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Goddard Space Flight Center

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Greenbelt, Maryland and Wallops Island, Virginia

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Goddard Physicist Predicts Intense Solar Cycle

by Michael Braukus and Randee Exler

A Goddard astrophysicist predicts that the next solar maximum may occur earlier than expected and the explosions and outbursts of magnetic energy could produce some of the most violent solar storms since Galileo first witnessed sunspots in 1610.

"Looking at the latest data, the peaked activity seems to be coming a little early," according to Dr. Kenneth H. Schatten, Code 610.1. "Recent new evidence appears to support our view of the solar cycle's severity. However, the peak we predicted two years ago for 1990 may occur in 1989, earlier than expected."

The solar maximum is part of an observed 11-year cycle where magnetic sunpots and other activities change the Sun's visible surface. "This solar cycle has been rising faster than any before. It's already passed the average level," Dr. Schatten affirmed.

Dr. Schatten, in a scientific paper presented at the American Geophysical Union meeting in San Francisco recently, explained the "dynamo theory," a technique that he and Yale University colleague Dr. Sabatino Sofia used to predict the exceptionally large solar cycle. They first used this method, which measures the strength of the Sun's magnetic field, to make successful predictions for the last solar maximum in 1979.

Unusual Strength

During the last sunspot minimum in 1986, the team found unusual strength in the magnetic field that extends between the Sun's north and south poles. Using eight prior solar cycles, they observed cause and effect relationships between the strength of the Sun's polar magnetic fields and the severity of future solar storms: the stronger the polar fields, stronger the future solar storms. The strong current cycle roughly matches their predictions.

Dr. Schatten compares the effect of magnetic influences on solar storms to the effect of yeast on dough. "It's like baking bread," Dr. Schatten explained. "If you add a little yeast, the bread will rise a little. If you add a lot, the bread will rise a lot. Thus, the magnetic field is like a seed for future solar activity."

Solar Storm Effects

Most people won't even know when these storms are taking place and may blame other sources for increased static on their radio or telephone. Changes in solar activity, however, affect NASA's low-Earth-orbiting satellites and communica-

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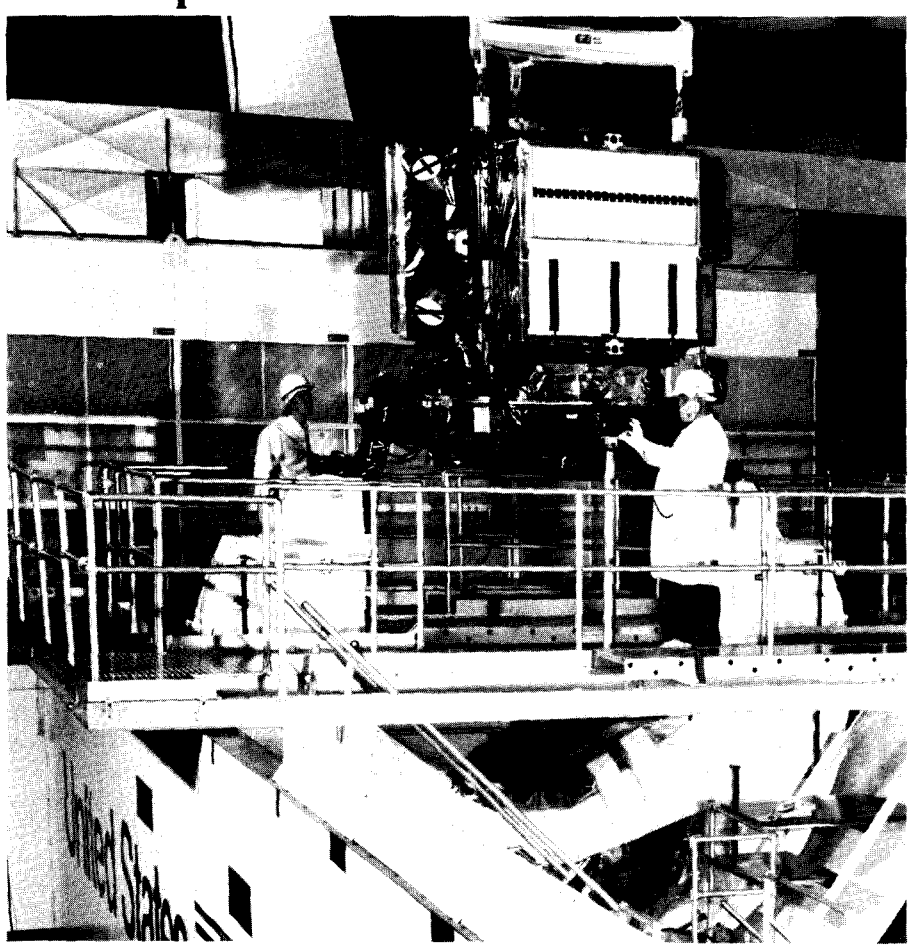
MMS Spacecraft Fitted for Shuttle



SPACECRAFT FITTING—Technicians at Goddard make final adjustments to a Multimission Modular Spacecraft (MMS) as it is lowered for fitting with Space Shuttle Flight Support System hardware. The technicians are suspended on a platform above Goddard's Shuttle mockup; directly below the workers is the Shuttle's payload bay. This MMS will become part of the Goddard-managed Upper Atmosphere Research Satellite (UARS)—scheduled for deployment from the Space Shuttle Discovery in September 1991—and will allow for UARS' on-orbit servicing or repair, or both, if necessary. The MMS is an on-orbit, modular, serviceable spacecraft bus of the type employed on the Solar Maximum Mission satellite during its historic on-orbit retrieval and repair by the crew of STS 41-C in April 1984.

INSIDE

Charlie Tulip: Goddard's Sixth Floor Banker

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Talk from the Top

John W. Townsend Jr.

Q: If this "can do" agency can help launch the Shuttle, then why can't its Daycare find an acceptable door or curtain arrangement so its toilets won't be open to the classroom?

A: I have received a number of comments concerning toilet arrangements in the Goddard Child Development Center. This turns out to be a thorny issue but it is under active review and I will keep you advised.

Q: During the past three days we have witnessed seven violent and extremely prolonged pigeon deaths in the courtyard of Building 23...we found enlarged corn kernels in the area... This led us to believe the pigeons were intentionally being poisoned. ...

A: In response to several inquiries, I want to assure you that Goddard is not poisoning pigeons, even though they have been a problem in Building 23. Poison is being used by exterminators throughout the area and has become a very lucrative business. ... It is possible that the pigeons are being poisoned elsewhere and are just returning to their nests to die. We are investigating the University of Maryland as a source for analyzing the corn and if that is not feasible, the corn will be disposed of properly. In order to significantly reduce the pigeon population at the Center, a number of measures are necessary. There are funding requests for alterations that would "pigeon proof" our buildings. Future construction projects will include "pigeon proof" considerations. We will never be able to prevent individual employes from trying to poison wildlife on the Center, nor will we be able to prevent other employees from risking their own health and safety to save sick or injured wildlife on the Center. Our hope is that by forward thinking, planning

Center Director Dr. John W. Townsend, Jr. Wants to Hear From You! Send your Questions to: TALK FROM THE TOP, Code 130.

Solar Maximum Mission to Re-Enter

The first satellite to be repaired by astronauts in space, the Solar Maximum Mission (SMM), or Solar Max as the spacecraft is known, will re-enter the Earth's atmosphere sometime in 1990, during the next period of maximum solar activity, according to Goddard project officials.

The packed shuttle manifest and science budget priorities were two reasons given by NASA not to retrieve, repair or reboost the fuel-shy spacecraft.

In a recent memo to Center Director Dr. John W. Townsend, Jr., NASA Associate Administrator for Space Science and Applications Lennard A. Fisk wrote, "We appreciate the science and programmatic benefits which could have accrued from the implementation of the proposed mission including post solar maximum science operations and reuse of spacecraft subsystems....

"...the ground impact risk to life and property is felt to be sufficiently small to support a reentry decision. ...

"We appreciate the support of the GSFC Satellite Servicing Project in performing the analysis and preparing the data such that an informed decision could be made while pondering all aspects of the problem."

The 5,100-pound solar observatory was launched on February 14, 1980, from the Kennedy Space Center, FL, to gather data on solar flares and their impact on the Earth's atmosphere. Solar Max was the first of a new breed of satellites built of standardized components that can be replaced or repaired in space.

After nine months of successful operations, three small fuses in the Solar Max Attitude Control Subsystem module failed, leaving the satellite unable to point precisely at targets of observation on the Sun. Solar Max's loss presented NASA a golden opportunity to repair a satellite in space.

The Solar Max Repair Mission took place on STS-41C aboard the Space Shuttle Challenger in April 1984. Linked by electronic communications, the five-member Shuttle crew and personnel at Goddard's Payload Operations Control Center (POCC), Greenbelt, MD, worked together as a team to demonstrate that satellites could be serviced in space. Not everything went as planned.

There were tense hours when the capture attempt faltered and control of the satellite was almost lost forever. Through the efforts of the dedicated team, Solar Max was saved and the repair effort was a stunning success. The Solar Max Repair Mission launched a new era in orbital servicing and repair.

The 1990 loss of Solar Max will create a void in the study of solar physics until the Solar and Heliospheric Observatory (SOHO) is launched in early 1995, scientist say. Goddard's International Solar Terrestrial Project (ISTP) is managing NASA's effort in this collaboration with the European Space Agency. SOHO will include three U.S. experiments that will study the structure of the Sun's interior, coronal plasma and the origin of the solar wind.

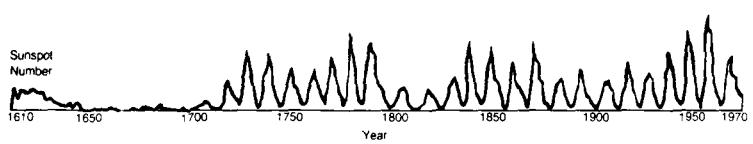
Intense Solar Cycle

Continued from page 1

"High solar activity increases the density and temperature of the Earth's upper atmosphere where some satellites orbit," Dr. Schatten said. "This thicker, hotter atmosphere has an adverse affect on a satellite. It increases the satellite's drag which in turn decays the orbit and shortens its lifetime."

"Goddard's flight dynamics experts, of course, have been placing our satellites in higher orbits so they can perform their mission without interference," he added.

The solar storms may produce a bonus for star gazers, Schatten explained. Spectacular aurora or northern lights usually restricted to very high latitudes may become visible at middle latitudes including parts of California.



***SUNSPOT CYCLE*–Pictured is a graph of solar activity from 1610 (when Galileo first observed sunspots) to 1970. The 11-year cycles are easily seen by the peaks and falls. In the 17th century, there were few sunspots. The next solar maximum, which should occur around the first part of 1990, will yield intense solar activity, according to scientists such as Goddard's Dr. Kenneth Schatten.**

Launch Update: New Shuttle Crews Named

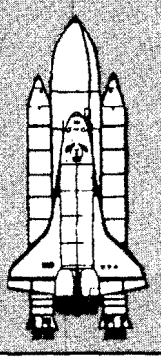
Astronaut flight crews have been named to four space Shuttle missions which are scheduled to fly in late 1989 and early 1990, bringing the total number of crews in training to nine.

Col. Frederick D. Gregory (USAF) will command STS-33, a Department of Defense mission aboard Discovery set for August 10, 1989. Gregory's crew members will consist of pilot S. David Griggs and mission specialists F. Story Musgrave, M.D., Kathryn C. Thornton, Ph.D. and Capt. Manley L. "Sonny" Carter, Jr., M.D. (USN).

The Space Shuttle Atlantis will fly under the command of Capt. Donald E. Williams (USN) on October 12, 1989, on mission STS-34, to deploy the planetary probe Galileo, sending it on its way to Jupiter. The pilot for this mission is Cmdr. Michael J. McCulley (USN). Mission specialists are Shannon W. Lucid, Ph.D., Ellen S. Baker, M.D., and Franklin R. Chang-Diaz, Ph.D.

Capt. Daniel C. Brandenstein (USN) will command the STS-32 crew aboard Columbia. The mission, scheduled for November 13, 1989, will feature deployment of the Syncom IV-5 communications satellite and retrieval of the Long Duration Exposure Facility. Lt. Cmdr. James D. Wetherbee (USN) will serve as pilot. Bonnie J. Dunbar, Ph.D., G. David Low, and Marsha S. Ivins have been named as mission specialists.

Shuttle mission STS-35 will feature the ASTRO-1 astronomy laboratory and is scheduled to fly March 1, 1990. Commanding the mission aboard Columbia is Capt. Jon A. McBride (USN). Col Guy S. Gardner (USAF) has been named as pilot. Mission specialists are John M. "Mike" Lounge, Jeffrey A. Hoffman, Ph.D., and Robert A.R. Parker, Ph.D.



NASA Pipeline

AMES RESEARCH CENTER, Mountain View, CA—As of December 5, 1988, the Pioneer orbiter spacecraft has completed 3,652 24-hour-long orbits of the planet Venus. This 10-year figure represents the first and most thorough survey of the planet yet made. The Pioneer spacecraft has returned data which enabled NASA scientists to map 93 percent of the surface of Venus, outline the general pattern of terrain and gravity relationships related to the plate tectonics and volcanic activity of the planet, and further understand the pattern of Venus's weather. Experiments on the "runaway greenhouse effect" of the planet Venus have special relevance to understanding similar Earth phenomenon.

HEADQUARTERS, Washington, DC—NASA and the University Corporation for Atmospheric Research (UCAR), Boulder, CO, announced the signing of a memorandum of agreement that establishes the terms and conditions for UCAR's use of Space Shuttle external tanks (ETs) for suborbital experiments. UCAR will use the tanks to conduct experiments contained in the unpressurized, 5000-cubit-foot inter-tank area, between the fuel and oxidizer tank within the Shuttle external tank. These experiments would be conducted during the suborbital trajectory of the tank following its jettison from the Shuttle and prior to its destruction during reentry.

LANGLEY RESEARCH CENTER, Hampton, VA–Cary R. Spitzer, manager of Program Plans and Contracts, Advanced Transport Operating Systems Program Office, has been awarded the Airline Avionics Institute (AAI) Volare Award. Spitzer was cited "in honor and deep appreciation for his contributions and for guiding NASA and other researchers in developing new technology responsive to airline avionics needs." Spitzer is the second federal government recipient in the 21-year history of the award.

Goddard Completes CFC Campaign

The most successful Combined Federal Campaign (CFC) in GSFC history has drawn to a close, thanks to Goddard's 3,747 civil service employees.

With all directorates going well over goal, $341,739 was collected for the more than 700 charities represented by CFC, according to Locke Stuart, this year's chairman. The previous high (last year) was $309,817. This 10 percent increase is well above the 3 percent increase for the "top 40" Federal agencies, of which Goddard is one, he said.

The average Goddard employee's gift was more than $150, compared to an average gift of $99 by employees in the "top 40" agencies, Stuart said, Moreover, other agencies' average 64 percent participation was surpassed by Goddard's 68 percent, he explained.

The new "Golden Eagle" award was presented to employees who gave 1 percent or more of their gross income. CFC presented 86 Golden Eagles to Goddard; the largest single employee contribution was $2,000.

Goddard is also extremely fortunate to have generous contractors, who, on their own initiative, gave a total of $22,825 Stuart said. Raytheon, Bendix, Computer Services Corporation (CSC), ST Systems Corporation (STX), Northrop, Ford Aerospace, and Computer Based Systems, Incorporated (CBSI) all shared in the success of the campaign.

"We at Goddard are for the most part so much more fortunate in our jobs and personal security than our fellow humans, and it is truly a sign of an unselfish and caring community that so many would care to give so much," explained Stuart.

DIAL 286-NEWS

When the snow starts to fall, do you know who to call? Dial 286-NEWS— Goddard's Audio News Service, sponsored by the Office of Public Affairs, for the latest update on Center closings due to weather.

Self-Paced Learning Center a Resource for Employees

More than 100 Goddard civil service and contractor employees attended an open house on December 14-16 at the Self-Paced Learning Center (SPLC) in Building 18's Information Technology Center (ITC).

Those who attended toured the facility, previewed courseware available in the learning center, and met with the SPLC staff. A highlight of the tour was the opportunity for attendees to view new training technologies such as interactive video.

The Self-Paced Learning Center uses audiotapes, videotapes, and computer tutorials to teach a wide variety of subjects. Employees traveling overseas may want to listen to the SPLC's foreign language audiotapes to brush up on their Spanish, German, or Russian. A number of technical, managerial and clerical courses are featured on videotape.

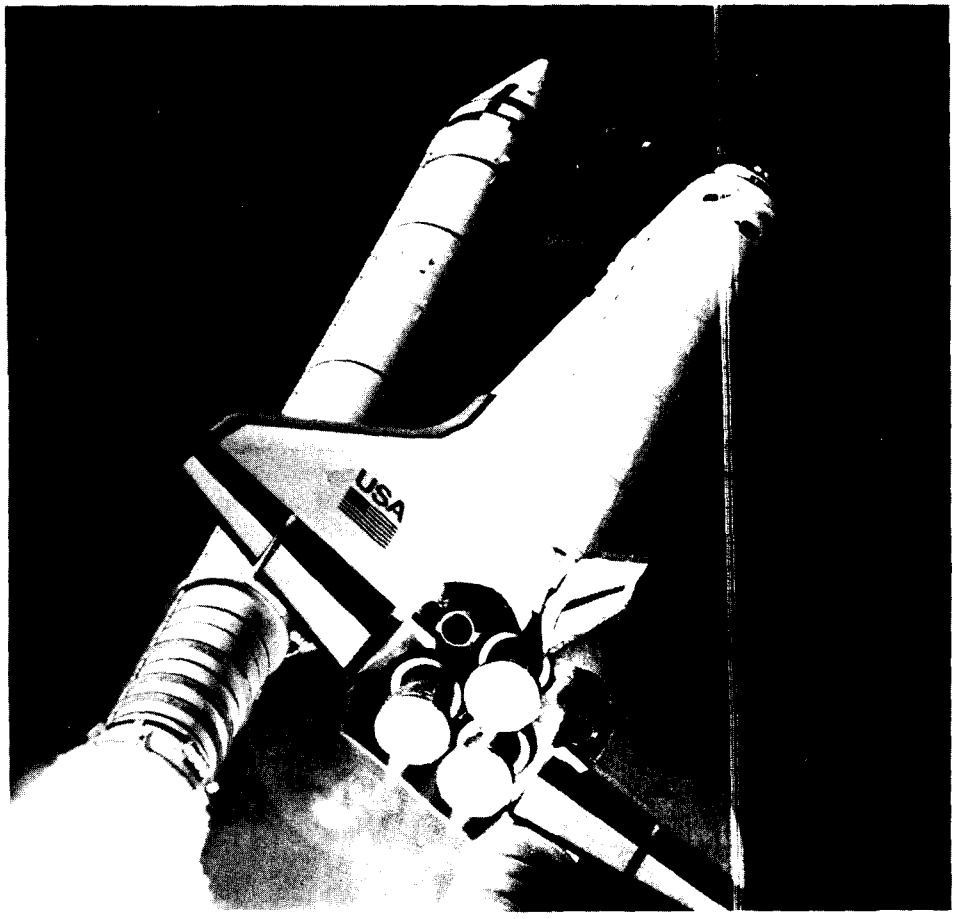
Employees can use the on-screen computer-based tutorials to learn a new software system, or to learn advanced uses of software they already use. A sampling of the computer-based courses available includes an introduction to the IBM Personal Computer (PC) and Disk Operating System (DOS), the Lotus 1-2-3 spreadsheet program, the dBASE III Plus database program, and the WordPerfect word processing program. For a complete listing of all SPLC courses, check the SPLC course catalog, located in offices Branch level and above.

To take a course in the Self-Paced Learning Center, employees simply complete the User Request form in the back of the SPLC course catalog, and call Pamela Moore, the SPLC Coordinator, on x6-7285, to schedule the course. The courses are available between 8:00 a.m. and 6:00 p.m.

"When your schedule is tight, you can schedule a course at a time convenient to you," said Moore. "And there is no charge for civil service or contractor employees for S)PLC courses."

Operated by Computed Based Services, Inc. (CBSI) for the Office of Human Resources, Employee and Organizational Development Branch, the Self-Paced Learning Center is "a resource to all Goddard employees," according to Ken Fly, of the Employee and Organizational Development Branch. "All employees are encouraged to take advantage of the SPLC—it's a savings in both time and money, especially when compared to the cost of a "live," instructor-led course, either on- or off-site."

Space Shuttle Atlantis Completes Successful STS-27 Mission



***BLUE SKIES*–Exuberant workers at Kennedy Space Center, FL, cheered the launch of the space shuttle Atlantis into a bright blue sky on December 2 at 9:30 a.m. EST, after bad weather on December 1 forced a one-day turnaround. As Atlantis soared skyward, the crew readied for several days of classified activities involving a Department of Defense payload. After slightly more than four days in space, the five-man all-military crew landed at 6:36 p.m. EST at Edwards Air Force Base, CA, on December 6.**

Following a successful launch at 9:30 a.m. EST on December 2, from Kennedy Space Center (KSC), FL, the Space Shuttle Atlantis and its five-man all-military crew landed at Edwards Air Force Base, CA, at 6:36 p.m. EST on December 6, after slightly more than four days in space.

The original launch plans for December 1 were scrubbed due to bad weather in the form of upper level winds which made launch impossible. The launch team performed a one-day turnaround, with retanking, before Atlantis became airborne on December 2.

Rear Admiral Richard H. Truly, Associate Administrator for Space Flight commented on STS-27's successful follow up to NASA's return to flight with the STS-26 launch of the Tracking and Communications Relay Satellite (TDRS-D): "I'm delighted that barely two months after STS-26 we've landed the second mission of the new era of the Shuttle program."

NASA Administrator James C. Fletcher also congratulated KSC Director Forrest S. McCartney and the launch team, saying "this is probably the best performing launch ever!"

Atlantis returned to KSC on December 13 atop a Boeing 747 carrier, where engineers and technicians on a special Damage Review Team will assess the thermal tile damage suffered during the mission and begin preparing Atlantis for its next flight in April.

TDRS-D Readied for February Launch Aboard Discovery

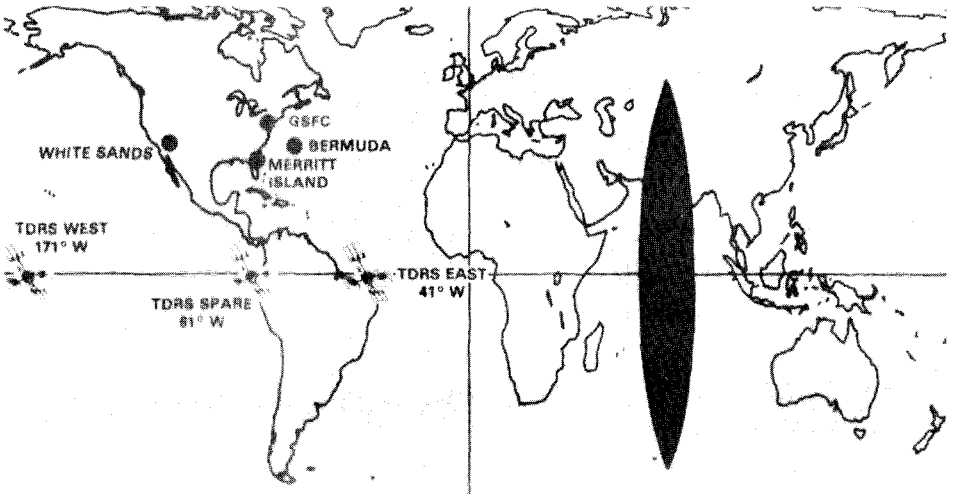
Launch of the Goddard-managed Tracking and Data Relay Satellite-D (TDRS-D) is scheduled for no earlier than February 23.

The 4,900-pound (2,222 kg) communications satellite will be carried into space from the Kennedy Space Center on Space Shuttle Discovery and boosted into geosynchronous orbit by an Air Force Inertial Upper Stage (IUS) booster.

The satellite, built by TRW, and owned and operated for NASA by Contel, will be the third TDRS to be placed in orbit, completing the constellation of communications satellites that will provide communications between orbiting spacecraft and the ground during 85 to 100 percent of orbit. With the previous system of ground stations, communications were able to be maintained only about 15 percent of orbit.

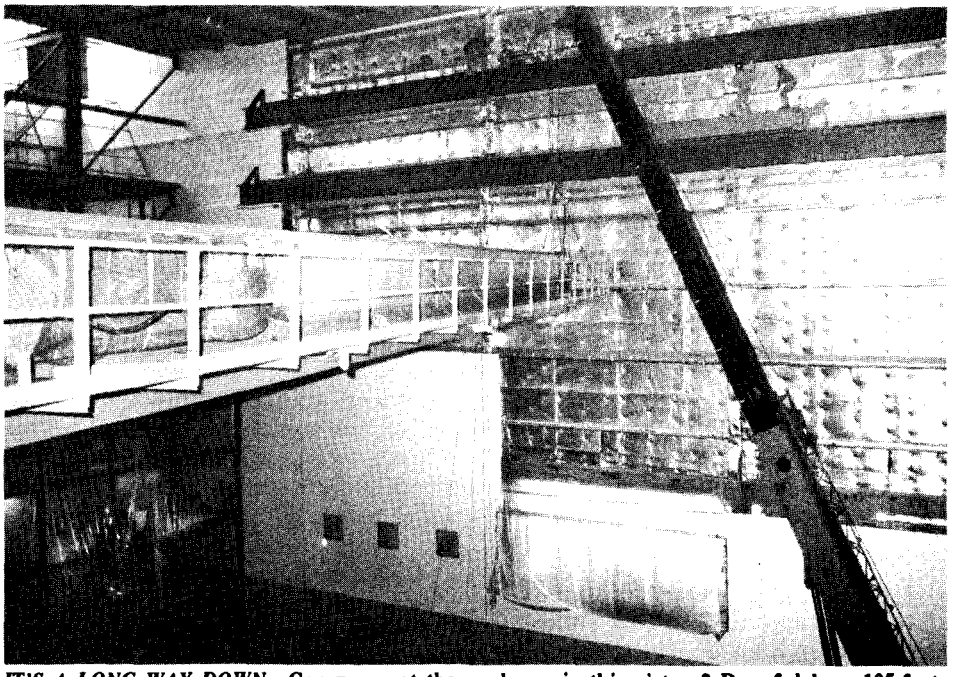
TDRS-D, which will become TDRS-4 in orbit, will take up a position at 41 degrees west longitude, now occupied by TDRS-1, launched from Space Shuttle Challenger (STS-6) at April 1983. TDRS-1 will be moved to 79 degrees west longitude, where it will serve as an on-orbit spare.

TDRS-3, launched last September 29, is now operating from its assigned position at 171 degrees west longitude. Following its launch on Discovery from the Kennedy Space Center, TDRS-3 operated from 150 west longitude for testing and calibration. After the Department of Defense shuttle mission STS-27, which it supported, TDRS-3 was moved to 171 degrees.



ZONE OF EXCLUSION–**This diagram shows NASA ground stations around the world, now used to track satellites in orbit. In conjunction with these ground stations, the first Tracking and Data Relay Satellite, TDRS-1, provides coverage during about 15 percent of the satellites' orbit. Together with TDRS-3, launched on September 29, 1988, and recently moved to its permanent position at 150 degrees west longitude, the constellation provides nearly 85 percent satellite coverage. When TDRS-D (to be renamed TDRS-4 when in orbit) is launched, TDRS-1 will be maintained on orbit as a spare.**

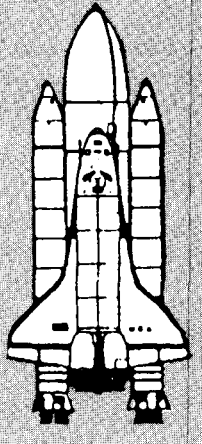
Cranes Installed in Bldg. 29



IT'S A LONG WAY DOWN—**Can you spot the workmen in this picture? Dwarfed by a 105-foot-long girder suspended from two cranes, workmen scale the walls in the still-under-construction Spacecraft Design and Integration Facility (SSDIF), to install the two-20-ton beams that will support a 35-ton-capacity crane in the SSDIF's clean room. Three men are perched precariously on a two-foot-wide beam on the wall, waiting for the cranes below to guide the huge girder to its place. When finished the SSDIF will boast the largest class A clean room in the free world with two of these cranes, each of which can maneuver a 35-ton payload the size of a Greyhound bus. In addition, the shipping and receiving area will have another 35-ton-capacity crane, to load and unload spacecraft arriving and departing from the facility. These cranes will be radio-controlled, freeing technicians to move about the clean room with a hand-held remote control device as they maneuver the satellite into position for integration and testing. The beams came all the way from Texas on two 140-foot-long telescoping flatbed tractor-trailers. The cranes travel between the beams on a trolley. At this writing, the girders and trolleys for both cranes in the clean room are in place, awaiting installation of the cable and controls to operate them. Installation of the crane in the shipping and receiving area is about halfway complete.**

See next month's issue for a complete update on the Building 29 construction.

DIAL 286-NEWS



Interested in the latest information on STS-29? Dial 286-NEWS. This is the number of the Office of Public Affairs code-a-phone. Dial in for up-to-the-minute information on Goddard and related events.

INSIDE

Charlie Tulip: Goddard's Shirt-Sleeve Banker

by Randee Exler

"How are the beans, Charlie?" Center Director Dr. John W. Townsend, Jr. unfailingly asks Goddard's new Comptroller at the beginning of his weekly Executive Council meetings.

Charles "Charlie" Tulip coordinates the Center's resource allocations among the members of the Goddard family. Among the NASA centers, Goddard has probably the largest number of diverse projects with different needs and Tulip's job is to assure that the "bean pot" goes as far as possible to meet the Center's needs.

Tulip joined Goddard in mid-October, having headed up the institutional resources division at NASA Headquarters since 1981. This experience made him very familiar with Goddard's financial concerns. When asked if he's worked with Goddard in the past, he replied, "only for the last 27 years!"

Michigan Native

Tulip hails from Farmington, MI, a town outside of Detroit. He holds a Bachelor's degree in Liberal Arts from Wayne State University in Detroit and a Master's degree in Public Administration from Indiana University.

How did a generalist get hired by the space agency?

"In 1961, when NASA was hiring people for what later became the Comptroller's Office, they were looking for people with general backgrounds.... We were solving resource management problems that were new to the agency and NASA found that generalists tended to treat problems without a lot of preconception," Tulip recalled.

"I was lucky that NASA was looking for a young guy when I walked by!" the Comptroller said.

Federal Beginning

"I came close to spending a career as a social worker, but the IRS [Internal Revenue Service] and taxes got me," he said.

An announcement in the newspaper that the tax agency was giving the Federal Entrance Exam and hiring based on test results brought Tulip to the IRS. He passed the test and the IRS hired him. He also passed a second exam and became qualified to be a management intern. Four months after joining the IRS, Tulip's young federal career brought him to the Civil Service Commission in Washington, DC.

After 18 months in Washington, Tulip joined NASA.

TULIP

"I had no idea that I'd ever work for the space agency," Tulip revealed. "I have to admit that if you had asked me in September 1961 who ran the space program, I probably would have said, 'the Air Force!'" the 1978 winner of NASA Headquarters' Exceptional Service Award admitted. He received also the Presidential Meritorious Executive rank award in 1987. Seven years into his NASA career, Tulip found himself back in school working on a Masters of Public Administration.

New Horizons

"Now I have a chance to work at Goddard and broaden my horizons," Tulip said. "I came to NASA the day they opened FOB [Federal Office Building] 6," he recalled. "This is the first time since I've been with the Agency that I have an office more than 50 yards from the office I was in when I came! I moved among three different floors but always on the western end of that building!" he joked.

Since joining Goddard, Tulip finds himself once again a student. "The transition, people-wise, hasn't been difficult, but I have so much to learn!" the new Comptroller admitted. "First of all, I have to learn a new culture."

"For all the years I came out to Goddard I dealt with a relatively narrow segment of the Center. I now have to learn what Goddard really does," the Comptroller revealed.

Pervasive Shorthand

"One thing about Goddard, as opposed to other centers, is that we tend to have more individual projects that are independent of each other," he said. "The shorthand is pervasive!"

"When you're downtown and you're dealing with all the centers, your depth of knowledge can be no more than one-tenth of what you need to know working at a particular center. At Headquarters, you only get a summary view," Tulip explained. "I do far more reading than I ever did. I take a lot of stuff home to try to keep up and learn. That's different."

New Focal Point

Tulip's focal point is different since joining Goddard. "Now I focus outward toward Headquarters and inward to the various parts of the Center," he explained. "In many ways dealing with Headquarters is easier than dealing with the OMB [Office of Management and Budget] or the Congressional staffs because Headquarters is more sympathetic to our needs and is more willing to listen to our problems."

Tulip enjoys meeting the challenge of his new position. "I feel that if you don't have challenge in your work, you're really going to get dull," he said. "It's almost like the buck stops here. The responsibilities that the NASA Comptroller makes for the Agency I tend to have out here and I find that very exciting."

High Enthusiasm

"I also find the level of enthusiasm at Goddard very exciting!" he said.

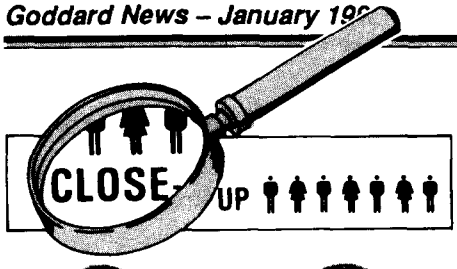
"Downtown you are insulated from the people doing the work. Unless I took the time to go out to a Center to take a tour, I didn't get to talk to these people," he explained. "The people here are doing something tangible that is directly expanding human knowledge."

Sailor at Heart

Sometime in the future, Tulip and his wife Carole plan to pull up anchor. About eight years ago, the three Tulip children gave their parents sailing lessons for Christmas. Since then, Charlie and Carole have spent their weekends aboard the Common Folly, a 36-foot sailboat docked in Herring Bay, MD.

Until then, Tulip looks forward to working a "long time" at Goddard. He plans to optimize Center resources. "I know we're not going to get everything we want," he confessed, "but it's my job to make sure we get the important things."

"I have an interesting challenge ahead of me," the Comptroller said in a contemplative manner. After pausing, he ended on a jovial note, "And besides, this job will keep my hair from turning gray!" The white-haired man looked up and laughed.



SAMOVISKI

FIGUEROA

DAN SAMOVISKI has been selected as the new Director of the Goddard Office of Inspect General (OIG). Samoviski replaces Nancy Butler, who recently joined the Office of Inspector General for the Department of Defense (DOD). Before coming to Goddard , Samoviski had served for two years as Deputy Director of Langley Research Center's Office of Inspector General. At Goddard, he occupied the position of OIG Audit Manager for three years, then became Acting Director. The Inspector General's Office was established to look into fraud, waste, abuse, and mismanagement at all levels of government. The Inspector General's Office also conducts and supervises audits and investigations.

Goddard's new Head of the Cryogenics Technology Section, Code 713.1 is **ORLANDO FIGUEROA.** The Cryogenics Technology Section develops critical cryogenic technology independently and in support of major Goddard programs including the Cosmic background Explorer (COBE), the Advanced X-ray Astrophysics Facility (AXAF), and Astromag. The branch has conducted more than 300 testing and development programs on two of COBE's major cryogenic instruments, the Far Infrared Spectrometer (FIRAS), and the Diffuse Infrared Background Experiment (DIRBE).

Thirty Greenbelt employees took a bus ride to the beach recently when they toured Goddard's Wallops Flight Facility, VA.

The tour, sponsored by the Code 200 NASA Employee Team (NET), began with a visit to the Wallops Visitor Center, followed by lunch in the Wallops cafeteria. After lunch, the tour continued with a walkthrough of the Wallops hangar, where the facility's two helicopters and four airplanes are stored. Next stop was the Wallops Island beach front, where employees were able to glimpse Wallops' rocket launch sites.

In Memoriam

TECWYN (TEC) ROBERTS, Director of Networks at Goddard from 1971 to 1979, and most recently consultant to the Bendix Field Engineering Corporation, died on Tuesday, December 27, 1988.

Roberts will be remembered for his countless contributions to the organization, operation, and evolution of tracking networks, and for his enthusiasm and the shared vision of space exploration that dates back to his involvement with the Mercury program in the early 1960s, when he was NASA's first Flight Dynamics Officer (FIDO).

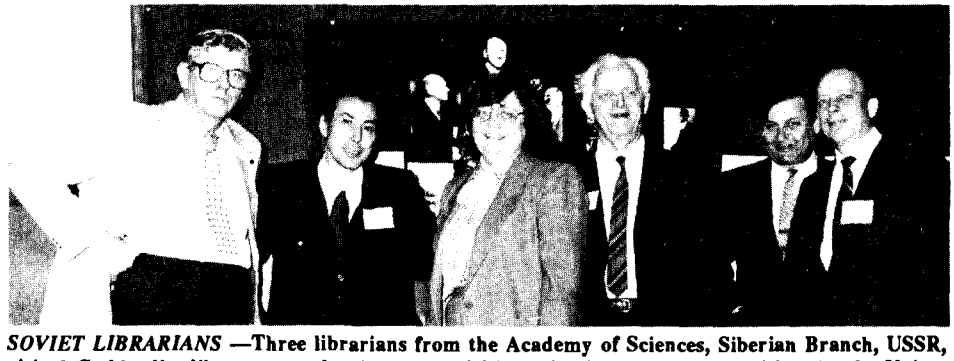
Expressions of sympathy in memory of Tec Roberts can be made to the local Heart Fund.

ROBERTS

Retirees

Congratulations to the following employees who recently retired from Goddard:

	CODE	YEARS		CODE	YEARS
Austin, Richard	151.2	38	Gotthardt, William	663	31
Mason, Perry R.	311	22	Rosette, Kenneth L.	408	45
Behannon, Kenneth	692	32	Griffin, Donald W.	841.3	21
Mayo, Edward	742	33	Schoenberger, Frederick B.	302	33
Coates, Robert J.	601	44	Harmes, Ralph H.	712	33
Peters, George L.	303	20	Stevens, Roxanne	253	11
Devlin, Richard A.	408	34	Hudgins, John	743.3	30
Mazuruck, Andrew	292.1	27	Vette, James I.	630.2	26
Doutrick, Ernest C .	303	2	Kingman, Howard, Jr.	502	35
Mercanti, Enrico P.	402	31	Webb, William C.	400.6	31
Erdman, Richard W.	754.1	30	Kraft, George E.	470	26
Moyer, Earl R.	733	30	Williams, Ruth B.	800	30
Foster, Jane N.	252	27	Mahoney, Michael	502	30
Potter, Nelson H.	663.1	28	Woodard, Leon	534.4	28



SOVIET LIBRARIANS **—Three librarians from the Academy of Sciences, Siberian Branch, USSR, visited Goddard's library recently, through a visiting scientist program established by the United States Information Agency (USIA). The librarians visited Goddard as part of a week-long program in Philadelphia sponsored by the Institute of Scientific Information. Pictured (left to right) are Goddard Librarian John Boggess, Code 252; Aleksandr Zakharov, Director of the Natural Sciences Library, Academy of Sciences, Siberian Branch, Novosibirsk, USSR; Library Branch Head Janet Ormes, Code 252; Oleg Volkonskiy, USIA Interpreter/Escort; and Nikolay Khalenov, Manager of the Department of Automation, Library of Natural Sciences, Academy of Science, Siberian Branch, Novosibirsk.**

GIVE Following is a list of Goddard donors who were cited by the American Red Cross with gallon pins at the Bloodmobile on December 7, 1988:

NAME	GALS.	NAME	GALS.	NAME	GALS.
Brenda Clermont	1	Wayne Kasprzak	2	John Spohr	1
David Cleveland	3	Sarah Leung	3	Paul Trahan	3
Mort Friedman	20	Dan Lowery	1	Stephen Volz	6
Donna Godsey	1	Thomas Manteufel	4	Tony Whiteman	1
Janet Jew	2	Ed Quinn	1		

The next bloodmobile visit will be on February 1, 1989, from 8:30 a.m. to 1:30 p.m. in the Building 8 Auditorium. Thank you, Goddard, for your continued support of the program.

Office Of Exploration Report Examines Three Pathways to Exploration

Human exploration of another celestial body in our solar system and establishment of an outpost on the moon are two of the ideas discussed in a report recently released by NASA's Office of Exploration.

The report, called "Beyond Earth's Boundaries—Human Exploration of the Solar System in the 21st Century," examines three paths NASA's space exploration could take, all of which require the same basic foundation in detailed research, technology development and concentrated studies, plus sustained commitment to the current NASA programs.

The first pathway examined, called "Human Expeditions," emphasizes a significant and visible effort by humans to accomplish the first scientific exploration of another body in the solar system. The report applies this approach to two different case studies: a mission to Mars and an exploration mission to the Martian moon Phobos.

HUMAN EXPLORATION—**Two astronauts explore the rugged surface of the Martian moon Phobos in this illustration from the report "Beyond Earth's Boundaries—Human Exploration of the Solar System in the 21st Century," recently released by NASA's Office of Exploration. The report examines three paths NASA's space exploration could take. This photo illustrates a case study on the first approach, "Human Exploration," an exploration mission to the Martian moon Phobos. Mars, as it would appear to the human eye from Phobos, looms on the horizon. The mother ship, powered by solar energy, orbits Mars, while the two crew members inside remotely operate rovers on the Martian surface. The explorers have descended to the surface of Phobos in a small "excursion" vehicle, and they are navigating with the aid of a personal spacecraft, which fires a line into the soil to anchor the unit.**

Outpost on the Moon

The second pathway is called "Science Outpost." This approach also emphasized the advancement of scientific knowledge while gaining operational experience at an extraterrestrial outpost. The report applies this approach to a case study of a human-tended lunar observatory on the far side of the Moon.

The final pathway studied is an "Evolutionary Expansion" approach—a methodical, step-by-step program to open the inner solar system for exploration, resource development and permanent human presence. The case study uses the establishment of an outpost on the Moon as a "stepping stone" to similar outposts on Mars and its moons.

However, the report concludes that regardless of what type of course is chosen for future exploration, the United States must begin now to lay the foundations for exploration through research, technology development, and commitment to current programs.

Critical Programs

The report identifies several programs critical to establishing this foundation for exploration, including the completion of Space Station Freedom, to serve as the key to developing the long duration capability to live and work in space these are the continuation of Project Pathfinder, to build the technology base of the U.S. civilian space exploration program; the pursuit of a critical life sciences research program, to lay the foundation for long duration human habitation of space for both Space Station Freedom and solar system exploration; and the continued development of more capable Earth-to-orbit transportation systems, to increase the capability to transport equipment, propellant and personnel to low-Earth orbit.

Also, programs in artificial gravity research and focused flight test and demonstration programs must be initiated if the U.S. is to maintain its options for exploration, according to the report.

The report concludes that by pursuing a modest near-term investment of resources in the 1990s in long lead technologies and capabilities, the U.S. will preserve the ability to undertake a wide range of opportunities at the turn of the century.

The report will be available from the Government Printing Office (GPO) in March.

NASA
National Aeronautics and Space Administration
Goddard Space Flight Center

Goddard News

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