

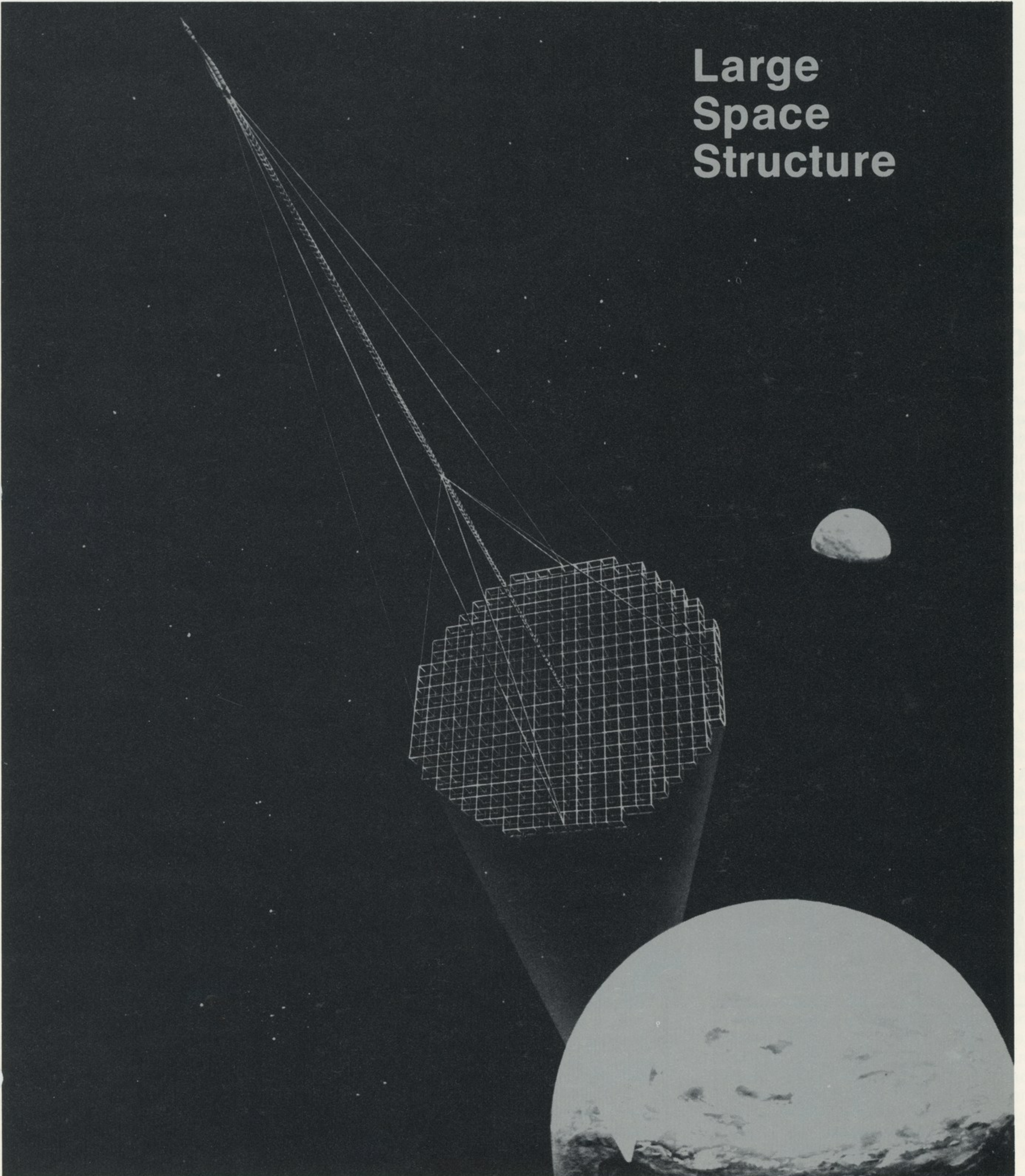
MARTIN MARIETTA

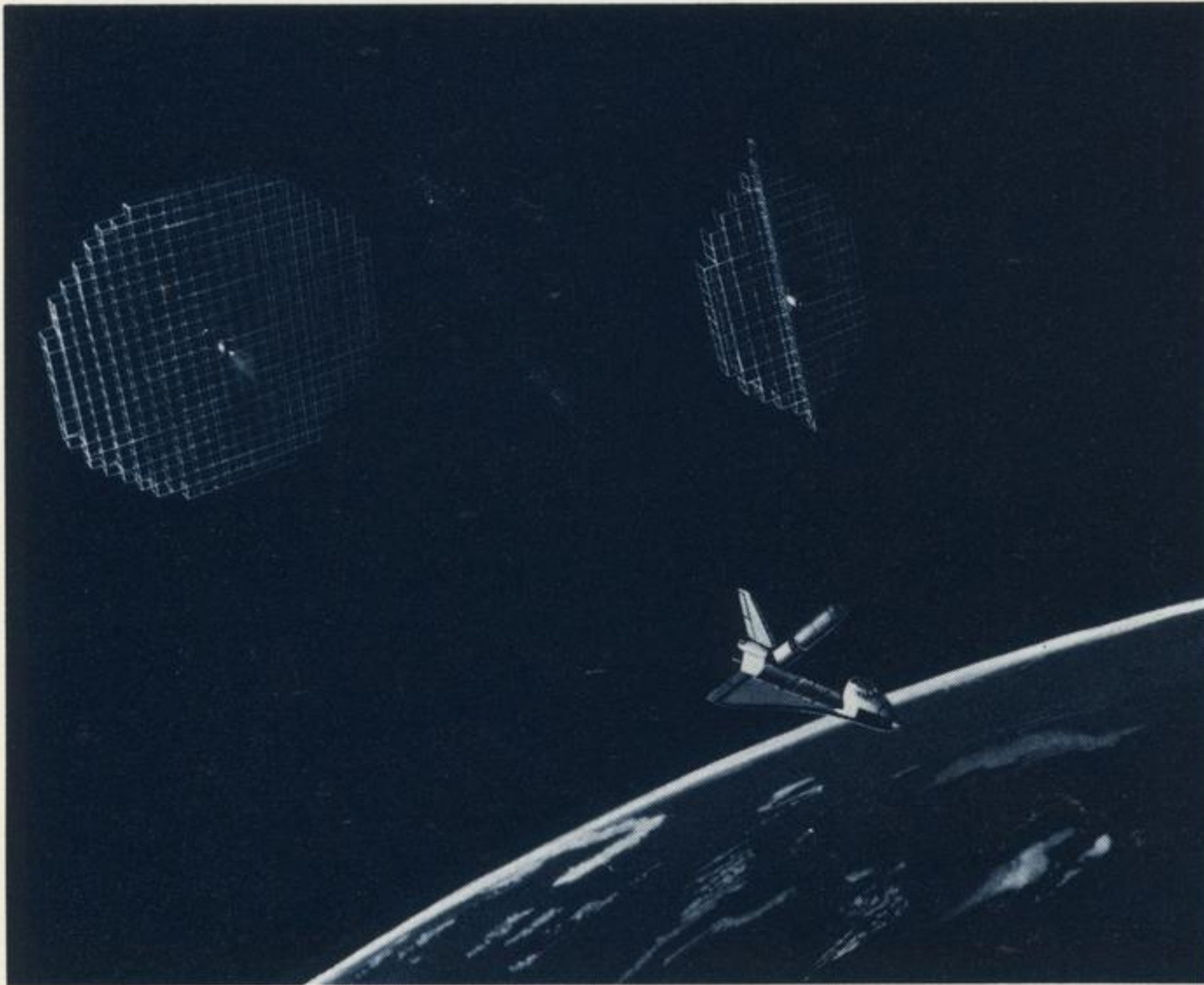
# news

DENVER DIVISION

NUMBER 4/1978

## Large Space Structure





Deployment stages are shown with structure moving from orbiter (lower right) to midway through box-truss deployment to full deployment.



The orbiter payload shown in the cargo bay consists of the array structure and a low thrust liquid transfer stage.

## Large space structures program to expand role of Shuttle satellites

In the next two decades, orbiting structures will play a significant role in fulfilling a wide range of needs on Earth. They will provide the backbone for satellites that will furnish improved and cost-effective communications, Earth observations, and energy generation.

The Denver Division's contract with the Air Force Space and Missile Systems Organization for the Department of Defense Space Transportation System on-orbit assembly design concept has the objective to develop a Shuttle-based, on-orbit structural deployment technique.

The division's contract team, managed by Thomas J. Sisk, is designing an innovative deployment technique applicable to spacecraft from 300 to 1000 feet in diameter. The first spacecraft being designed is a 600-foot diameter space-fied planar phased array radar which operates in geosynchronous orbit.

The mission plan is to carry a section of the structure (array) along with its geosynchronous transfer stage to low Earth orbit in the Shuttle orbiter. The array and stage are tilted up and separated from the orbiter. The box truss structure, chosen for its stowage effi-

ciency, low deployed density, and controllable deployment, is then deployed while under observation and control from the orbiter's aft flight deck.

The deployment is a step-by-step sequence with rows being deployed first and columns second. Transfer to the geosynchronous orbit is initiated after deployment completion. Several structural sections can be docked and attached together in geosynchronous orbit to form spacecraft 1000 feet or more in diameter.

Large space structures such as this are becoming practical with the advent of the Space Transportation System. No longer are designers limited to space system sizes that can be delivered by a single expendable booster.

### Employee earns spot award

R. D. Singley has received a launch vehicles organization Spot Award for his "superb effort as group leader for the programmable aerospace control equipment (PACE) software development."

Nelson G. Freeman, who announced the award, said Singley "did a super job on a tough contract in a tough job."

Singley, who has been on the PACE program since its beginning, recently was named group engineer for the PACE engineering group.

## Employee nominated as Sloan fellow

Grover W. Hall Jr., a program engineer in the division's product development department, has been nominated by the Martin Marietta Corporation to be 1978-1979 Alfred P. Sloan Fellow at the Sloan School of Management, Massachusetts Institute of Technology.

The Sloan Fellow program, started in 1931, is the oldest executive development program in the nation and is designed to provide young executives at mid-career a full 12 months in intensive advance management study at the graduate level. The program leads to a master of science degree in management.

Hall joined the division in June 1968 as an associate engineer in the electronics department. In 1972 he was promoted to senior engineer and served as the hardware technical consultant on the guidance and control and sequencing computer on the Viking program. Later, as a staff engineer, he was the product integrity engineer for the design, fabrication, and test of the backup core memory flown on the Viking spacecraft.

In 1976 he became a senior group engineer providing technical consultation and management leadership to the high density tape recorder technology. In October 1977 he was named a program engineer with full responsibility for management of the high density tape recorder product area.

Hall has a BS in electrical engineering from the University of Cincinnati.

#### MARTIN MARIETTA NEWS

Published by Public Relations  
MARTIN MARIETTA AEROSPACE  
Call Ext. 5364 with suggestions  
or information for articles

Denver Division  
P.O. Box 179 • Denver CO 80201  
March 1978

# Spacecraft launched by Titan IIIE/Centaur continue successes

Long after the last flight of a Titan IIIE/Centaur, every spacecraft launched by these rockets continues to operate, some well beyond original design life.

The three space programs, Helios, Viking, and Voyager, each having dual launches, have amassed astronomical amounts of data about the Sun, the solar system, and Mars. Years after the effort began at the Denver Division to design, build, and launch a Titan IIIE the goal of this effort — operating spacecraft — has been achieved. Space operations continue everyday from Pasadena to Bavaria, from scientists in Italy to physicists at universities around the U.S.

## Helios launched first

The first operational spacecraft, Helios A, an 800-pound scientific Sun observatory built by West Germany, was launched December 10, 1974, while its twin, Helios B, was sent toward the Sun January 15, 1976. At the closest point of their orbit, the spacecraft come within about 30 million miles of the Sun, the nearest approach of any man-made object. They gather a variety of data from X-ray and magnetic experiments to solar wind measurements.

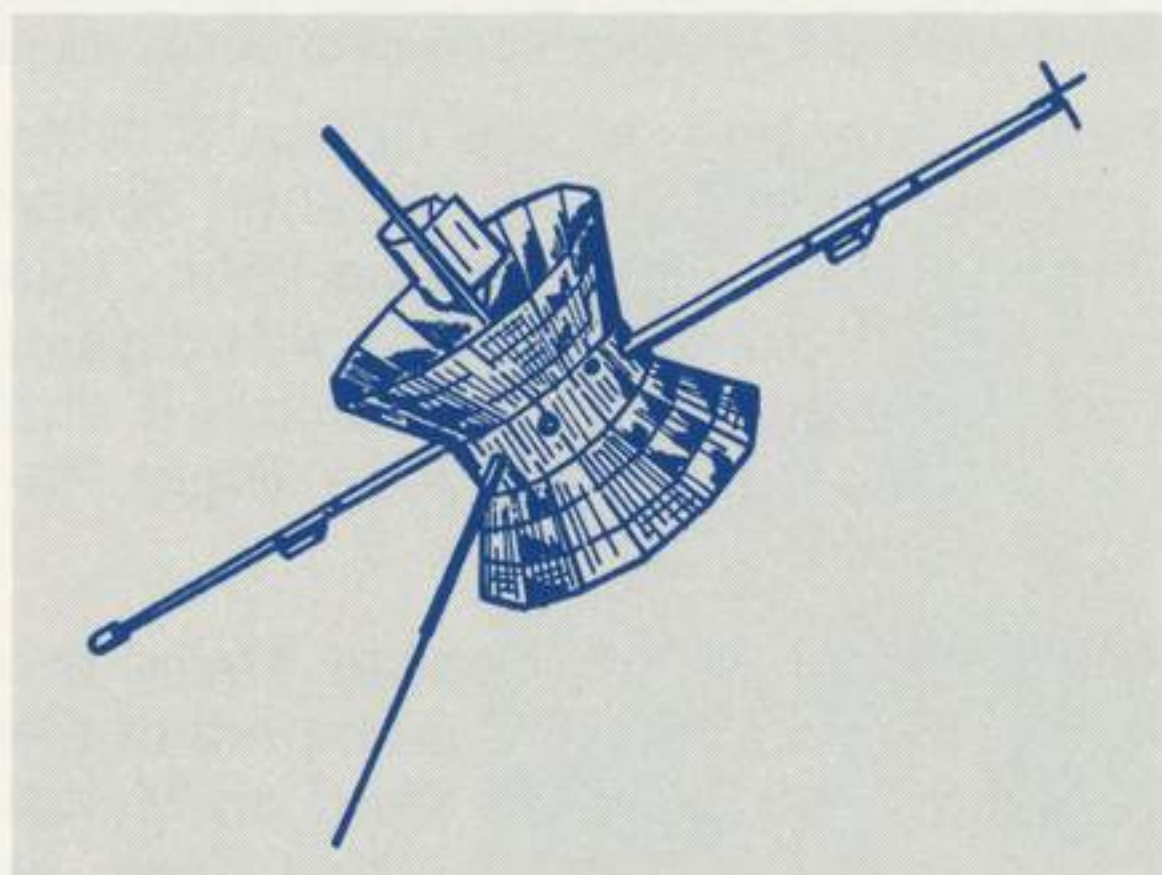
Helios A has made six close passes and Helios B four. All experiments continue to operate on both spacecraft. A unique event will occur April 17 when both spacecraft, due to orbit timing differences, will each reach their closest point to the Sun, allowing direct comparisons of the same measurements by two different spacecraft.

Both spacecraft have exceeded the four-month design-life requirement and the 18-month life design goal. Although Helios A may lose some of its experiments because of intense heat inside the spacecraft, both spacecraft continue to supply scientific data on the Sun as well as information on that area of space between the Sun and Earth.

## Viking launches successful

The Viking spacecraft for Mars exploration were launched in 1975, Viking 1 August 20 and Viking 2 September 9. The Denver Division built landers touched down successfully on Mars about 11 months later, Lander 1 July 20, 1976 on the Plain of Chryse and Lander 2 September 3, 1976 in the Plain of Utopia.

Both Viking orbiters and both landers continue to perform above expectations. The orbiters are now in a gas share mode, with pressurization gas used for attitude control. Orbiter 2's bioshield was jettisoned March 3, 1978 without incident. The science data return from the orbiters spans almost one Martian year.



Helios satellite was first launch.

As of March 7, orbiter 1 had circled Mars 628 times and orbiter 2 had completed 567 orbits. Lander 1 has been operating on Mars for 580 Martian days and Lander 2 for 535 days. There are 669 days in a Martian year.

Although each lander has had equipment failures, work-arounds have allowed them to function satisfactorily.

The landers will be put in a fully automated mission in June. They are now in an adaptive mode, which allows weekly uplinks to vary science data returns. The automated mission allows about one-quarter the science data return compared to the adaptive mission mode. Plans call for science data to be returned through November 1978. Radio science data and engineering data will continue into February 1979. This will cover the second solar conjunction for the Viking spacecraft.

## Voyagers on long journey

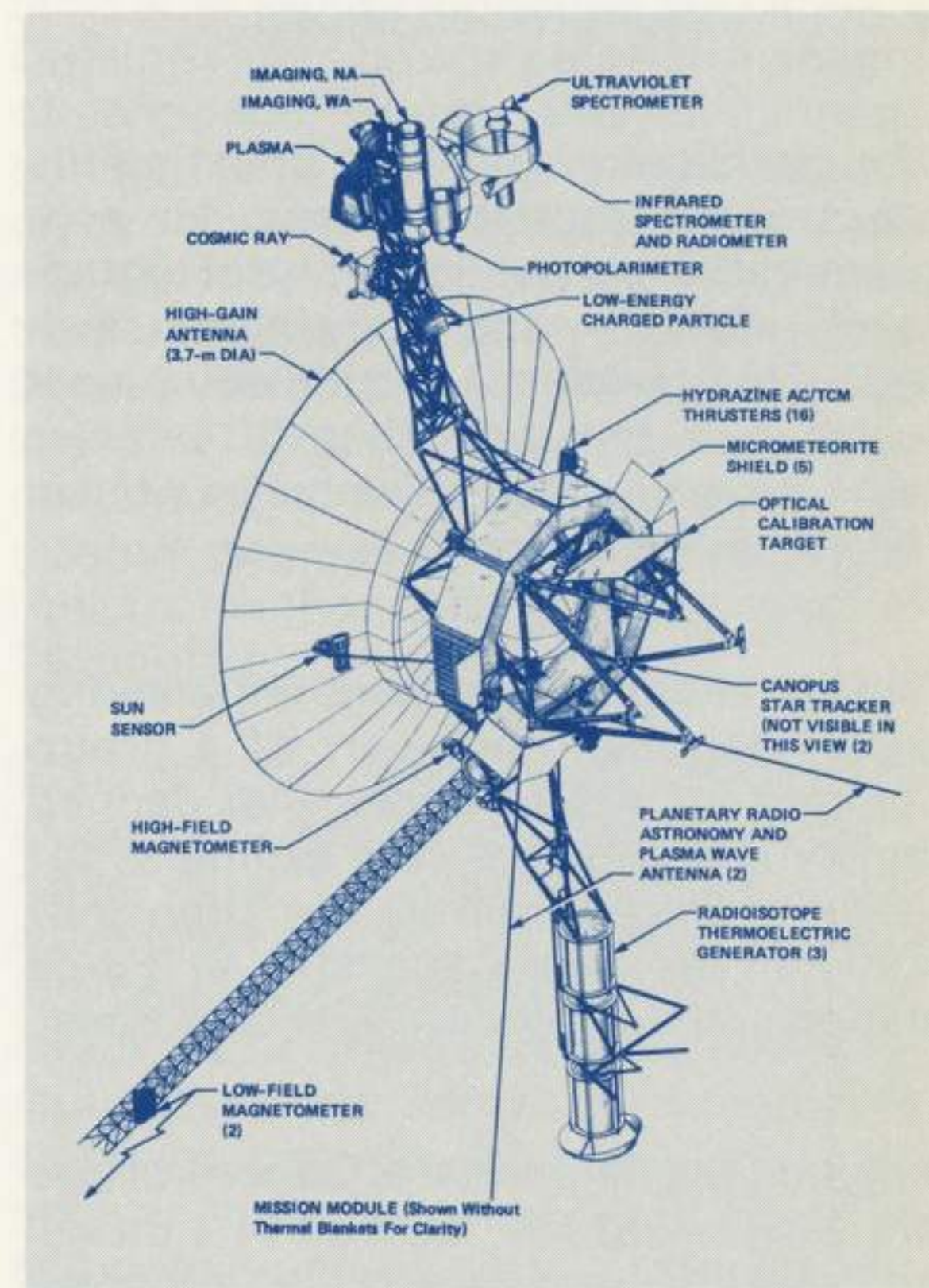
While the Helios and Viking spacecraft have completed their initial mission objectives, the two Voyager spacecraft on their way to explore Jupiter and Saturn, are not scheduled for their planetary rendezvous until 1979 and beyond. Voyager 1 was launched August 20, 1977 and its identical twin left Earth September 15, 1977. Weighing about 1780 pounds, the Voyagers will examine interplanetary space between here and the Jovian planets as well as carry out their prime mission of close-up examination of these huge bodies and their moons.

Voyager 1 is about 235 million miles from Earth with its encounter with Jupiter set for March 5, 1979. Voyager 2 is about 225 million miles on its way to a July 9, 1979 intercept of Jupiter followed by an August 27, 1981 date with Saturn. Voyager 1 will leave our solar system after its examination of Saturn and its rings while Voyager 2, as a bonus, is programmed to continue on to the far planet Uranus, arriving there, if all goes well, in January 1986.

Both spacecraft are generally in good

health even though minor problems have given the Jet Propulsion Laboratory flight team opportunities to analyze, design fixes for, and issue (from Earth) commands to the far-away spacecraft to work around most of their problems.

Some two years after the Titan IIIE/Centaur sent the Voyagers on their way, pictures and other scientific data will arrive on Earth from more than half a million miles in space.



Voyager spacecraft mission module.

## General cites division employee

In the aftermath of the brush fire that killed three persons at Vandenberg Air Force Base, including Col. Joseph G. Turner Jr., the base commander, a Martin Marietta employee has been cited for his contributions to the fire fighting.

Richard B. Hooley was recognized for his "extraordinary contributions" by Brig. Gen. Don M. Hartung, commander of the Space and Missile Test Center at Vandenberg.

General Hartung, in a letter, said, "Even as the raging fire threatened to penetrate the highly volatile environment of Space Launch Complex Four (SLC-4), he voluntarily remained at his station and brilliantly implemented innovative action to posture SLC-4 to survive the inevitable holocaust.

"If Mr. Hooley had not provided timely and accurate technical information, there is every reason to believe that incorrect decisions might have been made which would have certainly led to increased site damage and, feasibly, loss of life."



Benfield



Fogg



Harmel



Shrader



Plourde



Schwartz



Freeman

## Seven earn Martin Marietta Foundation scholarships

Seven of the 30 1978 Martin Marietta Corporation Foundation academic scholarships have been awarded to sons and daughters of Denver Division and Data Systems Denver operation employees. Two of those earning scholarships are Michoud area residents.

In Denver, those selected are Linda E. Benfield, Dennis C. Fogg, Todd A. Harmel, and Gerald R. Shrader representing the Denver Division and Mark E. Freeman representing Data Systems. At Michoud, the scholars are Harold J. Plourde Jr. and Stuart N. Schwartz.

The scholarships, initially for one year, are renewable for three more years based on academic achievement.

Selections were made by a three-member committee not associated with the Martin Marietta Corporation. Chairman was Joshua R. Wheeler, former superintendent of schools of Baltimore County. Other members were Dr. Donald Maley, chairman of industrial education at the University of Maryland, and Charles P. McCormick Jr., vice president of McCormick and Company.

The scholarship winners:

*Linda E. Benfield* is the daughter of Mr. and Mrs. Wilcomb A. Benfield. Her father is a staff engineer at the Denver Division. Miss Benfield, who will graduate this year from Arapahoe High School, plans to attend Colorado College and major in history. She has participated in a wide variety of school activities and was a class officer each year. She also was president of the student council.

*Dennis C. Fogg* plans to attend the Massachusetts Institute of Technology following graduation from Columbine High School. His major will be electrical engineering. He is the son of Mr. and Mrs. Ka Lun Fogg. His father is a senior group engineer at the Denver Division. Dennis attended the National Science Foundation's Hampshire College summer studies in mathematics in 1977.

*Todd A. Harmel*, who will graduate from Heritage High School this spring, is the son of Mr. and Mrs. Bradley B. Harmel. His father is a Denver Division staff engineer. Todd has chosen Boston University as his college of preference and plans a major in engineering. He has

been a participant in the annual bridge building contest and completed a model home for an architectural drafting class.

*Gerald R. Shrader*, the son of Mr. and Mrs. Franklin D. Shrader, will graduate from Alameda High School in Lakewood this spring. He plans to pursue a prelaw course at Oral Roberts University. His father is a senior specialist in configuration data management at the Denver Division. Gerald is active in music, antique car restoration, and is a member of his school's German-Russian club.

*Harold J. Plourde Jr.* plans to major in electrical engineering at Tulane University or the Georgia Institute of Technology. He is the son of Mr. and Mrs. Harold Plourde Sr. He will graduate from Slidell Senior High School. His father is a group engineer at the division's Michoud Operations. The young scholarship winner

is interested in music and is a member of the United States Chess Federation.

*Stuart N. Schwartz* has been accepted at Louisiana Tech where he will study biochemical engineering. The son of Mr. and Mrs. David B. Schwartz, he will graduate this year from Slidell Senior High School. His father is a senior staff engineer at Michoud Operations. Stuart has been on the staff of his school's literary magazine and has had his art work published.

*Mark E. Freeman*, son of Mr. and Mrs. Donald F. Freeman, will graduate from Heritage High School. He plans a career in electrical engineering and will attend Colorado State University. His father is a computer programmer with Data Systems in Denver. Mark participated in the University of Colorado honors engineering institute in 1977.

## Be considerate, smokers urged

Employees who smoke are being urged to voluntarily restrict their smoking when working or meeting with nonsmokers as a step in overcoming a problem that has developed.

"There is a growing concern among a number of our employees who do not smoke over the effects of smoke on their health and well-being," R.E. Weber, director of professional and industrial relations, reports. "These nonsmokers find prolonged exposure to smoke makes them uncomfortable or ill, having a serious effect on their efficiency."

It is the policy of Martin Marietta to provide a work environment that permits each employee to perform at the highest level of his or her capabilities.

"We do not feel this policy could be implemented fully by, on the one hand, prohibiting all smoking, or on the other hand, by ignoring the concern of nonsmokers," Weber said. "We believe much of the problem would go away if

smokers would voluntarily restrict their smoking in the presence of nonsmokers.

"We also believe the company has a responsibility to work with nonsmokers to solve the problem," he added. "For this reason, we have established guidelines to assure that employee concerns regarding smoking are considered and that action is taken to minimize or eliminate exposure to smoke.

"We believe nonsmokers are genuinely concerned about the effects of exposure to smoke on their health and operating efficiency," Weber says. "They have asked that nonsmoking areas be set up throughout the facility. We cannot meet this request now, although we have provided a nonsmoking area in the cafeteria.

"We will do what is reasonable and practical to honor the requests of nonsmokers," Weber said.

Weber stressed, "It is not our intent to tell employees they cannot smoke, but to ask that they show consideration for those who do not smoke."

# Command and information systems organizes to better serve customer

The Denver Division's command and information system (CIS) organization has been realigned to better serve its customers, make the most effective use of division resources, and to improve communication and management.

John L. Slack, division vice president for command and information systems, in announcing the assignments, said, "We have been studying and improving our management functions for several months and believe the organization as it is now formed will best meet our objectives."

Ten director-level areas of responsibility have been identified. Directors reporting to Slack are O. E. Cummings, requirements; S. B. Fisher, business management; C. P. Harrison, Army programs; O. C. Moore, Air Force programs; W. R. Herbert, electronic warfare and communication systems; C. D. Brudos, advanced programs; F. H. Hudoff, Rainmaker program; and E. C. Wood, production programs.

Slack will act as director for Navy programs. A technical director will be named later.

O. E. Cummings, who heads the requirements function, was formerly deputy director of marketing, communications, and electronics for the Orlando Division. He has been with Martin Marietta since 1961 in a series of senior engineering and management positions. He attended the University of Maryland and is a member of the Armed Forces Communications and Electronics Association, the Association of the United States Army, and the Air Force Association. The requirements function is the marketing arm of command and information systems.

S. B. Fisher was previously business manager for the division's technical operations. He now heads business management for CIS. He has held a variety of business and finance management positions at the division. Fisher has an AB degree in industrial management and has completed a four-year business training program, the equivalent of a masters degree in business administration.

C. P. Harrison, Jr., who has 20 years' experience in program and technical management of communications, command, and control programs, says the principal objective of Army programs is to establish Martin Marietta as the recognized leader in the communications, command, and control tactical information and message handling field. He has a BS



John L. Slack  
vice president



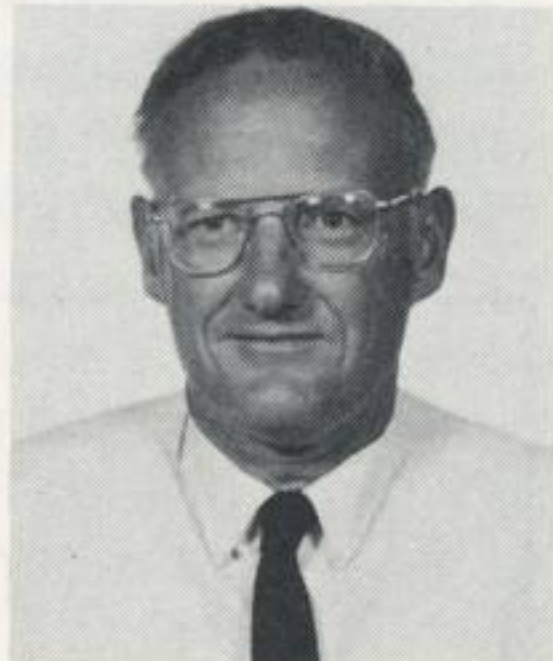
Cummings



Fisher



Harrison



Moore



Herbert



Brudos



Hudoff



Wood

in electrical engineering and has completed coursework for an MS in the same field.

O. C. Moore, a retired Air Force major general, directs Air Force programs which currently include operational application of special intelligence systems

(OASIS), global positioning system, space defense operation center (SPADOC), and an Air Defense Command study. Moore is a graduate of the U.S. Military Academy and has a masters degree in political science from the University of Omaha.

W. R. Herbert assumes responsibility for electronic warfare/communications systems after transferring from the Orlando Division where he was program manager of command, control, and communications systems. The function will include electronic warfare equipment contracts and Orlando communication and electronic contracts recently transferred to Denver. Herbert, an Alfred P. Sloan Fellow in 1972-73, earning an SM degree in management, has both bachelors and masters degrees in electrical engineering from the Georgia Institute of Technology.

C. D. Brudos, who directs advanced programs, began his Martin Marietta career in 1971 as the Viking systems test equipment leader. In addition to new business proposal efforts, Brudos will direct the command, control, and communication lab; independent research and development programs; and systems analysis. He has a BS in electrical engineering and an MS in engineering.

F. H. Hudoff has been with Martin Marietta for 16 years and brings experience on the division's major programs, including Titan, Skylab, and Viking, to his assignment as head of Rainmaker programs. He has a BS in electrical engineering and has completed coursework for an MS in the same field.

E. C. Wood has been named to direct production programs, including the control, checkout, and monitoring subsystem (CCMS), and will direct manufacture of current and future CIS products. He has been with the division since 1956, serving in a variety of management assignments. He is a registered professional engineer in Colorado and West Virginia and has a BS in electrical engineering. He has more than 20 years experience in hardware development and integration.

Navy programs, for which Slack is acting director, include tactical flag command center (TFCC); naval intelligence system architectural management (NISAM); and mission utilization and system interface concepts (MUSIC) programs. Supporting Navy programs in the CIS product area is the Washington-based operations under the leadership of Robert H. Crocker.

## Canaveral flight operations prepares for new launches

With the rapid turnaround launches of the Voyager spacecraft last summer successfully completed, the Denver Division's Canaveral flight operations turned its attention to checkout of four more Titan launch vehicles; modifications to the launch control center, transporter/van set number 2, and launch complex 40; and to participation in other major division efforts.

The modifications include updating the electronics control system to programmable aerospace control equipment — PACE — and returning the facility and the aerospace ground equipment to the ability to handle Titan IIIC vehicles rather than the Titan IIIE vehicles used in recent launches.

Canaveral flight operations engineering personnel also were part of a group completing project books that defined facility changes and cost estimates for modifications required for Titan 34D launches at Cape Canaveral Air Force station and Vandenberg Air Force Base.

Engineering personnel at Canaveral also are supporting the payload integration contract (PIC) and the Missile X proposal as well as preparing inputs for the Teleoperator program to reboost Skylab.

The Canaveral flight operations engineering department has responsibility for aerospace ground equipment and launch vehicle checkout through launch in these engineering system disciplines: mechanical, electrical, propulsion, propellant tank pressurization, ordnance, flight controls, and instrumentation. Engineers are responsible for technical direction, problem solving, data review, procedure preparation, and technical reviews at the Florida site.

### *Corporation to pay dividend*

The Martin Marietta Corporation board of directors has declared a quarterly dividend on the Corporation's common stock of 40 cents per share, payable on March 31, 1978 to shareowners of record at the close of business on March 6.

## *At Michoud*

# Space Shuttle emphasis shifts to Huntsville

Public attention to the Space Shuttle program shifted to the Marshall Space Flight Center in Huntsville, Ala., this month with the arrival there of two giant external fuel tanks from Michoud and the orbiter from the Dryden Flight Research Center, California.

A crowd of 6,000 people from the Huntsville area and 175 members of the working press were on hand on March 13 when the orbiter touched down at precisely 10:00 a.m. riding atop its converted 747 carrier aircraft.

Earlier, on March 5, the two external tanks arrived on two barges after a two-week 1,000 mile journey from Michoud up the Mississippi, Ohio, and Tennessee Rivers, from Martin Marietta's Michoud operations.

Purpose of these arrivals in Huntsville is to begin a nine-month series of ground tests on the Space Shuttle orbiter, external tank and solid rocket motors to prove their structural design for launch. Approximately 70 engineers and technicians from Michoud operations are in Huntsville conducting the external tank portions of the tests.

Three basic test configurations will be used to create five test conditions. First, the orbiter and the external tank will be mated vertically to test the system during the solid rocket motor mid-burn, burn-out, and jettison phases of the launch.

Second, the solid rocket motors will be mated to the already mated orbiter and external tank to form, for the first time, the basic launch configuration of the Space Shuttle. With the solid rocket motors empty, the vehicle will be tested during simulations of the pre-solid rocket booster separation phase of the launch.

Third, with the solid rocket motors filled with an inert material, the vehicle will be tested during simulations of the liftoff.

All of the tests are primarily ground vibration tests. Engineers and technicians, with the Shuttle in a 400-foot high test tower, will apply vibrations to the vehicle's exterior with exciters powered by amplifiers similar to those found on home stereo sets. Sensors placed along the skin at numerous locations on the Shuttle will record the characteristics of the vibrations as they pass from one area to another.

Information from these tests will allow engineers to verify the system design and mathematical models that predict how the Shuttle's control system will react to the much more severe vibrations

expected during launch and flight in orbit.

The ground vibration tests will continue throughout most of the year with pauses only to change the test configuration of the vehicle.

## New Orleans firm wins Michoud facility contract

Martin Marietta has awarded an architectural and engineering design contract to a New Orleans firm for work on a new building to be constructed at the NASA Michoud assembly facility.

The \$538,000 contract was awarded to the Waldemar S. Nelson Company, Inc., for design work on the new facility which will be used to apply an ablator coating to the exterior of the liquid hydrogen tank portion of the Space Shuttle external tank. Work will begin immediately on the 10-month contract.

Two large bays inside the 150-ft. square, 4-story high building will be used to house the liquid hydrogen tanks in a horizontal position while a thin heat ablator coating is sprayed to the exterior of the tanks. A third bay will be used to clean the tanks. A thicker, foam-like thermal protection system coating will be applied to the tanks later in the already completed bays in the vertical assembly building.

The new facility, to be built by Martin Marietta for NASA in 1979, will be located southwest of the vertical assembly building. The construction contract will be awarded later this year.

## NASA authorizes long lead procurement

NASA has authorized Michoud operations to begin procurement of a number of long lead items required to begin work on the external tank production contract scheduled late this year.

Involved are machined parts, milled aluminum, support services, and special tooling that must be ordered now to be ready for delivery by the manufacturer to the Michoud assembly facility when the production contract to build 27 additional flight tanks begins. NASA plans to award the Increment II production contract late this year.

Michoud operations already has completed the three ground test tanks and has begun final welding on the first of six flight test tanks called for in the Increment I design development, and test contract.