. Fritz Neubauer, is from the University of Cologne, W. Germany).

The Goddard co-investigators studying the very hot ionized gases that exist in interplanetary regions and within planetary magnetospheres are Drs. Len Burlaga, Richard Hartle, Keith Ogilvie, Jack Scudder and Mr. Edward Sittler, Jr.

The study of aerosol particles in Uranus' atmosphere and the textures and compositions of the surfaces of the Uranian moons is the focus of James E. Hansen and Makiko Sato of the Goddard Institute for Space Studies (GISS), New York, N.Y.

Another of the projects being co-investigated by Goddard scientists is the search for and study of a variety of radio signals



PLANET URANUS—the planet as imaged by Voyager 2 on January 14.

emitted by Uranus. Michael L. Kaiser and Michael Desch of Goddard are among the co-investigators.

Dr. James H. Trainor of Goddard is a co-investigator in the measurement of high energy particles in the Uranian atmosphere.

During the peak activity observations on Jan. 24, the Voyager 2 gathered more information about Uranus, its satellites and rings than has been learned since William Herschel discovered the planet in 1781.

The Voyager 2 encounter began Nov. 4, 1985 and continues through Feb. 25, 1986. After that, destination: Neptune, its last planetary visit, on August 25, 1989.

Voyager 2 was launched in August, 1977 aboard a Titan-Centaur rocket from Cape Canaveral Air Force Station, FL. It was joined in space the following month by Voyager 1 which has completed its planetary encounters and now is hurtling through unexplored space.

Team Confirms Water On Comet Halley

A team of NASA Goddard and university scientists, observing Comet Halley in December 1985, has made the first direct confirmation of water in the comet.

The discovery, the first definite detection of neutral water in any comet, lends new support to astronomers' widely held theory that comets are 'dirty snowballs' composed primarily of frozen water. That theory, was first developed by astronomer Fred Whipple in 1951, but has only received indirect corroboration to date through discoveries of atoms such as oxygen and hydrogen, molecules such as OH, and ions such as H_2O+, assumed to be the destruction of by-products of the evaporated ice.

"This is our first direct confirmation that neutral water is the dominant molecular species in a comet," explained Dr. Michael Mumma, Head of the Planetary Systems Branch at Goddard.

The discovery stems from a new theoretical model developed at Goddard by Mumma and Dr. Harold Weaver, now an Associate Research Scientist at the Center for Astrophysical Sciences of the Johns Hopkins University in Baltimore, MD. The theory holds that the parent molecules can best be detected by measuring their infrared fluorescence spectrum, stimulated by sunlight. The theory has been developed extensively since then by the two astrophysicists and has been confirmed by independent work of scientists in France and Japan. It predicts in precise detail the wavelengths and relative intensities of infrared spectral lines emitted by gaseous H_2O and other parent molecules, in comets.

Problem Minimized

The theory also predicts that a definitive study of cometary water is not possible from conventional ground-based telescopes, because of absorption by water in our own atmosphere. This problem was minimized by using an airborne telescope and special instrumentation developed at the Lunar and Planetary Laboratory of the University of Arizona by Dr. Harold P. Larson, Dr. D. Scott Davis, and Mr. Michael Williams. This Arizona group specializes in airborne spectroscopic studies of solar system objects, a program which

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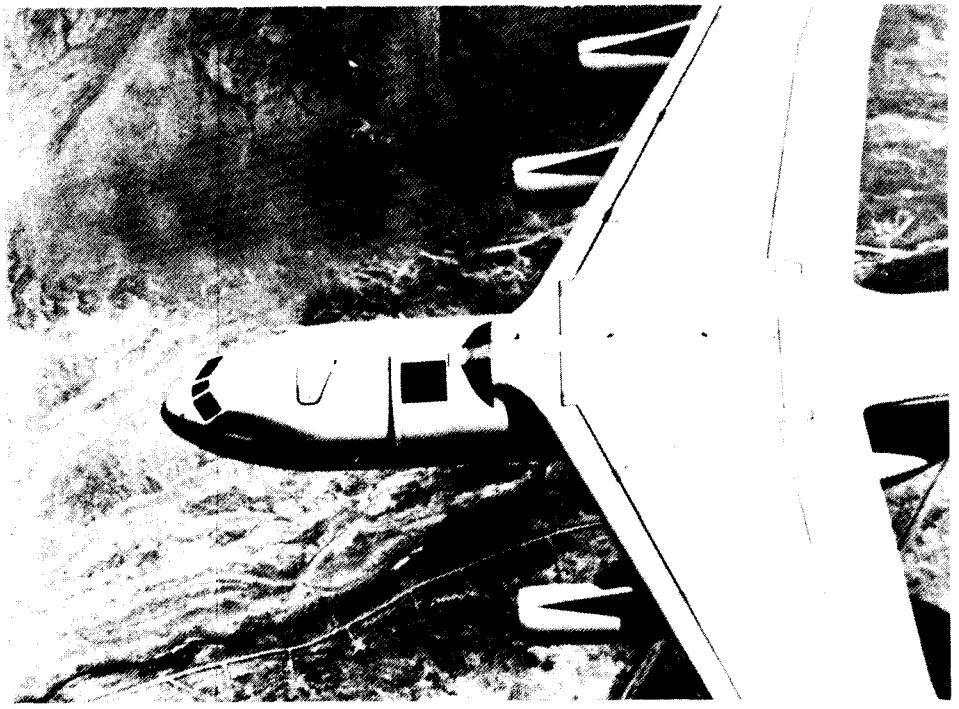

***HIGH-FLYING*—Using a theory and observations from NASA's Kuiper Airborne Observatory operated by Ames Research Center, the Goddard/university team discovered water vapor on Halley's Comet.**

Water on Comet

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produced, for example, the detection of H_2O in Jupiter's atmosphere ten years ago. The Arizona spectrometer was used to observe Comet Halley on the nights of December 21, 22 and 23 from NASA's Kuiper Airborne Observatory (KAO). This flying observatory consists of a 36-inch diameter telescope in a modified C-141 aiecraft, operated by the NASA Ames Research Center at Moffett Field, CA. All observations were made at an altitude of 66,000 kilometers (41,000 feet), far above that of any conventional ground-based telescope to reduce interference by terrestrial water vapor.

Soviet and European spacecraft encountering Comet Halley later this spring also will be looking for water. According to Larson, "Although NASA did not send a spacecraft through Comet Halley, as far as the confirmation of H_2O is concerned, the use of the KAO was the most cost-effective way this country could have solved this central problem in cometary science. This facility and its dedicated staff deserve equal recognition for the success of our project".

Confirmation Sought

Astronomers have been seeking to confirm the presence of water in comets for over 20 years, first using radio astronomy telescopes and later satellites such as the International Untraviolet Explorer that observe in the ultraviolet spectrum.

"These attempts largely have failed because water, like most polyatomic molecules, does not fluoresce in the ultraviolet, and the new theory shows that its radio spectral lines are too weak to be seen," according to Weaver.

The direct detection of a major parent molecule ushers in a new era of direct investigations of the compositions of cometary nuclei and of the physics of cometary comae. Until now, scientists had to work backward, using the known fragments to infer the identities of plausible parent molecules. This process was highly uncertain because many potential candidates could have produced the observed fragments, but it was impossible to identify any specific precursor. This discovery demonstrates that astronomers now have a powerful new tool for predicting and detecting with accuracy parent molecules in comets, including gaseous water and other constituents.

The NASA/university team plans to observe Comet Halley again on March 21 through 27 from the KAO in Australia, both for water and methane in an effort to compile the first complete map of a cometary coma for these substances.

ICE Team Releases Rendezvous Results

Scientists from the U.S., France, the United Kingdom and West Germany have released their findings from the rendezvous of the International Cometary Explorer (ICE) spacecraft with the Comet Giacobini-Zinner—the world's first—on September 11, 1985.

Although some of the data transmitted back to Earth by the ICE spacecraft—launched in 1978—confirmed the traditional portrait of a comet, other information was unexpected.

Perhaps the most unexpected result was the spacecraft detection of electrical wave (plasma) disturbances and high-speed molecular species from the comet more than a day before the rendezvous. The detection of the electrical waves—while ICE was 2,300,000 kilometers (1,429,200 miles) away from the comet—was made by ICE's plasma wave experiment developed by Dr. Frederick Scarf, TRW, Inc., Redondo Beach, CA.

Scientists had theorized that first detection might occur just a few hours before the spacecraft crossed the comet's tail.

A few hours after the initial detection, but still one day prior to the intercept, two of the ICE's instruments discovered electrically-charged particles (ions) as far as 1,800,000 km (1,130,000 mi.) from Giacobini-Zinner.

The ions were detected by the energetic proton experiment and the low energy cosmic ray experiment, the former directed by Dr. Robert J. Hynds, Imperial College, London, England; the latter by Dr. Dieter Hovestadt of the Max Planck Institute for Extraterrestrial Physics in Garching, West Germany.

Hynds reported that the gas molecules escaping from the comet's nucleus were ionized by solar ultraviolet light and then picked up and accelerated back toward the comet by the solar wind, a constant outpouring of magnetized, electrified gas from the Sun.

The discovery of the plasma waves and "pick-up" ions at great distances from Comet Giacobini-Zinner prompted Dr. John C. Brandt, ICE comet scientist at Goddard, to predict a possibly larger role for the spacecraft than earlier planned.

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IUE Loses Stabilization: Engineers Produce Fix

The International Ultraviolet Explorer (IUE) lost stabilization and faced near disaster after one of its three remaining gyros failed recently. Thanks to a highly unconventional plan devised and implemented by engineers at Goddard, the IUE made what experts called a miraculous recovery and continues to study stars, planets, galaxies and interstellar gas 24 hours a day.

The IUE originally was designed to maintain three-axes stabilization using three of the six onboard gyros. The problem of maintaining three-axes stabilization with only two gyros is considered nearly impossible. But Goddard's engineers, astronomers and analysts accepted the challenge and developed a substitute system that saved the $250 million spacecraft.

They substituted the spacecraft's Sun sensor for the dead gyro. Not only did using the Sun sensor stabilize the ailing spacecraft, but pointing accuracies and stability have remained unchanged.

Little Lost

Tests have shown that the IUE lost little of its operational capabilities. Under this new control system, the IUE can no longer point directly away from the Sun without losing power. Yoji Kondo, IUE project scientist at Goddard, explained that this is not crucial to operations because the position of the Sun changes throughout the year. At worst, an object cannot be observed for one month during a year.

The IUE was launched into a geosynchronous orbit (with an average distance from the Earth of 22,300 miles or 35,900 kilometers) on January 26, 1978. During the first year of the mission, one of the spacecraft's original six gyros was lost, leaving the spacecraft with two spares.

Gyros help point the spacecraft at targets and stabilize the spacecraft during observations. The IUE was designed to operate with one gyro for each of the three reference directions in space. In addition, three gyros were built into the spacecraft as spares that extend the life of the spacecraft and serve as backups in case of failure.

The first gyro failed shortly after the launch. According to Kondo, this is not unusual and is one reason why spacecraft have extra gyros built into their design. This failure occurred when a gyro was deliberately turned off during an experiment and wouldn't turn back on.

Second Gyro Fails

The second gyro failed in March 1982. The IUE ran out of spares in July 1982 when the third gyro failed. In anticipation of the next failure and the possible loss of the spacecraft, project astronomers, engineers and technicians began studying a "stumper"—how does one control a spacecraft in three axes with only two gyros?

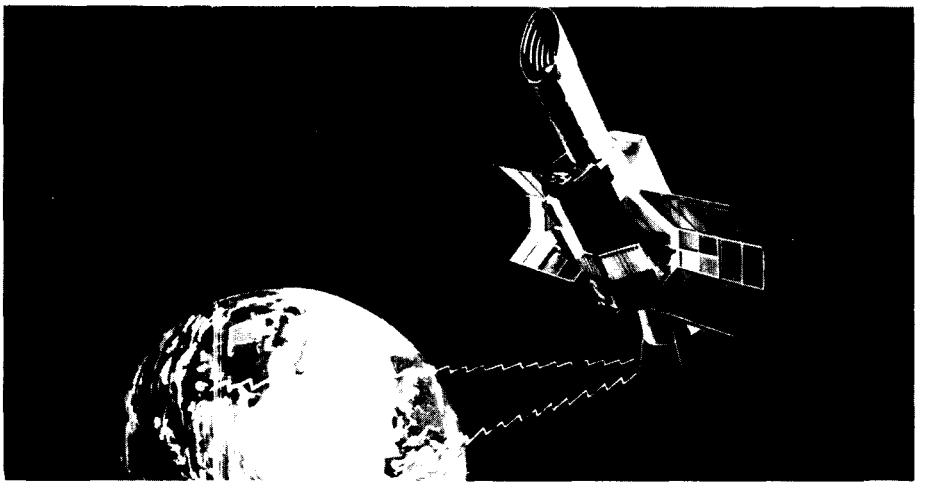
Engineers from Goddard's Guidance and Control Branch devised the solution which led to the recovery. Their plan to use the Sun sensor in lieu of a gyro took six months to develop, with an additional year to modify the software.

The plan was translated into software, which the IUE's onboard computer could understand, and was filed away until it was needed. Operationally, the IUE would become a new satellite containing the same scientific instruments as the old.

Two and one half years later, on August 17, 1985, the fourth gyro died, and the satellite lost stabilization. The plan to replace the faulty gyro with the IUE Sun sensor was taken off the shelf and implementation began.

To conserve as much power as possible, controllers first put the IUE into a "sunbath mode." Henry Hoffman, Chief, Guidance and Control Branch explains, "The sunbath mode gave us the capability to live without gyros. It put the satellite in a power-safe mode so it wouldn't freeze or burn."

With the spacecraft in a safe hold, the team fed the new software program to the onboard computer and began testing for "bugs." When everything checked out, they took the IUE out of the sunbath and waited with apprehension.



STABILIZED—**The International Ultraviolet Explorer (IUE), which has lost four of its six stabilizing gyros, continues to send back excellent data thanks to a highly unconventional "fix" by Goddard engineers.**

The team was rewarded for its efforts by clear stellar images—proof that the spacecraft was once again stable in three axes using the two remaining gyros and spacecraft's Sun sensor.

During the next several weeks each portion of the onboard computer programs was checked and fine-tuned. The repaired IUE performed much better than the simulations studied by the observation staff indicated it would.

Halley's Comet

On September 11, 1985, seven and one half years after its launch, IUE beamed to anxious observers the first image of Halley's Comet ever recorded from space. Not bad for a satellite with an initial three-year mission goal and only two gyros!

There is no significant loss of data with the IUE operating in this fashion, and engineers expect this space observatory to continue producing quality science.

In reality, a one-gyro system technically is feasible, according to Hoffman. The Goddard team already is developing another plan which will be on standby if another gyro fails.

Around The Center

TOM BURMINGHAM, a physicist in the Laboratory for Extraterrestrial Physics (Code 695), has assumed editorship of the Journal of Geophysical Research - Space Physics for four years. The journal is published monthly by the American Geophysical Union. Burmingham has established an office at Goddard to process manuscripts submitted to the prestigious publication.

MIKE METCALF, one of ten national finalists for the Teacher in Space project, is working in the Education Office at Goddard this year as part of the Center's education outreach effort. Metcalf teaches geography and government at Hazan Union High School in Hardwick, Vermont and is on sabbatical from the school.

FAREWELL MESSAGE. William Hocking, who recently retired from Goddard, sent the following message to all his fellow workers in the satellite tracking business:

I want to say goodby and thank you to all who have walked with me along one of the greatest adventures anyone has ever experienced. Surely you and I have been privileged to have been able to play a part in this space drama. I salute those of you who are still around and were at the Naval Research Laboratory (1955 and 1956) when project Vanguard was first being organized.

To all the early minitrackers, the down range trackers (Grand Turk and Antigua), the early Project Mercury people at Langley (1959), those who helped to build the early control centers here at Goddard, the Apollo Unified S-band gang, and on through the years to the first shuttle launch (1981), the still going strong Project SUE Gang, and all those presently involved in the GSTDN phasedown activity, I say to you all that I am fortunate to have met and to have worked with you.

I cannot imagine what my life would have been like had I not been involved in the space effort. It was fun and exciting to bring back to my children stories and pictures of distant lands like South Africa, Alaska, and England. Running through airports (I could never do it like O.J.) kept me young and vigorous. I was always excited about going to far away places and working with people of different cultures and even more excited when it was time to come back home.

How proud to be an American, how proud to be a member of the NASA team. Those of you who have walked this journey with me know the looks of awe, the respect received from people all over the world when they discovered that you are a member of that same team that put a man on the moon, that team that helped create new technologies around the world, that team that helped bring into the 20th century those peoples who are direct descendents of the great past civilizations (Lima, Antafagasta, Santiago).

My best wishes to all my good friends around the globe and thank you for being a part of the dream.

Mail your story to the Goddard News (Code 130), or call the Editor at 344-5565.

Goddard Celebrates Engineers' Week

Goddard will celebrate national Engineers' Week (NEW) February 18-22 with activities ranging from special colloquiums and forums to Engineering Fairs for Center personnel, educational institutions and employees' families.

The theme for the 1986 NEW is "Turning Ideas Into Reality." Officially, NEW runs from February 16-22.

Activities for NEW include:

February 18 - Special engineering colloquium

February 19 - Luncheon with guest speaker

February 20 - Fair for Center personnel

February 21 - Fair for schools a' ' colleges

February 22 - Fair for employees' families

For more information on NEW, contact David Thomas: 344-8956.

Bendix Presents Performance Award

Mission Operations Support Services (MOSS) employees from the Bendix Field Engineering Corporation (BFEC), Columbia, Md., International Ultraviolet Explorer Operations Control Center (IUEOCC) group assigned to the Goddard Space Flight Center (GSFC), Greenbelt, Md., have been awarded the first MOSS Excellence Award by BFEC's MOSS Program Management.

The award: for the June 1, 1985 through September 30, 1985, performance period—is being given to MOSS IUEOCC employees for their outstanding efforts in support of the MOSS program. This first award establishes MOSS Program Management efforts to reward contributions to the space program by BFEC in support of NASA mission operations. The outstanding MOSS support element is to be selected for each triannual performance period and each group or element is awarded a plaque to be prominently displayed for the benefit of all employees.

BLOOD DONORS

The next mobile is scheduled for Wednesday, February 5, 1986 in the bldg. 8 auditorium from 8:30 a.m. to 2:30 p.m. Watch flyers for details!

ICE Results

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Brandt reasoned, "The results from the ICE encounter lead to the conclusion that ICE may directly detect Halley." The results also indicate that Halley measurements by other spacecraft should be initiated earlier than previously planned.

Comet's Plasma Tail

Some scientists expected that ICE, while between Comet Halley and the Sun in late March and early April 1986, would gather data only on variations in the solar wind to compare with the resulting disturbances caused in the comet's tail as photographed by ground telescopes.

In another finding stemming from the ICE rendezvous, Dr. Samuel J. Bame of the Los Alamos National Laboratory, Los Alamos, N.M., reported that in contrast to the hot electrons on the outskirts of the comet, the comet's plasma (gas) tail—the feature that appears blue on color photographs—consisted of a dense, narrow structure of cool plasma. This finding was also made by the radio wave experiment of the Meudon Observatory in France directed by Dr. J.L. Steinberg.

The ICE's ion composition experiment of Dr. Keith Ogilvie of Goddard made the first direct measurements of molecules in a comet. The experiment found mainly water wapor ions (H_20+), confirming the "dirty snowball" model of comets.

A major prediction confirmed by the ICE data was that the magnetic structure of the comet's plasma tail was found to consist of two parallel lobes, each threaded by a magnetic field of opposite polarity. This structure, predicted by Nobel prize-winning physicist Dr. Hannes Alfven in 1957, was mapped by the ICE's magnetometer experiment of Dr. Edward Smith of the Jet Propulsion Laboratory, Pasadena, CA.

No Clear Cut Bow Shock

Putting conflicting scientific conjecture to rest, the ICE mission revealed that no clear cut bow shock—a surface moving ahead of the comet like that through which a jet aircraft passes as it breaks the sound barrier—accompanied the comet. Instead, experimenters found what Dr. Tycho Von Rosenvinge, ICE project scientist at Goddard, called "a transition region" around the head of the comet, in which "the solar wind has been heated, compressed and slowed." One of the most pleasantly unexpected occurrences of the September 11 mission was that neither the ICE spacecraft nor its instrument payload suffered any detectable damage as a result of the impact with the comet's dust.

In the historic intercept mission, ICE sliced through the 22,530 km (14,000 mi.) wide tail of the comet. 7800 km (4800 mi.) behind the cometary nucleus. Travelling at 74,030 km (46,000 mi.) an hour, ICE emerged from the tail approximately 20 minutes later.

The encounter was a high point of a seven-year odyssey through space for ICE, launched in 1978 as the International Sun-Earth Explorer.

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Goddard News

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Executive Editor ..... James C. Elliott
Managing Editor ..... Charles Recknagel
Senior Editors ..... Carter Dove and Joyce Milliner

Retirees

Best wishes for the New Year to the following Goddard employees who retired in January!

	Code	Years
Arndt, Albert	727.3	26
Ashby, Abel T. (Wallops)	273.2	34
Banning, Ralph N.	534.1	35
Bender, Frederich (Wallops)	821.2	42
Benson, Rose A.	560	26
Burda, Bernard	717.3	25
Carey, Charles W.	543	22
Chapman, James W.	120	37
Cridlin, Maurice	731.4	28
Drummond, Robert	720.1	24
Gigerich, Enola W.	502	31
Green, Sylvia	253.3	22
Hardesty, Charles V.	253.4	42
Hatakeyama, Lawrence F.	563	31
Heddinger, Frank	420	24
Henley, Paul E.	754.3	41
Hocking, William	531	32
Hui, Peter	712.4	35
Jennings, William F.	515.1	37
Kenny, Florence D.	535.1	35
King, Joseph C.	742	35
Kirchman, Edward J.	750	26
Lindner, Frederick J.	731	33
Logan, Francis J.	400.6	35
Madison, Charles P.	754.4	36
Marshall, Augusta Q.	247.2	31
Martin, Frank T.	750	34
Mears, Ellouise B. (Wallops)	202.3	34
Mooney, Thomas H.	290.1	34
Moore, Arthur L. (Wallops)	834.1	36
Morris, Richard	710	36
O'Grady, Francis A.	271	26
Poland, Woodrow W.	751.2	34
Prokopchak, Michael	513	21
Schade, Andrew C.	234.2	32
Schulman, Joseph R.	420	25
Scott, Thomas H. (Wallops)	833.1	34
Shaddeau, Chester Jr.	530	39
Sing, Milton L.	430	28
Suguira, Masahisa	696	22
Surgen, H. Ronald	535.2	39
Thomas, Charles W.	663.3	35
Thoreson, Leroy F.	303	32
White, Richard A.	400.2	33
Winker, Arthur R.	754.4	32
Wright, William F.	200.3	35

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Allison, Calvin F.	751	44
Kolb, Frederich	303	31
Marcotte, Paul	700	34
Mills, James F.	200	32