NASA National Aeronautics and Space Administration

GODDARD NEWS

Goddard Space Flight Center, Greenbelt Md. Vol. 30 No. 7 July 15, 1983

Joe Walters photo

—TDRSS Project Manager Ronald K. Browning

"From the very beginning we were optimistic about recovering the satellite and placing it into proper orbit. We've saved spacecraft before but never anything of this magnitude. I'm glad we had the resources and the personnel to pull this thing together."

Making the bird fly high

TDRS-1 recovery team puts satellite into proper geosynchronous orbit

by Jim Elliott

June 29, GSFC – After 58 days of delicate maneuvers, a NASA-industry team of engineers succeeded in placing the Tracking and Data Relay Satellite System (TDRSS) spacecraft into a geosynchronous orbit.

Overcoming what was one of the most demanding engineering challenges ever faced by the Nation's space program, the engineers used tiny one-pound thrusters, with nozzles about the size of a thimble, to boost the 5,000-pound spacecraft 8,662 miles farther into space, a feat never even attempted before, let alone accomplished.

The spacecraft, designed to usher in a new era in space communications, was deployed from the Space Shuttle Challenger on its first mission on April 4, 1983. After the satellite had been deployed successfully from the shuttle, a failure occurred while the Inertial Upper Stage (IUS) booster rocket was attempting to propel the spacecraft into geosynchronous orbit. As a result, the TDRS-IUS combination began tumbling at 30 revolutions per minute. The engineers succeeded in separating the two and in stabilizing the TDRS spacecraft, but its orbit was only 13,574 miles in perigee (low point) and 21,970 miles in apogee (high point), far short of the planned 22,236 statute miles needed for geosynchronous orbit. The elliptical orbit had a period of only 18 hours and the spacecraft was drifting 110 degrees a day. In geosynchronous orbit, the period is 24 hours, meaning that the spacecraft appears to remain stationary over one point of the Earth.

The final maneuver was highlighted by ceremonies at Goddard, where the

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Pete Baltzell photo

L-r: Richard Sade, Networks Director; Henry Hoffman, Guidance and Control Branch; Charles M. Hunter, TDRSS Deputy Project Manager; Center Director Noel W. Hinners; Robert O. Aller, Director, TDRSS Division, NASA HQ. Hoffman, using a model of the TDRS, shows how the thrusters were used in the maneuvers that engineers developed to boost the spacecraft into geosynchronous orbit.

TDRS-1 video-teleconference a first—big success

The satellite video-teleconference held among NASA, TRW and SPACECOM, during the final burn which placed TDRS-A into proper orbit, was the first two-way video utilization of satellite communications of this kind in NASA. The NASA satellite video-teleconference among three stations was a very complicated operation but was conducted without a hitch. Congratulations to all involved for making this NASA first a tremendous success.

Simulations Operations Center

SOC crew socks it to em'

The Simulations Operations Center (SOC) personnel operated non-stop for 58 days after TDRS-A failed to reach proper orbit. During each series of burns, the SOC staff and representatives from Goddard's TDRSS project office manned the machines that told them what was taking place on the spacecraft. Clockwise from top left: l-r, Joseph Iffrig, Bendix, Richard Beckwell, Bendix, and Bob Burns, Goddard; Cathy Reed, CSC and Joe Polesel, CSC; Ken Lavery, Bendix; Burns on phone, name unavailable for other man; activities during initial burn; Iffrig. Not pictured are Ken Clark, Ken Garner, George Lokke, John Dissinger, Dan Marx, Ed Moore, Lynn Marnhout and Willard Buchanan, all of Bendix; and Kevin Parker and Henry Zavaleta of CSC.

During pre-launch tests and simulation periods for spacecraft, Goddard uses a special site to emulate the mission's control center. The Simulations Operations Center (SOC) recently operated non-stop for 58 days, after serving as the operations center for simulations that ultimately became the series of maneuvers that nudged the errant Tracking and Data Relay Satellite (TDRS-A) into proper orbit. Headed by Robert Stanley, chief, Simulations Section, and staffed with a civil service/contractor crew of about 15 personnel, the SOC assumed an additional role following the failure of TDRS-A to reach geosynchronous orbit – that of monitoring the delicate maneuvers used to correct the satellite's path.

"The support the SOC provided was outstanding," TDRSS Project Manager Ronald K. Browning said. "By getting real-time information from the spacecraft, we were able to conduct the maneuvers much more efficiently and much more comfortably." Browning said the SOC was a clear demonstration of a low cost flexibility during a high time of need.

During each series of maneuvers, the SOC staff manned the machines that told them what was occurring on the spacecraft, virtually monitoring TDRS-A constantly. Significantly, the additional responsibility placed on the SOC staff required additional equipment. The SOC team not only gathered the equipment, but also got it running and never suffered a major equipment failure.

In just two weeks, the SOC team prepared itself to handle the additional role of providing real-time data from TDRS-A monitoring each of the 39 burns. TDRSS Deputy Project Manager Chuck Hunter said the SOC crew did a "fantastic job in a short time."

TDRS-1 save

Continued from page 1

TDRSS project management team is located.

As the countdown to the maneuver proceeded, NASA Administrator James M. Beggs, gave the order on closed-circuit television to "execute the maneuver" to Flight Director George Harris, at the Spacecom ground facility at White Sands, New Mexico. Harris initiated the burn with a signal that was relayed to the satellite via the Goddard Space Flight Center and then the network tracking station at Goldstone, California.

In remarks following the completion of the burn, which ran approximately six minutes, Beggs congratulated the people on the team which carried out what he described as a "spectacular" space achievement. That included people primarily with NASA; with TRW, which built the spacecraft; and with Spacecom, which owns the spacecraft and operates it for NASA under a 10-year lease agreement. The maneuver was started at 12:25 P.M. EDT.

"The effort of the TDRSS team represents some of the best in American skill and ingenuity," Beggs told an audience of approximately 150 persons gathered in Goddard's Simulations Operations Center. "They have demonstrated what can be accomplished when government and industry cooperate for the benefit of all."

Goddard Center Director Noel W. Hinners also praised the personnel involved in the recovery operations. Holding up a thruster similar to the ones aboard the TDRSS spacecraft, he pointed out that the nozzle of the thruster was about the size of a thimble. By comparison, he said, one could picture something as small as a thimble trying to push a huge, armor-plated limousine 8,600 miles into space.

"That's why it has taken so long," he smiled, underscoring the tedious and sometimes frustrating challenges the engineers have faced during the 58 days of maneuvering.

The final burn lifted the satellite another 23 miles in its perigee, from 22,213 miles to 22,236 miles and corrected its apogee downward from 22,239 to 22,237 miles. Its east-west movement was corrected to zero drift, and its period of orbit was 24 hours. At Goddard News press time, it was located at 67 degrees West longitude, which is over the Equator above northwest Brazil.

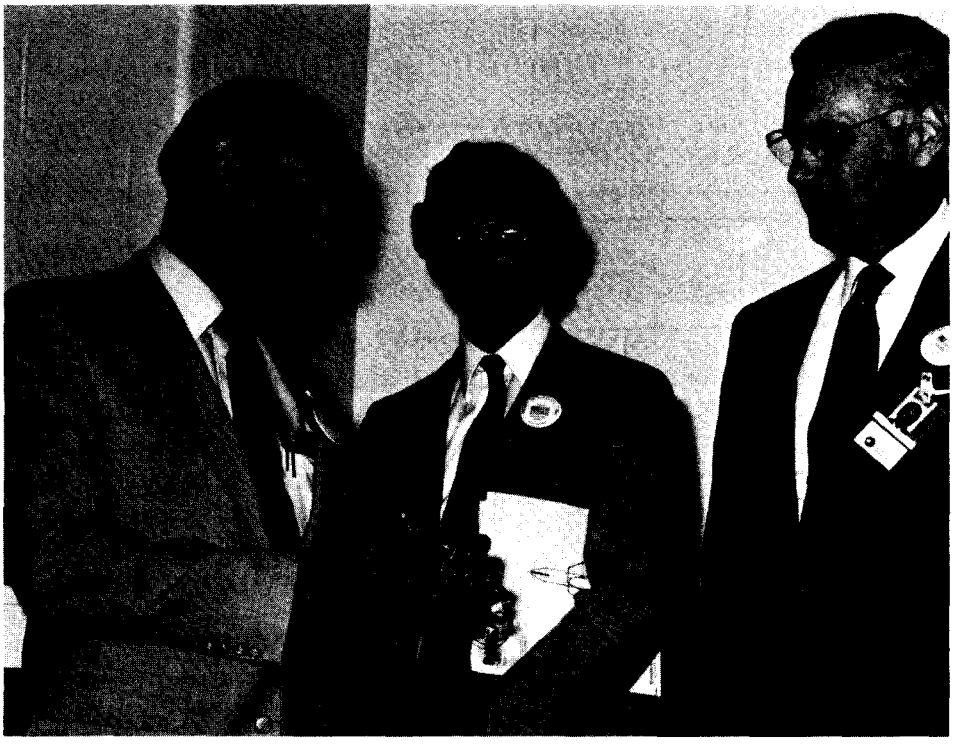
Project officials began immediately to check out the communications systems aboard the spacecraft. First, the spacecraft was reoriented to what the engineers call an "Earth mode," meaning that the satellite is now stabilized with its antennas pointed toward the Earth and its solar panels pointed toward the Sun.

The payload activation sequence was activated shortly after reaching the "Earth mode," TDRSS Project Manager Ronald K. Browning said. A series of tests will be conducted then, including a demonstration with the Landsat 4 Earth resources satellite late this month. After the Landsat demonstration, which will be conducted over a four-day period, TDRSS will make tests with the STS-8 Space Shuttle mission, now scheduled to be launched from the Kennedy Space Center in Florida in late August. The TDRSS also will support the STS-9 mission, scheduled for late September, which will carry the Spacelab payload, the European Space Agency's orbiting research laboratory.

TDRS-1 is the first of three communications satellites to make up the TDRSS network. TDRS-1 will be located in its final location at 41 degrees West longitude, over the Atlantic east of Brazil. The second TDRS originally had been scheduled for launch on STS-8 in August. But it has been postponed indefinitely pending definition of the problem with the Inertial Upper Stage booster rocket. When it is launched, it will be positioned at 171 degrees West longitude over the Pacific. A third TDRS satellite, to be launched later, will be used as an in-orbit spare and will be located at 79 degrees West longitude, over the Pacific off the coast of South America.

"...Picture something as small as a thimble trying to push a huge, armor-plated limousine 8,600 miles into space...that's why it has taken so long."

See thruster on page 8



Pete Baltzell photo

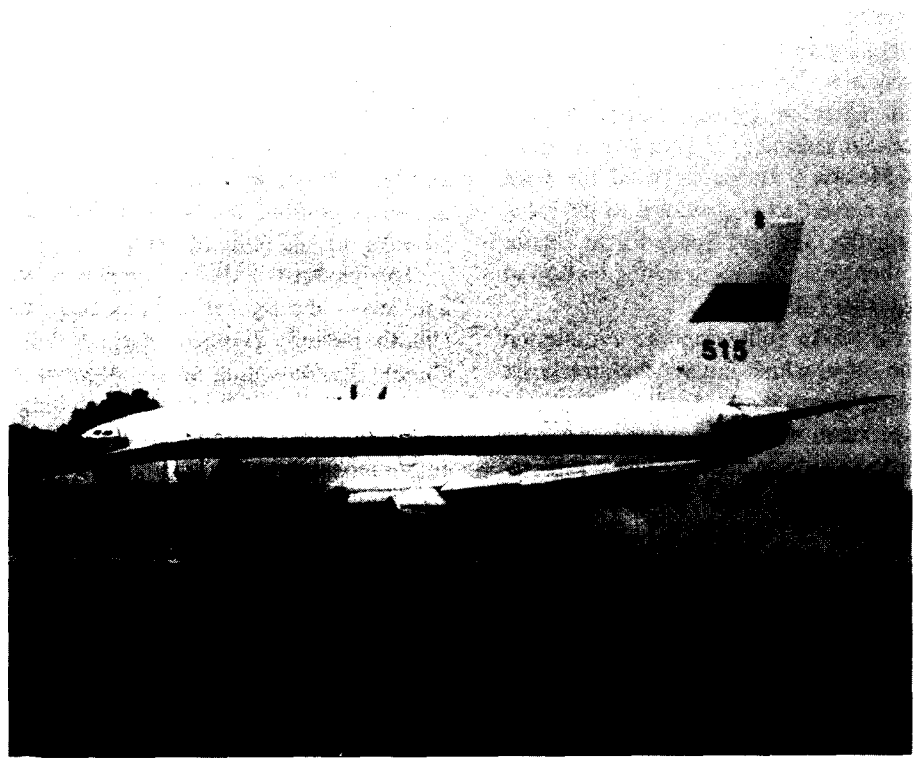
NASA Associate Administrator for Office of Space Tracking and Data Systems Robert E. Smylie (l), Goddard Center Director Noel W. Hinners (c) and NASA Administrator James M. Beggs marvel over the size of the thrusters used to boost TDRS-1 into geosynchronous orbit.

NASA, FAA conduct aircraft braking tests

NASA and the FAA conducted tests recently at two separate airports to measure runway surface friction on grooved and ungrooved runway surfaces. The tests were conducted at Goddard's Wallops Flight Facility and the FAA Technical Center airport in Atlantic City, New Jersey, and could provide timely and accurate information on runway surface friction characteristics under adverse weather conditions. Instrumented aircraft and ground vehicle tests were performed on dry runways as well as simulated wet and natural wet conditions.

A major priority of the tests was to identify the severity of potentially hazardous conditions to aircraft and airport users. Results from the tests will help in evaluating how friction measurements relate to actual aircraft braking performance.

In this first phase of testing, phase-II will begin in the fall, NASA's Langley B-737 aircraft was used. This fall's testing will include the FAA's B-727 as well as the Langley aircraft. Langley Research Center's Impact Dynamics Branch is conducting the program with Tom Yager as program manager. Gene Godwin is the Wallops Project Coordinator.



NASA's Langley B-737 aircraft undergoes braking tests at Goddard's Wallops Flight Facility.

It pays to think

employees get cash for good ideas

Two of Goddard's employees recently received cash awards for their suggestions. In keeping with our never-ending concern for employee safety, Kathleen Gray suggested the use of cradle hooks on machines equipped with air hoses. The air hoses will be neatly coiled and secured in the cradle hooks and only the required length of hose will be released thus eliminating excessive lengths of hose on the floor and walkways. Gray is an Aerospace Engineering Technician in the Machining Branch.

Perhaps you have seen the new preprinted mailing labels which will now be used to forward correspondence to the Wallops Flight Facility. Those labels are the result of a suggestion submitted by Patricia Neff. Having these labels preprinted, leaving a blank space for the attention line, will result in time saved. Neff is a Printing clerk in the Printing Office.

Center employees are encouraged to participate in the Employee Suggestion Program. Implemented suggestions could result in cash awards, certificates, and Center-wide visibility. Please refer to the Goddard Management Instruction 3451.1b for the criteria. For further information, please call the Awards Office at 344-6118.

Employee's son wins grand prize in international Science Fair

A Goddard employee's son recently won one of two grand prizes at the 34th International Science and Engineering Fair in Albuquerque, N.M. President Reagan met the Bowie High School senior and his family, and Bowie's principal and chemistry teacher after inviting them to the White House for a meeting in the Oval Office.

Jonathan Santos, son of Severino Santos (code 855), topped some 560 finalists from 50 states and 12 foreign countries by figuring out a way to make planes fly more cheaply. His invention was a special airfoil attachment for the standard airplane wing.

"I just wanted to do a project to seek a more efficient aircraft," Santos said.

To do so, Santos studied the flight of birds. He said that the characteristic oval shape of an airplane wing that produces its lift during flight also causes a swirling vortex of air at the wingtips that inhibits lifting ability. Airplanes use up to 40 percent of their fuel to combat that effect, he said.

He noticed that in certain situations, birds extend their feathers in a fashion that virtually eliminates the vortex. Santos tried more than 60 plastic shapes to come up with the best form of airfoil to simulate the wingtip effect and tested his model wings in a 10-foot homemade wind tunnel. The end product resulted in increased fuel efficiency by 27 percent in model airplane tests.

Santos won $1,000 in cash, an expense-paid trip to Stockholm for the Nobel Prize ceremony this December, $5,000 worth of scientific equipment for Bowie High School and several free trips to various scientific installations across the country. Santos plans to enter the University of Maryland this fall.

Randy Frisch photo

Jonathan Santos, winner of international science and engineering fair, is shown here with his father, Severino Santos, head, Tracking Systems Branch. Santos is holding a copy of his paper entitled "Tip Vortex Propulsion: A New Approach," autographed by President Reagan. In front of them is a model of his invention.

Galaxy-A launched

NASA launched the Galaxy-A communications spacecraft on Delta 170 from Cape Canaveral Air Force Station, Fla., on June 28. The Galaxy-A satellite, owned by Hughes Communications, is relaying television programming to cable systems in the continental United States, Alaska, and Hawaii. The satellite carries a total of 24 transponders. The 18 primary transponders have been sold to six cable programming companies. One of the remaining six standard transponders has been committed to another major programmer and the rest are in various stages of negotiation.

Galaxy-A is in a stationary orbit 22,300 statute miles above the equator at 134 degrees west longitude, roughly due south of Juneau, Alaska. It operates in the 6/4 GHz C band and has a design lifetime of at least nine years.

The Galaxy-A is the first in a series of three Galaxy satellites. The second and third Galaxy satellites, to be launched in September 1983 and June 1984 respectively, will relay video, voice, data, and facsimile communications in the continental U.S. for large corporations, long haul carriers, and broadcasters.

The Operations Control Center for the Galaxy satellites is located at Hughes Communications' headquarters in El Segundo, Ca., with telemetry and commands terminals in Filmore, Ca. and Brooklyn, NY.

The Delta 170 rocket, a 3920/PAM version of the launch vehicle, consists of an Extended Long Tank First Stage, the thrust of its Rocketdyne RS-27 engine augmented by nine Castor IV strap-on solid motors; the new improved Aerojet AJ10-118K second stage, and a Payload Assist Module (PAM), which functions as the final stage. The entire vehicle is a uniform eight feet in diameter (excluding the strap-on solid motors) and 116 feet high.

Following launch by the first two stages of the Delta 3920, Galaxy-A was inserted into an elliptical transfer orbit by the PAM, rather than conventional third stage. The PAM was attached to the satellite.

To produce a near-stationary orbit, an apogee kick motor, mounted in the satellite itself, was fired. Positioning of the spacecraft followed, using the satellite's on-board attitude-positioning gas system.

Quality Circles

employees resolve problems themselves

by Donald James,
Presidential Management Intern

Quality circles (QC) are a small group of workers organized to find their own ways of improving their work, rather than leaving the task to management. After experimenting with the QC concept since February, the Small Purchases Section of the Institutional Procurement Division has found a solution to a problem they chose to solve.

The problem concerned the distribution of purchase requests to the buyers of this section. The solution entailed devising a way of reorganizing the distribution list in order to alleviate and to make more equitable the internal distribution of purchase requests. The solution evens out the workload among employees in the Small Purchases Section.

Members of the QC presented their findings and recommendations last month. The group solved their problem by outlining the problem, discussing alternative solutions (including pros and cons for each solution), and finally arguing their case for one solution before the Section Head Mickey Garrett and the Branch Head Mike Kelly.

Later that week, the circle's proposal was accepted and presently the section is preparing to implement it.

Joe Walters photo

Terri Howerton (standing) was one of four QC members who presented their findings on a solution to a problem during a QC meeting of the Small Purchases Section. The other three speakers were: Sandy Howard, Laura Simmons and Sheila Zurvalec.

STS-8 crew

L–r: Daniel C. Brandenstein, pilot; Dale A. Gardner, mission specialist; Dick Truly, commander; William E. Thornton, mission specialist; and Guion S. Bluford, Jr., mission specialist. STS-8 is scheduled for launch in August.

Heppner receives Lindsay Award

Pete Baltzell photo

Dr. James P. Heppner (r), head, Electrodynamics Branch, Laboratory for Extraterrestrial Physics, Sciences Directorate, receives the 1983 John C. Lindsay Award from Goddard Center Director Noel W. Hinners.

Heppner received the award for his pioneering research in studies and in-situ measurement with rockets and spacecraft, highlighted in the Chemically Active Material Emitted from Orbit (CAMEO) experiment.

Goddard retirees plan homecoming

A special homecoming for Goddard retirees is scheduled for September 28, 1983 from 4 p.m. to 11 p.m. at the Rec Center. A social hour and a buffet dinner are planned for the occasion. Additional details are forthcoming. For information, call Jesse Stern, (301) 422-9506; Roland Van Allen, (301) 577-2119; or Peggy Becker, (301) 474-7987. Or write: Roland Van Allen, P.O. Box 163, Seabrook, Maryland 20706.

Secondary school girls spend time at Goddard

Thirty students will come to Goddard July 20-29, 1983, to participate in the "Summer Institute in Science and Technology for Junior High School Girls." These girls will be coming primarily from schools in Prince George's County, Montgomery County, and the District. The Institute's purpose is to encourage these girls to pursue careers in engineering, science and mathematics; and to emphasize the importance of continuing the mathematical training needed to achieve these goals. This program developed out of the Federal Women's Program's efforts to give girls role models

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Agreement signed

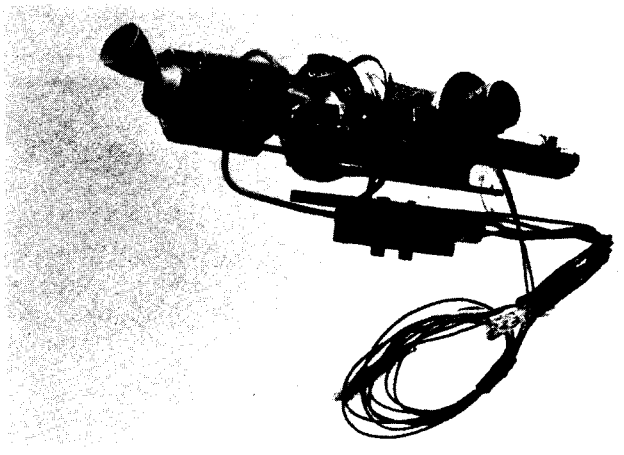
At a recent ceremony, Center Director Noel W. Hinners (l) and Goddard's Engineers, Scientists and Technicians Association (GESTA) President Fredrick G. Schamann sign a Memorandum of Understanding implementing a Performance Appraisal System for all non-supervisory professional engineers and scientists classified in NASA Class Codes 200 and 700. The ceremony culminated 15 months of negotiations and marks the first substantive agreement between the parties. Training for supervisors and GESTA bargaining unit employees has been scheduled for the first two weeks of August. Standing l-r: Joyce Crooke, Mary Caraker, Floyd Ford, John Ferguson, Pat McClain, Stan Watson, Dan Grant, Steve Schwartz; sitting l-r: Jerry Hodge, Hinners, Schamann and Danny Mistretta.

Pete Baltzell photo

SPACE TELESCOPE INSTITUTE DEDICATION – Riccardo Giaconni (l), director, Space Telescope Science Institute and Steven Muller, president, The Johns Hopkins University, Baltimore, Md., cut the ribbon during the dedication ceremonies for the Space Telescope Science Institute at Johns Hopkins on June 15. The Institute, designed to be the world center for astronomical research into the 21st century, will house facilities for astronomers to analyze visual and computer data transmitted from the telescope. Space Telescope (ST) will provide astronomers with images possessing 10 times more detail than existing observatories. ST will also allow them to detect stars 50 times fainter than is now possible. Goddard's John C. Brandt was one of several panelists who addressed "The Promise of ST" during the ceremonies. Brandt is chief of Goddard's Laboratory for Astronomy and Solar Physics and serves as Principal Investigator for the ST High Resolution Spectrograph.

Joe Walters photo

ENTERPRISE LANDS AT DULLES – Over 50,000 spectators lined the roads and filled the parking lots at Dulles International Airport outside Washington June 13 to greet the Enterprise. The space shuttle Enterprise, riding atop a Boeing 747, landed at Dulles after flying at 2,000 feet over the nation's capital, Baltimore and an air show in Easton, Md. Goddard took bus loads of nearly 700 people to greet Enterprise at Dulles, the final stop on a month-long tour. Previously, Enterprise was on display at the Paris Air Show.



Joe Walters photo

Tiny, one-pound thrusters like the one shown above were used to push the 5,000-pound Tracking and Data Relay Satellite some 8,600 miles farther into space. It took 39 burns totaling 44 hours to correct the 18-hour elliptical orbit to the 24-hour circular orbit desired for the spacecraft. The TRW-built thruster has been rightly dubbed "the little engine that could."

Jr. high girls

Continued from page 7

in fields that are underrepresented by women.

The girls will work in pairs with a mentor, and in other activities as a group. The mentors are professional women who have volunteered to show these students what their work is like. Each mentor works with only two girls at a time, who learn by doing a work activity. This year the work activities include: measuring the moisture of plants, using statistics to characterize data, describing moon photographs by their crater structure, setting up and using a telescope to look for sunspots, working with a laser, using a computer to generate graphs, reading weather maps, and analyzing satellite photographs of the earth.

Highlights of the group sessions include: an astronomy night, a tour of Goddard facilities, a talk on sounding rockets used in atmospheric research, a panel discussion by women engineers, a model rocket launch and a demonstration of a "talking" computer.

The Summer Institute, which is in its sixth year, has received enthusiastic support from both the program coordinators and the mentors. In addition, the participants and their teachers have responded favorably. Many of the applicants mentioned that teachers and former participants recommended the program to them. One student, who participated in the 1980 program, will be attending the closing exercises to share her insights about her future with her younger peers.

For further information contact Nancy Goodman, 344-5719, or Varona Wynn, 344-9271.

NASA
GODDARD NEWS

The GODDARD NEWS is published monthly by the Office of Public Affairs, Goddard Space Flight Center, Greenbelt, Md. 20771. Deadline for submitted material is two weeks from the date of publication. For additional information on articles contained herein, contact the editor on (301) 344-8102.

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25th Anniversary
1958-1983