

# Satellites Discover Huge Comet Clouds



Experiments aboard two Goddard satellites, OAO 2 and OGO 5, have demonstrated that hydrogen, the most common element in the universe, is a major constituent of comets, and that this hydrogen may form huge clouds far larger than the sun itself.

Both experiments study comets in the Lyman-Alpha region of the ultraviolet spectrum which does not penetrate the earth's atmosphere. Since atomic hydrogen scatters Lyman-Alpha sunlight, astronomers have previously had to be content with observing comets through their less abundant constituents.

The historic satellite studies conducted this spring during the (See Page 2.)

COMET BENNETT is shown in a photograph taken with an F/2 Schmidt telescope here at Goddard. The tail of the comet is clearly shown as two distinct streamers trailing out millions of miles into a star brightened background. Not shown in this, or any picture taken of comets from the earth is the huge cloud of hydrogen being studied by Lyman-Alpha instruments aboard OAO 2 and OGO 5. The photograph, made by Dr. Robert G. Roosen and Sarma Modali, was an eight-minute exposure taken on April 16, 1970.

## GODDARD NEWS

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### Apollo 13: The Long Journey Home

The longest four days in the history of the nation's space program began the night of April 13 when an explosion aboard the Apollo 13 service module knocked out much of the spacecraft's oxygen and power supply. From that moment, the world watched and prayed while astronauts James Lovell, Fred Haise, and John Swigert took charge of their crippled ship for the long journey which would carry them around the moon and home again for splashdown on April 17.

By not landing on the moon, the mission was a scientific failure. Yet, at the same time, Apollo 13 was a triumph of the teamwork that has made NASA programs work in the past.

The team most on the spot was made up of astronauts themselves. To save their ship and their own lives they had to carry out a multitude of emergency measures ranging from constructing a system for removing excess CO<sub>2</sub> from the atmosphere of the command module to using the descent engine of the lunar module not for a landing on the moon but to set the ship on a course for home.

Focal point for emergency operations on the ground was the team at Houston's Mission Control Center. Many of the measures taken by the astronauts were first tested at NASA centers and contractor installations. Test results were evaluated at Houston and relayed to the spacecraft to reduce the uncertainty of a situation that left little margin for error.

Linking the spacecraft with earth were the tracking stations of Goddard's Manned Space Flight Network and the communications circuits of the NASCOM Network. For comments on the outstanding operation of both networks and the men who run them, see Pages 6 and 7.



PRESIDENT Richard Nixon is greeted by Dr. John F. Clark, Goddard Director, as he arrives here on April 14 for an Apollo 13 briefing. At right is Henry F. Thompson, Goddard Deputy Director of Manned Flight Support.

### Nixon Received Apollo 13 Briefing Here

President Richard M. Nixon came to Goddard in the afternoon of April 14 for a briefing on the status of the Apollo 13 spacecraft. The Goddard visit was a part of the President's effort to keep fully informed on mission events from the beginning of the crisis to splashdown.

Mr. Nixon had first learned of the service module explosion shortly after it happened on the night of April 13. The visit to Goddard followed two telephone conversations in which the President talked directly with NASA Administrator Dr. Thomas O. Paine who was at the Houston Mission Control Center.

At Goddard Mr. Nixon was met by Dr. John F. Clark, Goddard Director. He then went to the Manned Space Flight Network control room in Building 14 where he was briefed for about 45 minutes on the Apollo situation by William C. Schneider, Director of NASA's Skylab Program (formerly Apollo Applications Program Director).

With the President at Goddard were H. R. Hademan, White House chief of staff; John B. Ehrlichman, presidential deputy for domestic affairs; and former astronaut Michael Collins, who served as command module pilot for Apollo 11 and is now assistant secretary of state for public affairs.

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**COMET CLOUDS .... From Page 1.**

apparition of the comets Tago-Sato-Kosaka and Bennett gave scientists some new and exciting data on comets streaking through space.

The world's first look at a comet's hydrogen cloud came on January 14, 1970, when the University of Wisconsin's instruments aboard the Orbiting Astronomical Observatory (OAO 2) locked on to the comet Tago-Sato-Kosaka. The experiment, conducted by Dr. Arthur D. Code, Dr. Charles C. Lillie and Theodore R. Houck, studied the comet for the rest of the month and determined that the glowing cloud of hydrogen around the comet head was as large as the sun itself.

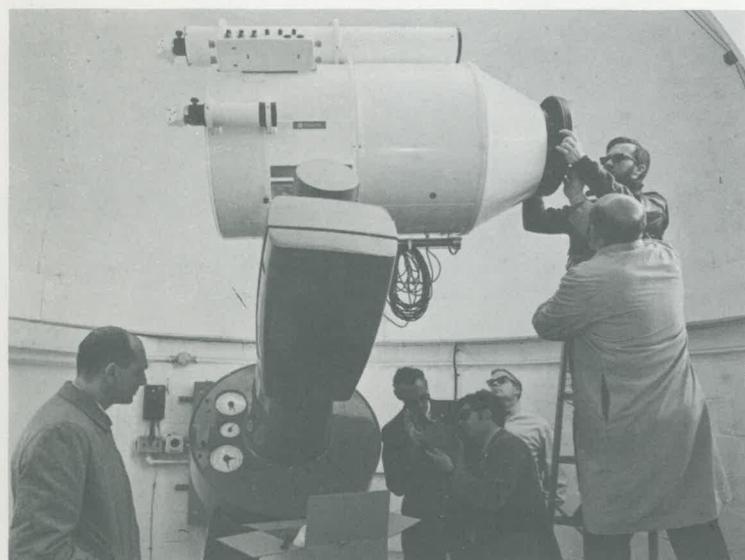
A second great hydrogen cloud, this one ten times larger than the sun, was discovered around the comet Bennett in March and has been studied by both OAO and an Orbiting Geophysical Observatory (OGO 5). Comet Bennett's huge gas envelope is about 8 million miles across and is the largest entity ever observed orbiting the sun.

The OGO observations were made using Lyman-Alpha measuring devices developed by the University of Paris under Professor Jacques E. Blamont, and the University of Colorado under Professor Charles A. Barth. Using preliminary data from this observation, Professor Blamont believes hydrogen clouds are a fourth feature to be added to the classical three components of a comet: the center or nucleus, the coma or glowing region immediately around the nucleus, and the tail which streams out thousands of miles, always in a direction away from the sun.

Dr. Enrico P. Mercanti, OGO Project Manager, is enthusiastic about the success of the intricate OGO 5 maneuver and with the wealth of new scientific data obtained. He says "Our scientific satellites in orbit have a vast potential for special experiments and correlative studies. I welcomed the opportunity to have OGO 5 serve as an example of what can be accomplished by maintaining close liaison between NASA and scientists during flight operations. We intend to actively encourage such activities in the future."

The satellite comet watch has determined other features of comets besides the huge hydrogen clouds. Oxygen, carbon, water and ammonia were detected in the Tago-Sato-Kosaka by University of Wisconsin scientists Charles F. Lillie and Theodore R. Houck using their instruments on OAO 2. More recently, the University of Colorado experiment on OGO 5, developed by Dr. Charles A. Barth, has detected water in comet Bennett.

OAO 2 was launched December 7, 1968 from Cape Kennedy, Florida. OGO 5 was launched on March 4, 1968, also from the Cape.



GODDARD'S NEW Schmit comet camera system is shown being installed at the Goddard Optical Research Facility. The new system is specially designed for photography of comets in black and white and color. From left are Dr. Leslie H. Meredith, Chief of the Laboratory for Space Sciences; Dr. George Pieper, Director of Space and Applications Sciences; Dr. Stephen P. Maran, Dr. John C. Brandt, Head of the Solar Physics Branch; Dr. Robert Roosen (on ladder) and Robert Krauss.



PROFESSOR BLAMONT (left), Principal Investigator for the OGO 5 Lyman-Alpha experiment, discusses his observations with Frank Liberatore, OGO Project Coordinator.

## Edmund Habib Receives AIAA Award



EDMUND J. HABIB (right), Associate Chief of the Advanced Development Division, receives the 1970 AIAA Space Communications Award from Philco-Ford executive Dr. Harry J. Goett, former Goddard Director.

Edmund J. Habib, Associate Chief of the Advanced Development Division, has received the American Institute of Aeronautics and Astronautics' 1970 Space Communications Award for "pioneering developments of the advanced tracking and telemetry data processing systems of NASA's Space Tracking and Data Acquisition Network, and for leadership of the development of technology for the future Tracking and Data Relay Satellite space network."

Besides winning a \$500 honorarium, Mr. Habib was given the right to nominate someone for a four-year tuition scholarship in the field of electrical engineering communications. Both the scholarship and the honorarium are sponsored by the Philco-Ford Corporation.

The award was presented at the AIAA Third Communications Satellite Systems Conference in Los Angeles on April 7 by Dr. Harry J. Goett, Director of Spacecraft Systems Operations for Philco-Ford's Space and Re-entry Systems Division in Palo Alto, California.

Mr. Habib came to Goddard in October of 1958 from the Naval Research Laboratory where he was a member of the original Vanguard team. At NRL he had worked on instrumentation for the Viking rocket, and on the Minitrack tracking, time standard and optical calibration systems on which the present Space Tracking and Data Acquisition Network (STADAN) is based.

At Goddard he has worked on many phases of STADAN development including calibration of the Minitrack system, development of the highly successful Goddard Range and Range Rate system, and the development of the Optical Tracking System (MOTS). He is presently Associate Chief of the Advanced Development Division.

Mr. Habib received his BSEE degree from Catholic University in Washington, D. C., in 1949. He and his wife Mary Lou have five children and live in District Heights, Maryland.

# Sounding Rocket Branch Hosts Junior Rocketeers

Easter Monday was "Goddard Day" for some 30 members of the "Star Spangled Banner" Rocket Club. Arriving on Center at 9:15 a.m., the youngsters spent the day touring the Sounding Rocket Branch facilities in the Glendale Building. By the time they left at 4:15, they had learned about Goddard sounding rockets from launch to the retrieval of experiment data — and met the men who make them work.

The Star Spangled Banner Club was founded in September of 1964 by Howard Galloway, an aerospace physicist in the Sounding Rocket Branch, and meets regularly at Mr. Galloway's home in Severna Park, Maryland. A member section of the National Association of Rocketry (NAR), the club is dedicated to safe ways of building and launching model rockets.

Since 1964, SSB members have traveled widely to NAR rocket meets, staged demonstrations of their own for Goddard and local educational and civic groups using the NAR's safe, pre-constructed rocket engines, and even starred in an educational movie on rocketry for WETA Channel 26. Although club members have frequently travelled to such points of interest as the Wallops Island launch area, March 30 was their first chance to take an inside look at Goddard's own "rocket works."

During the Goddard tour the young people, who range in age from seven to 21, talked about the Aerobee 350 with Robert McIntyre and John Lane, toured a sounding rocket ground station with Leon Kalinowski and Bill McAlister, discussed the operation of rocket startrackers with David Shrewsbury and Walter Allison, inspected microcircuits with Paul Hinds, talked to Les Thompson about rocket antennas, toured the Engineering Test Department with George McVeigh, and received an explanation of computer operations from Mrs. Virginia Archambo.

By the time they left the Center, they had seen and heard more about sounding rockets than they could easily remember, but they were all anxious to apply what they had learned to their own club activities. They wish to thank everyone who helped make the day possible.



10, 9, 8.....3, 2, 1, LIFTOFF! Stephanie Sue Winchester listens to a pre-taped countdown for a sounding rocket launch.



LES THOMPSON demonstrates an ARCAS antenna for members of the SSB Club.

## Sollars Bowls 279

A STRING of nine strikes followed by a spare and another strike gave Dale Sollars of NASCOM a total of 279 points in a recent bowling game at the Rinaldi Lanes in Riverdale. For his efforts, he won \$85, a new shirt and a trophy. In 1958, while bowling for a Bell Telephone Laboratory team, he qualified for the ABC 11-in-a-row club, and in 1962 he became a member of the coveted 300 club here at Goddard by rolling a 300 game at the Fairlanes in Capital Plaza. He is currently the president of the Wednesday Mens League.



## 5th Aerospace Mechanisms Symposium

At Goddard June 15-16, 1970

The 5th Aerospace Mechanisms Symposium will be the first symposium held on the East Coast dealing exclusively with mechanisms topics. It will follow the format found successful for previous symposiums. A wide range of topics will be covered including comprehensive discussions of the development of mechanisms for various NASA, Air Force, and Navy spacecraft systems including Apollo, Mariner Mars, Biosatellite, and others. A special feature of the program will be a panel discussion on nutation dampers with audience participation.

Goddard participants will include: Dr. John F. Clark, Robert C. Baumann, Frank T. Martin, Dr. Joseph V. Fedor, Charles E. Vest, and Philip A. Studer. Goddard organizers are Dr. Joseph Fedor and Bowden W. Ward.

Advanced registration is requested. The registration fee of \$20 for full participation will cover preprints, luncheons on June 15 and 16, and a bound volume of symposium proceedings. For further information call Bowden Ward on extension 4362.



ROCKETEERS of the Star Spangled Banner Club who toured the Sounding Rocket Branch on Easter Monday.

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## Radio Club Begins Third Year

The Goddard Amateur Radio Club (GARC) has been an exceedingly active group since it was first established in May of 1968. Past activities have included setting up its own, well-equipped station (call sign WA3NAN) in a van at the old WWV site here, and tracking the AUSTRALIS-OSCAR 5 amateur radio satellite (Goddard News, February 9, 1970).

Future events will get underway with the annual "Field Day," a national contest sponsored by the American Amateur Radio Relay League on June 27 and 28. The object of Field Day is to test the proficiency of amateur stations operating under portable conditions. This year the club will try to beat its own record of 483 radio contacts made in 1968.

Regular "day-to-day" GARC activities focus on promoting good amateur radio station operation, improving the technical skills of members, and helping interested individuals become licensed radio operators. Meetings are held on the third Wednesday of each month at 5:00 p.m. in the Management Information Center. Classes in radio theory and Morse code practice are also held, and are open to all Goddard employees and their children.

In its two years of operation, the club has grown to include 43 members from all fields of Goddard activity. The present roster of club officers is: Don Tinari (W3RYQ), President; Carl Medrow (W3FA), Vice-President; Bill Opdyke (K3KHK), Secretary; Buck Moore (W3ZKI), Treasurer; Ted Jarmillo (WA3FUM), Activities Manager; and Gil Gates, Publicity Manager. An annual election will take place at the May meeting, provided a quorum of the membership is present.

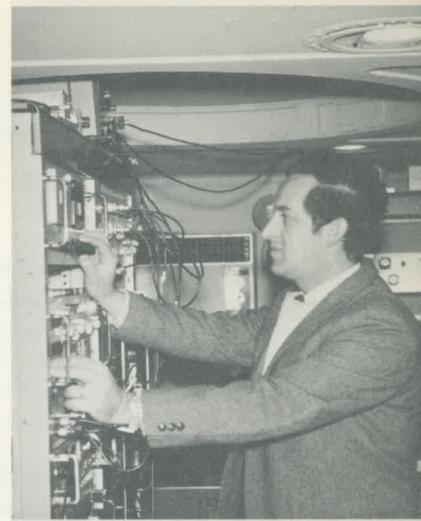
GARC is a member of the Foundation for Amateur Radio (a local federation of ham clubs), the Amateur Radio Emergency Corps, and the Radio Amateur Satellite Corporation (AMSAT). In the near future, it may join the American Radio Relay League, an association of amateurs located throughout the world.

For additional information on GARC activities, meetings, and classes, please call Don Tinari on Ext. 4900.

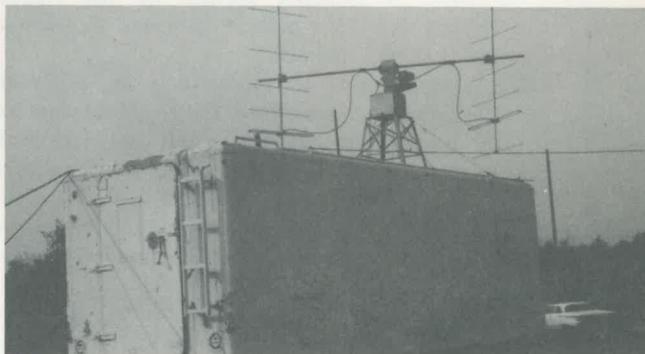


GARC MEMBERS Bill Scholtz and Don Tinari contact amateur station 5R8AS in Africa during a tracking assignment.

TED JARAMILLO, station manager of WA3NAN, operates special equipment used in the tracking of the OSCAR 5 amateur satellite.



THE GARC VAN located at the old WWV site. Shown are antennas used in the tracking of OSCAR 5.



## Basketball Season Ends



GODDARD'S BASKETBALL LEAGUE ended its 1969-70 season with the crowning of new champions in each division of the league. For the first time in a number of years, the Green Monsters were dethroned as King of the league. This honor went to the Wolfpack, top team of the A Division. Top team of the B Division is the Eagles. Shown above are the top team coaches and the most valuable players during the league's Allstar Game. From left are Frank Hicks, Carrol Tapper, Wolfpack Coach; Mike Reamy, and Jack Thompson, Eagles Coach. The top scorer in the league is Bryan Carpenter of the Road Runners with a game average of 36.6 points.

## Invention Award

The NASA Inventions and Contributions Board has presented an original citation and cash award to Mr. A. Kampinsky, of the Advanced Plans Staff, for the invention-patent entitled "Apparatus Providing a Directive Field Pattern and Attitude Sensing of a Spin-Stabilized Satellite". This is popularly known as the Mechanically Despun Antenna System, which has been operating on the ATS III spacecraft since launch on 5 November 1967.

The Mechanically Despun Antenna System is patented in the USA and in 8 foreign countries. It has been adopted by the Comsat Corporation for its Intelsat Series III Spacecraft and has been extended as the basis of the Military TACSAT-1 Spacecraft and the Comsat Intelsat IV System. Additional spacecraft utilizing this concept are the Skynet Military Spacecraft as well as the German/NASA Cooperative Spacecraft Helios, the NASA Data Relay Satellite DRS-Mark-1, the ESRO/NASA Cooperative Navigation Traffic Control Spacecraft DIOSCURE, and the Planetary Explorer Spacecraft P.E.



# Nimbus 4: Goddard's Latest Weather Eye

Goddard now has two Nimbus "weather eyes" in operation. Nimbus 4, launched April 8, 1970 from the Western Test Range, has joined Nimbus 3 as the latest satellite in a highly successful series of orbiting research laboratories.

Both satellites are designed to test out advanced spacecraft systems and sensors while providing a comprehensive picture of the earth's weather. The earlier Nimbus 3, launched April 14, 1969, has doubled its life objective of six months and provided meteorologists with a major first step in long-range weather predictions. Nimbus 4, the most advanced Nimbus yet, will continue the project's objective of expanding man's capabilities in measuring the earth's atmospheric structure on a global scale, particularly vertical profiles of temperature, ozone and water vapor.

Nimbus 4 was launched into a nearly perfect orbit by a Thorad/Agena D on April 9. "All phases of the observatory initial stabilization and experiment turn-on went as planned," according to Harry Press, Nimbus Project Manager, "and all systems are performing beautifully. We are especially pleased with the performance of the new attitude control system, developed by the Technology Directorate. It is steady as a rock, and ignores cold clouds which have significantly perturbed other attitude control systems."

"After only three weeks of operation, all major success criteria have been met. Measurements of the distribution with altitude of temperature and moisture are being made by both Dr. Hanel's Interferometer and the IR spectrometer developed by Dr. Wark of ESSA. The Selective Chopper Radiometer, provided by the Science Research Council of the United Kingdom, has for the first time derived temperature distributions in the stratosphere up to 60 Km. A high altitude balloon released in New Zealand is being tracked to obtain upper air winds, and day and night maps of the earth and its

cloud cover are being recorded."

"Certainly," said Mr. Press, "all of this would not have been possible without the dedicated efforts of both the Government and Industry Members of the Nimbus Team. Our special thanks go to the Technology Directorate, to the Laboratory for Atmospheric and Biological Sciences for some of the experiments, to the A&M Directorate for all the business assistance, and to the Delta Project for a fabulous launch. The Tracking and Data Systems Directorate support has been outstanding in permitting full operations on both Nimbus 3 and Nimbus 4."

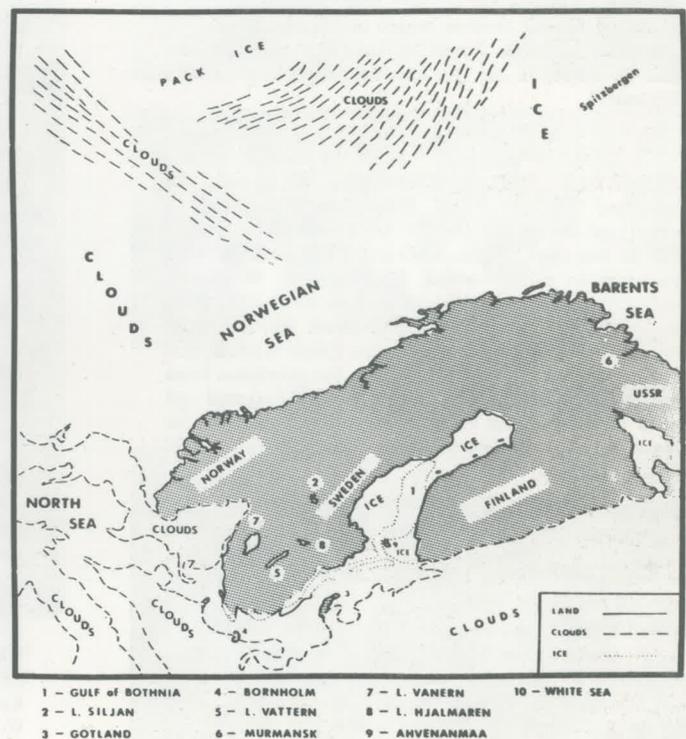
Experiments aboard Nimbus 4 include three significantly improved versions of sensors which have been flown on earlier Nimbus missions, three experiments similar to those on Nimbus 3, and three new experiments.

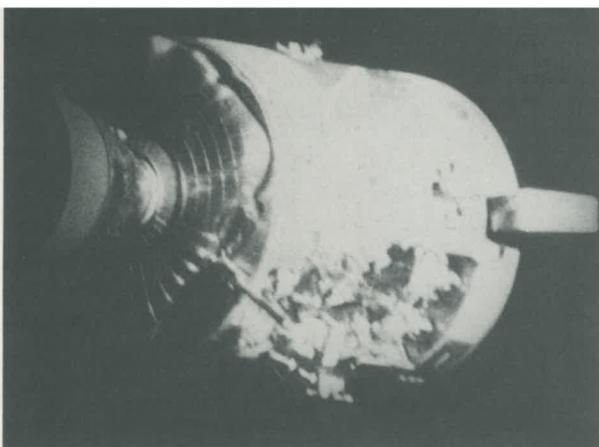
New experiments are: The Backscatter Ultraviolet Spectrometer developed by Dr. Donald Heath of Goddard, the Filter Wedge Spectrometer developed by Dr. Warren A. Hovis, and the Selective Chopper Radiometer developed by Dr. J. T. Houghton of the Clarendon Laboratory, Oxford, England and Dr. S. D. Smith of the J. J. Thompson Physical Laboratory, Reading, England.

Improved experiments are: The Infrared Interferometer Spectrometer developed by Dr. Rudolph A. Hanel and Dr. Barney J. Conrath of Goddard, the Satellite Infrared Spectrometer developed by Dr. David Q. Wark and Donald Hilleary of ESSA, and the Interrogation, Recording and Location System developed by Goddard's Charles E. Cote.

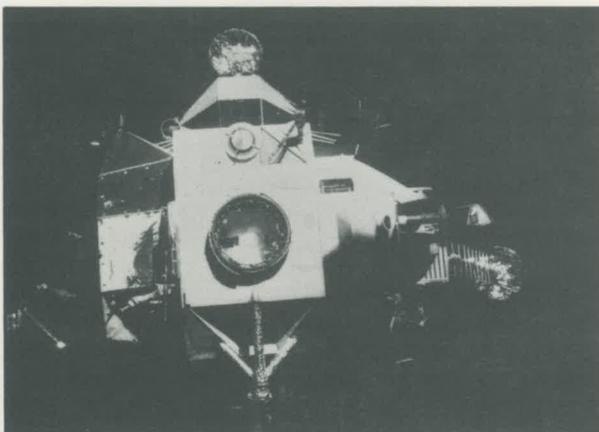
Experiments similar to those on Nimbus 3 are: The Temperature Humidity Infrared Radiometer by Goddard's Andrew W. McCulloch, the Image Dissector Camera System by Gilbert A. Branchflower of Goddard, and the Monitor of Ultraviolet Solar Energy by Dr. Heath and Raymond D. Wescott.

SCANDINAVIA as seen by the Nimbus 4 Image dissector Camera System on April 13, 1970.





**DAMAGED SERVICE MODULE.** This view of the severely damaged Apollo 13 Service Module was photographed from the Lunar Module/Command Module following SM jettisoning. As seen here, an entire panel on the SM was blown away by the apparent explosion of oxygen tank number two located in Sector 4 of the SM. Two of the three fuel cells are visible just forward (above) the heavily damaged area. Three fuel cells, two oxygen tanks, and two hydrogen tanks are located in Sector 4. The damaged area is located above the S-Band high gain antenna. Nearest the camera is the Service Propulsion System (SPS) engine and nozzle.



**GOODBY AQUARIUS.** This view of the Apollo 13 Lunar Module was photographed from the Command Module just after the LM had been jettisoned. The jettisoning occurred a few minutes before 11:00 a.m. (CST), April 17, 1970, just over an hour prior to the splashdown of the CM in the South Pacific Ocean. The apparent explosion of oxygen tank number 2 in the Apollo 13 Service Module caused the Apollo 13 crew of Astronauts James A. Lovell Jr., John L. Swigert Jr., and Fred W. Haise, Jr., to rely on the Lunar Module as a "lifeboat."

**ASTRONAUT JOHN L. SWIGERT, JR.,** Apollo 13 Command Module Pilot, holds the "mailbox" a jerry-rigged arrangement which the Apollo 13 astronauts built to use the Command Module Lithium hydroxide cannisters to purge carbon dioxide from the Lunar Module. Lithium hydroxide is used to scrub CO<sub>2</sub> from the spacecraft atmosphere. Since there was a limited amount of lithium hydroxide in the Lunar Module, this arrangement was rigged up to utilize the cannisters from the Command Module. The "mailbox" was designed and tested on the ground at the Manned Spacecraft Center before it was suggested to the problem-plagued Apollo 13 crewmen.



## APOLLO 13 . . . From Page 1.

Ozro M. Covington, Director of Manned Flight Support to the MSF and NASCOM Networks:

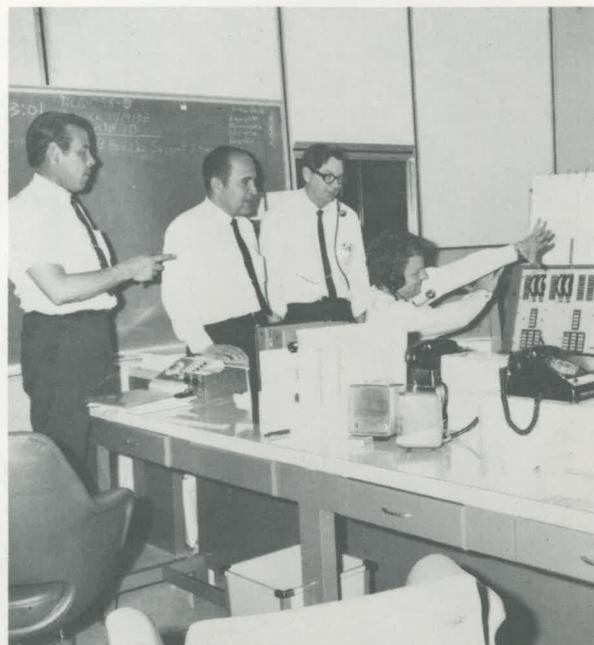
"It is a great source of satisfaction to me to note the professional manner in which all of you performed during the Apollo 13 mission. It was indeed gratifying to have all of the systems work so well at a time when they were so badly needed. I know that performance such as this can only come through special attention to all of the little details in every area. I commend all of you for the job you did which enabled the safe return of the Apollo 13 crew."

Goddard Network Operation Managers to all MSFN Stations:

"Your efforts and dedication in supporting this mission were major contributing factors in the safe return of the Apollo 13 crew. The tracking and data provided by the MSFN surpassed all expectations in spite of the adverse tracking conditions imposed by the failure of the Service Module. Our Thanks to all!"

Houston Director of Flight Operations to Goddard's Networks:

"We at MSC wish to commend the entire MSFN for their superior performance in support of Apollo 13. In the midst of this most difficult and critical mission it was extremely reassuring to have a network with so few anomalies and one which provided us with the urgently needed voice and data to bring the crew back safely. We thank you for our outstanding support."



**APOLLO 13 WATCH** in the Control Room of the Madrid MSFN tracking station is conducted by (from left) Steve Stomp, Assistant Station Director; Jack Zeratzian, Maintenance and Operations Supervisor; Fred Weldon, Maintenance Supervisor; and Carl Johnson, Assistant M&O Supervisor.

# THE LONG APOLLO GUIDED TOUR VIA GODDARD MSFN

Dale Call, Associate Chief of the MSFN Division and Goddard Network Director:

"As Network Director, I know the network did not experience any anomalies which could affect our ability to provide information to the Mission Management Team. Any anomalies in the data were compounded by the problem of the lunar module and deutilization of the expendable launch vehicle of the crew. The tracking errors increased by the reduced signal strength that experienced during a no-communication period. The MSFN experienced a mission performance can only be described as outstanding."



**AT MADRID** Gen. Louis de A. Bautiste, Spanish Station Director, is seen (left), President of the Spanish Aerospace Technology Institute.

MADRID PHOTOS BY SAAC

# NG VIGIL: LO 13 O SAFETY DDARD'S LINKS

Tecwyn Roberts, Chief of the Manned Flight Engineering Division:

"With the safe recovery of the crew, I felt that the network stations and all the people associated with the Program could feel justifiably proud. I particularly felt that here was one mission where it was essential that the Network performance be outstanding because of the spacecraft problems and the low signal levels the stations were working with."

Vern Stelter, Chief of the NASA Communications Division:

"It is a credit to the thousands of people involved in providing circuits and facilities to the NASCOM Network, that during the duration of the Apollo 13 emergency, NASCOM problems were virtually non-existent."

Dale Call, Goddard Network Director, to E. G. Bowen and Ian Homewood in Australia:

"I would like to express my personal thanks along with the appreciation of everyone involved in the Apollo 13 mission for the outstanding support provided by Honeysuckle, Carnarvon and Parkes. This support contributed significantly in the safe return of the Apollo 13 crew. I would especially like to single out those responsible for bringing up the Parkes antenna and associated data systems in record time. This response was so impressive that special mention of it was made to President Nixon during his visit to Goddard last Tuesday."

the Manned Flight Operations Director:

was extremely pleased that  
ience any significant failures  
lity to provide the necessary  
Control Center during this  
a was so critically needed.  
data would have greatly  
of determining the condition  
developing a time line for the  
les so vital to the safe return  
ing problem was greatly  
gnal levels (down 16db from  
ormal mission).

ed fewer failures on this  
llo mission to date. Its  
cribed as being superb."



Azcarraga y Perez Caballero  
panish National Institute of  
(INTA); and Dr. Manuel  
irector.



DAN HUNTER (left), Station Director at the Madrid  
MSFN station; discusses Apollo 13 with Tecwyn  
Roberts, Chief of the Manned Flight Engineering  
Division, who was at the station for the mission.

## At GSFC, VIGIL . . .



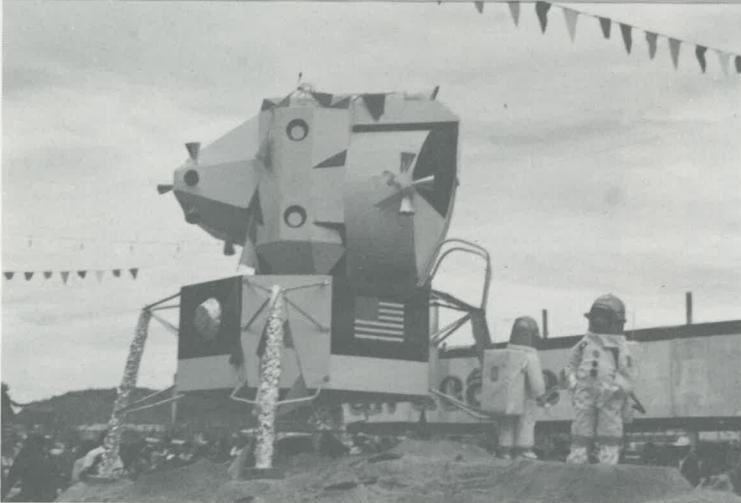
## . . . TENSION . . .



## . . . AND RELIEF



## GODDARD AROUND THE WORLD



**GUAYMAS, MEXICO (MSFN).** There is a tradition, still strong in Mexico, that dates back to the time of the Roman Empire. In Spanish speaking countries it is called "Carnaval" and is a week of reveling prior to the fasting and penitence of Lent. At the city of Guaymas, the 1970 Carnaval blended this 2000-year-old custom with a representation of man's new goals — space travel and exploration — in the form of a parade float representing the Apollo 11 spacecraft "Eagle" in which man first landed on the moon. The half-scale wood-and-metal Lunar Module was built by personnel from the MSFN tracking station and won second place out of a total of 39 float entries. At the float's base was written the legend, "Un paso pequeño para el hombre — un salto gigantesco para la humanidad," Neil Armstrong's first words from the moon in Spanish.



**USNS VANGUARD (MSFN).** The Apollo Tracking ship Vanguard hosted on April 28, the opening day session of the bi-annual meeting of the Geodesy and Cartography Sub-Committee of the nations Space Science Applications Steering Committee. Of particular interest to the group was the Vanguard's sophisticated navigation system and its possible application in association with geodetic satellite tracking to marine geodesy studies. From left to right front row are Otto W. Thiele, Vanguard Station Director; Arthur J. McNair, Cornell U.; Martin J. Swetnick, NASA HDQ/OSSA; William M. Kaula, UCLA; James H. Sasser, NASA/MSC; Friedrich O. Vonbun, NASA/GSFC; Armando Mancini, NASA HDQ/OSSA; back row, E. M. Gaposchkin, Smithsonian Astrophysical Observatory; L. R. Sykes, Columbia U.; William H. Michael Jr., NASA/Langley Research Center; Urho A. Uotila, Ohio State U.; Patrick M. Hurley, MIT; H. Ray Stanley, NASA/Wallops Island Station; Charles A. Lindquist, Smithsonian Institution; Helmut Schmid, ESSA/C and GS; and John D. Alvey, NASA/GSFC.



**GRAND BAHAMA ISLAND (MSFN).** Senator Stephen M. Young (D-OHIO), a member of the Senate Committee on Aeronautical and Space Sciences, visited the station in March. From left, Lawrence H. Odenthal, Station Director; explains the use of the Station's operations console to Senator Young and Lt. Col. Howard J. Anderson, USAF liaison officer.



**BERMUDA (MSFN).** Col. Frank Borman, Apollo 8 Commander, signs the station's Apollo 8 Group Achievement Award. Station Director Fred Healey assists Col. Borman while Charles N. Manning, U. S. Consul General in Bermuda, looks on. Col. and Mrs. Borman had been in Bermuda at the invitation of Mr. Manning. The Achievement Award had been presented to the Bermuda station in March of 1969 by Goddard Director Dr. John F. Clark.

## NASA Closes Antigua Station

The National Aeronautics and Space Administration has notified the Governments of the United Kingdom and Antigua of its decision to close its tracking station in Antigua by June 30. The station is no longer required for support of the NASA manned space flight program.

Established under an international agreement signed in 1967, the Antigua station has been operated by NASA's Goddard Space Flight Center as a unit of the Manned Space Flight Network. The station includes a unified S-band radar complex and a 30-foot dish antenna.

Since it became operational the station has played a major role in tracking functions for all Apollo flights through Apollo 11, the first manned lunar landing. Following that event NASA reduced tracking requirements for the Apollo Program, and the Antigua station reverted to caretaker status. The agency has since determined that the station will no longer be required.

At peak operation, the Antigua tracking complex had a complement of 92 persons. The staff now consists of 17 American and 11 Antiguan employees who are carrying out the phaseout work. Equipment from the site will be used in other systems in the worldwide network.

## Goddard Employees Honored at The Kennedy Space Center

Three outstanding employees, the first from Goddard to receive such recognition, were honored recently at Cocoa Beach, Florida, where they visited as special guests of NASA and the astronaut team. They were joined by over 220 other honorees representing some of the nation's top craftsmen and professionals responsible for the success of the Apollo program.

Representing Goddard were Mrs. Patricia Hensel of the Office of Instrumentation Ships, Darrell H. Olesen of the Manned Flight Engineering Division, and Tony Begenwald of Bendix and associated with MFOD.

The two day visit was crammed with activities highlighted by a five hour tour of the Cape Kennedy Space Center complex, a VIP reception, and the spectacular launch of Apollo 13. At the reception they were entertained by top NASA and industry officials. Among the dignitaries were Dr. Thomas Paine, Dale Meyers, and Dr. Rocco Petrone, all of NASA Headquarters, and many presidents and vice presidents from various aerospace companies under NASA contract.

Among the more than a dozen astronauts at the reception was Alan Shepard, who flew America's first sub-orbital spacecraft and is currently Commander of the upcoming Apollo 14 flight, along with crew members Edgar Mitchell and Stu Roosa who were also present. Dick Gordon of Apollo 12 fame, Don Holmquist of SKYLAB I and Dr. Karl Henze slated for SKYLAB II were also in attendance to honor the awardees.

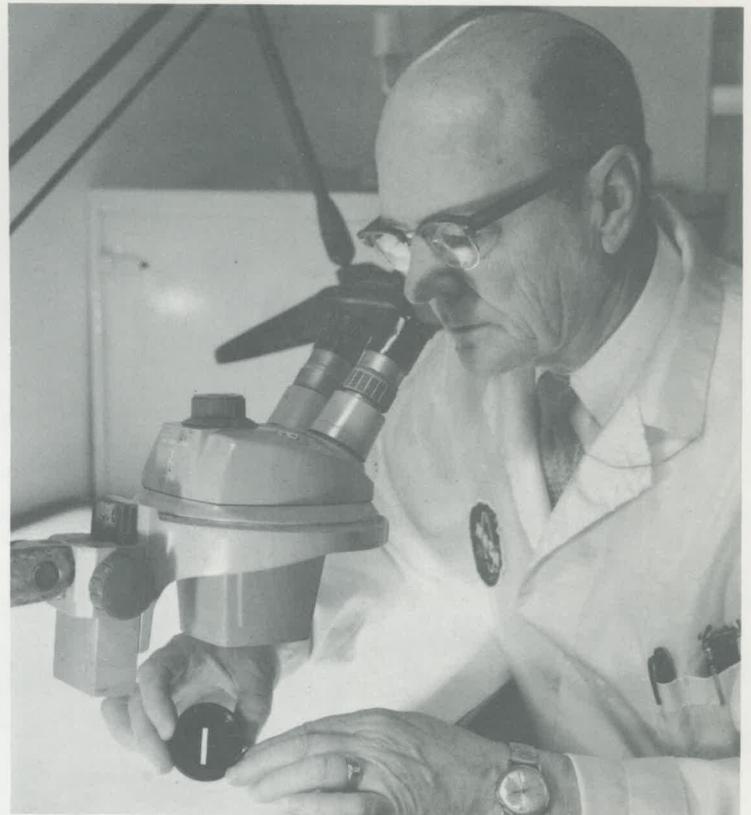
Visits to Cape Kennedy are a regular feature of the Manned Flight Awareness Program and are awarded to outstanding workers in industry and government. These employees are selected due to exceptional skills and/or quality workmanship and for exceptional performance within their scope of authority and responsibility.

The granting of this award is not to be confused with the Silver Snoopy awards. While they are both sponsored by the Manned Flight Awareness Office, each is a separate award and each is normally presented to different individuals.



**VIP TREATMENT.** Stopping long enough to have their picture taken are Goddard Manned Flight Awareness awardees Pat Hensel, Darrell Olesen and Tony Begenwald enjoying themselves at a reception in their honor where they were entertained by top NASA and industry officials on Friday evening prior to the launch of Apollo 13. From left are Mrs. Turner Wiley, Tony Begenwald, Turner Wiley, Darrell Olesen, Patricia Hensel, and Walter Hensel. Turner Wiley is Chairman of the MFSD/Manned Flight Awareness Council and acted as host to the trio during their visit to the Cape.

## Electroformed Radiation Shields



Earl Ellis

A significant example of the capabilities of Goddard's Electroplating Laboratory had been recently demonstrated while solving a problem for the Stabilization and Control Branch. A contract for fabricating and plating a set of SCADS aluminum reticle holders was placed with a highly recommended industrial plating facility. The specifications called for a 20 mil. thick .500-inch wide gold band to be electrodeposited evenly on the inner surface of the units.

After many tries, the contractor was still not able to protect the reticle holders from the caustic plating baths and, as a result, the reticle holders were completely consumed by the solution. At that point, new reticle holders were fabricated and the task given to Goddard's plating laboratory.

The problem was successfully solved by Earl Ellis who is shown here inspecting the finished product. The ability of Goddard's personnel were particularly appreciated by the project engineer who had owned and had operated a plating plant for 25 years.

## 1970 IEEE International Computer Group Conference

The Conference, sponsored by the Institute of Electrical and Electronics Engineers, will be held at the Washington Hilton Hotel. It will be the first International Computer Group conference in Washington, D. C. The program will emphasize the engineering and design aspects of new developments in computer-related memories, terminals and peripherals.

For additional Conference and exhibit information, call or write: Don E. Doll, IBM Corporation, 18100 Frederick Pike, Gaithersburg, Maryland 20760. Phone: (301) 840-6217.

# Work+Study=Success for Goddard Co-op Students

Work a semester, study a semester, is the formula that has made the Co-operative Work-Study Program a success at Goddard.

Each year some 60 students, working on an alternate basis, combine meaningful employment here with full-time undergraduate programs at their own colleges and universities. By the time many receive their degrees, they have made a valuable contribution to Goddard's program while gaining up to three years of work experience that will give them a headstart on future careers or an incentive for graduate training.

"The aim of the program," says Co-op Coordinator James Wingrove of the Employee Development Branch, "is to provide meaningful work assignments which enhance the student's self-realization and direction."

Students at Goddard generally major in aeronautical, electrical or mechanical engineering; mathematics and physics. This year the

program has added the administrative fields of personnel management, budget, program support and procurement. With students alternating on a group basis, no more than 30 Co-ops work on-Center at any one time.

Many graduates of Goddard's Co-op program return here as regular employees. In the past four years, more than half of our graduating Co-op students have returned.

The Goddard Cooperative program is similar to Co-op programs throughout NASA, at other government agencies and in private industry. Since the program's beginning at Goddard in 1965, students from 22 colleges and universities have worked here. Currently active schools are Akron, Cincinnati, Cleveland, Drexel, Georgia Tech, Indiana State, Maryland, Northeastern, Pratt, South Florida, Tennessee, VPI, and Virginia State.



**ARLENE LUTES**, a mathematics major from Indiana State University, assists in the data analysis work of the Particle Physics Branch. Among her varied duties is the writing of statistical analysis programs and the hand plotting of particle data.



**PHIL ASCHRAFT**, an aerospace engineering major at the University of Cincinnati, determines the absorption properties of a gallium-arsenide crystal in a carbon dioxide laser heterodyne system. This is a project for the RF Systems Branch.

**PAUL THOMPSON** works in the Optical Systems Branch. At present he is working on a method to determine atmospheric attenuation during the ATS-F Laser Communications Experiment. He is a physics major at Drexel University.



**CHARLES COSNER**, a mathematics major at VPI, is a computer programmer whose work includes program support for the Definitive Orbit Determination System.



**DAVID WAGAMAN** is a business student trainee. His job at present includes processing data from contract information.

**KENNETH RUSH** works on the new split fairing nose cone for the Javelin sounding rocket as part of his job in the Sounding Rocket Branch. He is an aerospace engineering major at the University of Tennessee.

