



NUMBER 20/1981

**Division Expenses
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261 WORKING DAYS

- SALARIES AND WAGES (93 DAYS)
- GOODS, UTILITIES, TRANSPORTATION AND SERVICES (131 DAYS)
- LOCAL, STATE, FEDERAL TAXES (15 DAYS)
- PENSIONS, INSURANCE, AND DEBT SERVICE (13 DAYS)
- EARNINGS (PROFIT) (9 DAYS)

Building on mission success

"Three achievements in 1981 stick out most in my mind," said C. B. Hurtt, president of Denver Aerospace.

"First, is the 100 percent mission success carried out across the entire Denver Aerospace operation.

"Second, is our financial performance in which, during the year, we bettered all of our important financial commitments for the year.

"And third, is our ability to successfully integrate the thousands of new employees into our system and our culture."

Hurtt added, "Those are the best indicators, in my judgment, that our new four-division organization worked well in its first full year. It matured more quickly than I thought possible.

"Now the total organization has the structure and the flexibility to achieve our business goals — and our personal career goals.

"Decisions can be made at lower levels than before, and we are training more decision makers. That promotes growth."

Turning to 1982, Hurtt forecast a modest business growth, and strengthening of the company's competitive position in the ever-widening market place.

"We have reached our manpower commitment," Hurtt pointed out. "Next is the task of continuing to perform our assignments in the same competent fashion that brought us the record of 100 percent mission success.

"If we do that, impressive growth will follow.

"I want to express my personal and professional appreciation to each of our 16,000 employees for the dedication, hard work, and excellence that made 1981 a record-setting year," Hurtt said.

On the cover

Marking off the days on a calendar is one way to view the results of 1981 and to see how Denver Aerospace met its obligations. All income for 93 days was required for salaries and wages for employees. Every penny taken in for 131 days went back to suppliers for goods, utilities, transportation, and services. It took the income from 15 days to pay taxes to local, state, and federal governments. Pensions, insurance, and debt service took the income from 13 days. Earnings (profits) were equal to just 9 days' income. Earnings are used to pay shareholders for the use of their money, for growth, expansion, and other capital needs, like adding new equipment, new facilities, or modifying them, to make us more competitive. That's why everyone should help make the green days grow.

Denver Aerospace writing new chapters in technology as first 25 years ends

Twenty-five years ago, as America stood on the threshold of space exploration, Martin Marietta was there.

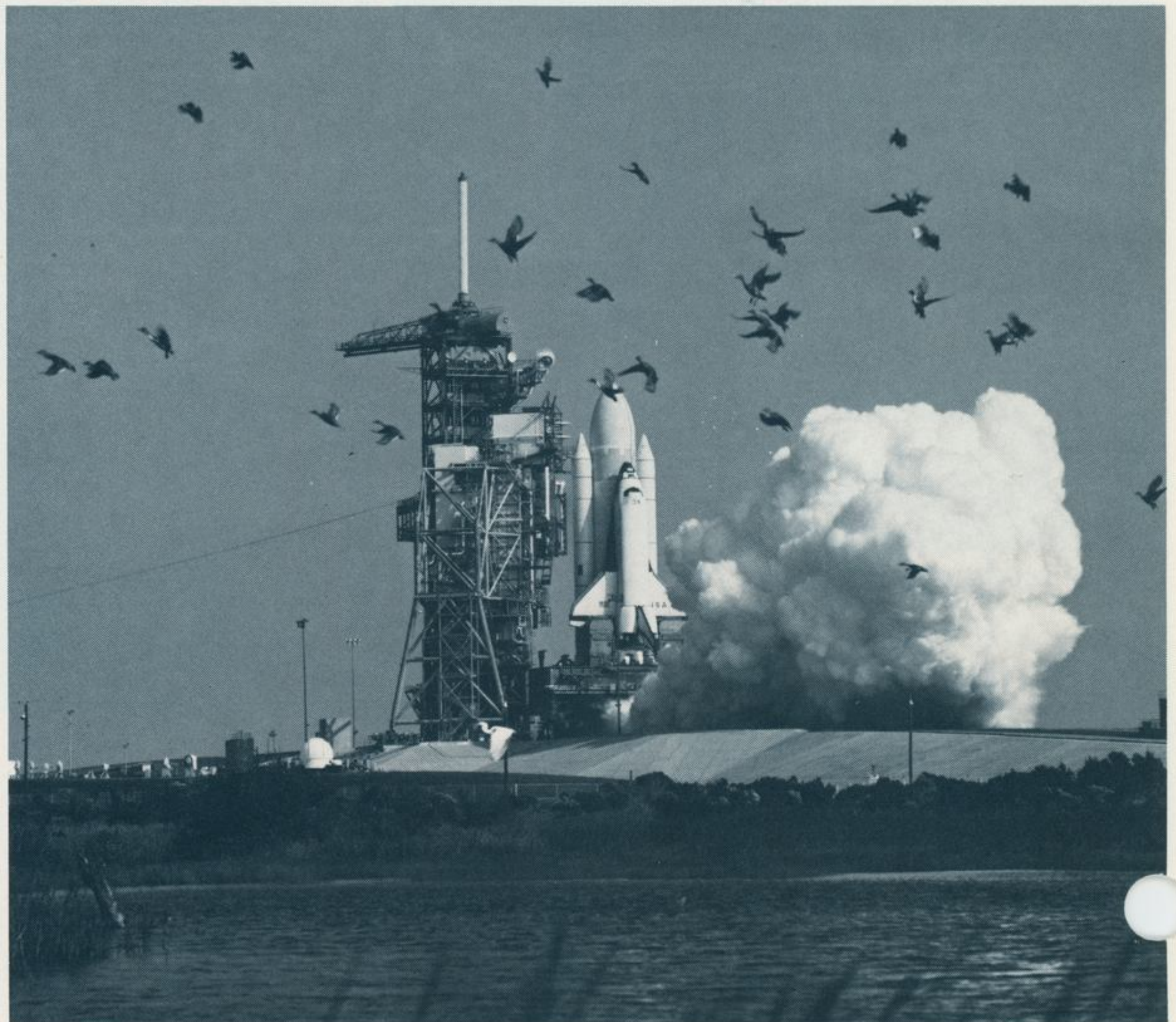
And, when a new space exploration chapter was written April 12, 1981, Martin Marietta was there again.

Every American swelled with pride on that day as Columbia rocketed skyward atop a billowing cloud of flame. The Space Shuttle once again proved the prowess of American technology and the prowess of Denver Aerospace employees who brought their skills, knowledge, and commitment to achieving a national goal.

Seven months later, on November 12, Columbia blasted off a second time. Again, systems produced by Denver Aerospace performed as required and contributed to the success of the second Space Shuttle mission.

"The two Space Shuttle launches were clearly the high points of 1981 for us, and in many ways for the nation," said C. B. Hurtt, Denver Aerospace president. "In a time when the country seems to be having difficulty with the domestic economy and with its international political focus, these Shuttle launches stand for much that represents the best of American achievement.

"I think they do the same for us," he said, "tying together, as they do, the outstanding work of the Michoud division, the space and electronics systems division, technical operations, and the work of our people at Kennedy Space Center.



The sound of Space Shuttle's powerful rocket engines send a flock of startled, but otherwise unharmed, water fowl into flight.

"And, with the major role of the space launch systems division in the military Shuttle, it is clear that Shuttle mission success will be a significant measure of our achievements for many years to come," said Hurtt.

Response to growth

To maintain its prominence in the industry and in response to business growth, Denver Aerospace organized in 1980 into four product divisions which had their first full year of experience in 1981.

Formed were:

The Michoud division, with Kenneth P. Timmons as vice president and general manager, builds the external tank for Space Shuttle.

The space and electronics systems division, responsible for command and information systems, and civilian and military space systems, is led by W. O. Lowrie as vice president and general manager.

The space launch systems division, headed by C. E. Carnahan, vice president and general manager, builds the Titan launch vehicles and is responsible for Space Shuttle activities for the Department of Defense.

The strategic systems division has created the MX missile program and is responsible for future strategic missile systems. Howard F. Keyser is the division's vice president and general manager.

One product beginning

In 1956, Denver Aerospace started with only one project — Titan. Now, 25 years later, 500 contracts are spread across the divisions, the solar energy product area, and in the growing research and development efforts of technical operations. These functions have been joined by a new group called future systems which is charged with the responsibility to explore long-range opportunities.

This year, 1981, was a year in which the new organization was validated and a year that saw Denver Aerospace grow by nearly 4000 people. The excellent new talent, attracted in the successful hiring program developed by the personnel department, met the manpower needs for critical programs.

"Obviously, we could not meet the rest of our objectives without the addition of the skilled people needed for our expanding business," said Hurtt.

Facilities expanded

Even with the explosive growth, facilities expansion kept pace providing more work space and acquiring needed special equipment. Additions to the Denver systems center, electronic manufacturing facility, and the space support building were completed. More office space was leased and improvements were made in the factory and other existing facilities. A new building purchased in Littleton will provide more than 400,000 square feet of office and light-assembly space.

The improvements will continue in 1982. A new cafeteria will replace the old one on the second floor of the engineering building, seating twice as



A jubilant group celebrates the first Space Shuttle launch in a room full of CCMS equipment at Kennedy Space Center.

many as the one on the first floor. Laboratories will be upgraded, offices will be modernized, more functional furniture will be added.

Future systems look ahead

This was also the first full year for the future systems group.

"With this group," said Hurtt, "I think we will know what we should be doing five to 20 years from now."

The concept of high energy laser systems has received the most serious study, with the group winning a contract in 1981 to investigate the possibilities of a space-based, high-energy laser system.

A major objective in 1982 will be to establish a competitive position for Denver Aerospace in high-energy laser systems.

Space and electronic systems

The space and electronics systems division is responsible for a host of Space Shuttle tasks. In each of the first two flights, equipment performed according to plan.

The equipment includes:

- The checkout, control, and monitor subsystem (CCMS) which is the heart of the launch processing system that manages all Shuttle ground activities up to liftoff. The CCMS also has been installed at Vandenberg Air Force Base for the Air Force Shuttle program. The CCMS program has earned another 100 percent award fee this year, its eighth out of eleven opportunities.

- The solid rocket booster recovery system.

- The reaction control tanks supplying fuel and oxidizer to the orbiter's thrusters for attitude control.

- The caution and warning system that provides audible and visual warnings of malfunctions and irregularities to the crew.

- The pyrotechnic initiator controllers that control, arm, fire, and disarm more than 120 explosive devices triggering key Shuttle events.

In 1981, the space and electronics systems division completed design studies for the Venus orbiting imaging radar spacecraft. VOIR will provide NASA with a detailed topographic map of the surface of Venus by using synthetic aperture radar.

The VOIR proposal was submitted in the fall with the contract announcement expected in January 1982.

The space sextant, equipment that will provide a precise celestial attitude determination for spacecraft and satellites on which it is used, was tested in 1981. It proved it can be used without ground-based adjustments.

The faint object spectrograph project made good progress this year and is scheduled for tests in 1982. The FOS is part of the space telescope which will be able to observe objects 100 times fainter than the most powerful Earth-based telescopes.

Work will continue in 1982 on the integrated tactical surveillance system (ITSS) study contract.

The division will continue its pursuit of a contract for the tethered satellite system.

The manned maneuvering unit may be put to work soon on two possible assignments: first, to repair the solar maximum mission satellite, and, second, to examine the external tank's thermal protection system while the tank is in orbit.

"The command and information systems group won several important contracts in 1981, including an automated staff message processing system for the Army, and SMARTS — a computer-based system to test command, control, and communication system for the United States and NATO air forces," said W. O. Lowrie.

"Much of what was accomplished by command and information is new business," Lowrie said. "This is important growth."

A key effort in 1982 will be to bid on — and win — a contract for the space defense operations center (SPADOC) near Colorado Springs.

Growth at Michoud

The year 1981 was one of growth and success for the Michoud division. The second Shuttle tank was delivered to Kennedy Space Center only 10 days after the first Shuttle mission began. The third tank, to be used on the next Shuttle launch scheduled for March 19, 1982, was delivered to KSC two weeks ahead of schedule.

The weight of the third tank has been reduced by 600 pounds by eliminating the exterior paint.

"I'm proud of the performance of the external tanks," said Kenneth P. Timmons, the division's vice president and general manager. "And I'm also proud of the performance of our employees. The first two flights were tremendous accomplishments for us and we look forward to many similar achievements in the coming years."

The external tank operations at the Kennedy Space Center has been recognized for its superior performance with nine consecutive 100 percent performance ratings, the only organization at KSC to achieve this recognition.

Michoud grew by more than 800 people in 1981 and will add additional staff to support NASA's requirements in 1982.

The division was awarded a phase two contract in 1981 to continue studying Shuttle-derived vehicles and also is studying the requirements for taking the tank into orbit so that astronauts using the manned maneuvering unit can inspect its thermal protect system.

Efforts to improve productivity and product quality while reducing costs were made with the addition of two large manufacturing cells that have computer-controlled fixtures to spray components of the thermal protection system (TPS) onto the intertank and the liquid hydrogen tank.

Michoud's quality engineers also devised a new electro-mechanical system for checking welds that requires one-tenth the normal time and improves the accuracy 100 percent.

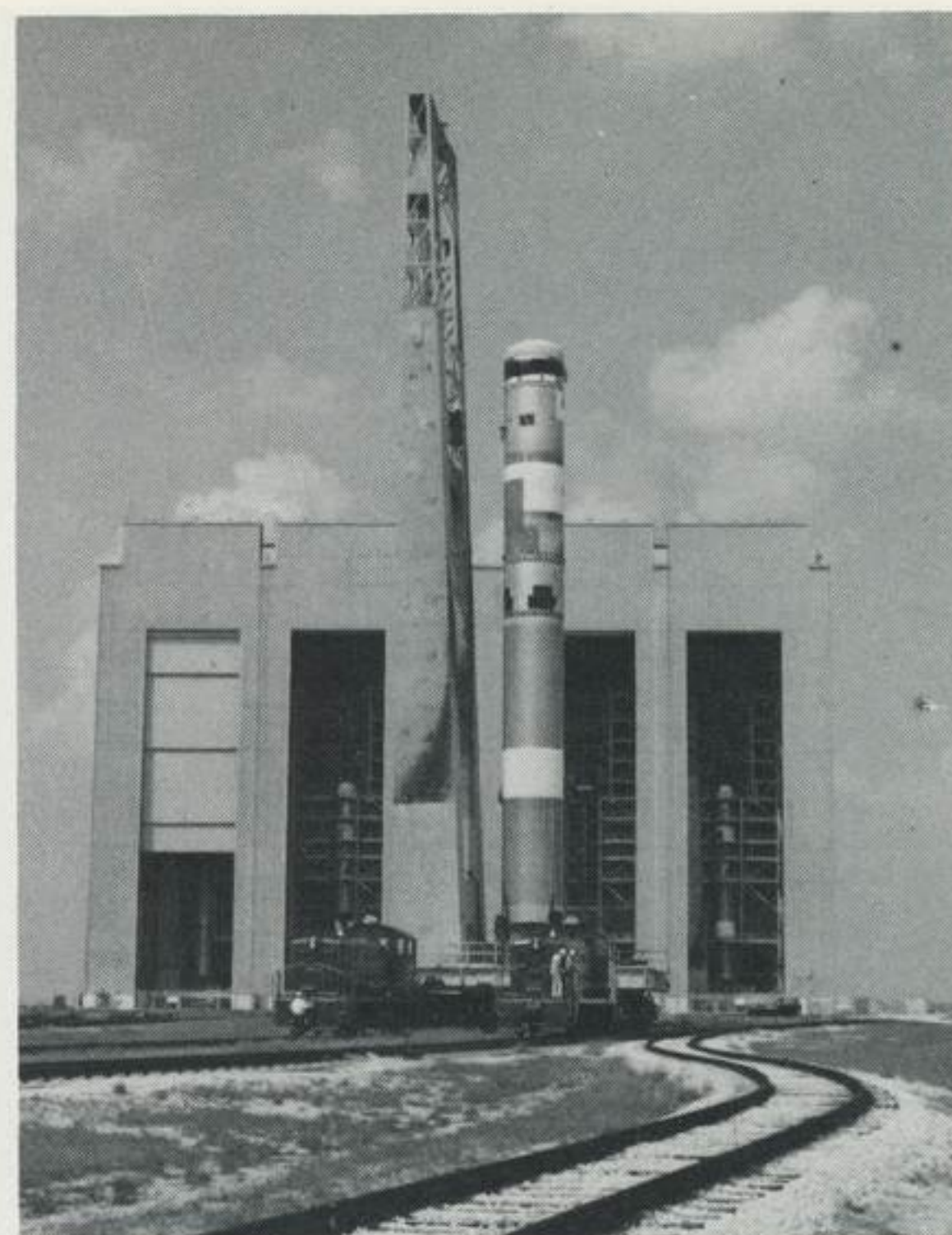
Other facility modification and tool relocation work will continue in 1982 to help the division reach a production rate of 24 external tanks per year by 1986.

In 1982, Michoud will deliver five external tanks, including the first two lightweight tanks. The weight saving will allow the Shuttle to carry an extra 6000 pounds of payload. Three additional cells to apply the thermal protection system will come on line in 1982. This will complete the automation of the facilities for applications to the oxygen tank, intertank, and hydrogen tank.

Space launch systems

The space launch systems division continued to build on its 25 years of Titan performance with a perfect year of Titan III launches. In the past 13 years, there has been only one Titan failure.

A key event in the continuing history of Titan, according to C. E. Carnahan, the space launch systems division vice president and general manager, will occur in 1982 when the Titan 34D, the newest member of the Titan family, will have its



Titan 34D at Cape Canaveral.

first launch. The Titan 34D is expected to have an important place in the country's expendable booster program, replacing Titan IIIC and Titan IIID.

"We expect to have Titan business through this decade," Carnahan said.

One of the space launch systems division's most important current assignments is to ready the Air Force's Shuttle launch complex at Vandenberg Air Force Base by 1985. All major facilities were under construction this past year.

"We will see the beginning of the outfitting of these facilities with checkout equipment in 1982," said Carnahan.

At Vandenberg in February and April of 1982, more than 1300 ground support systems people — now housed in 30 locations — will move into two modular office buildings, providing more than 200,000 square feet of space.

Another important task for space launch systems is the payload integration contract (PIC). PIC received two award fees in 1981 — both 94 percent, the highest ever awarded by the Air Force Space Division. PIC is a continuing effort the division hopes to expand as it competes for the Shuttle payloads operations center at Cape Canaveral.

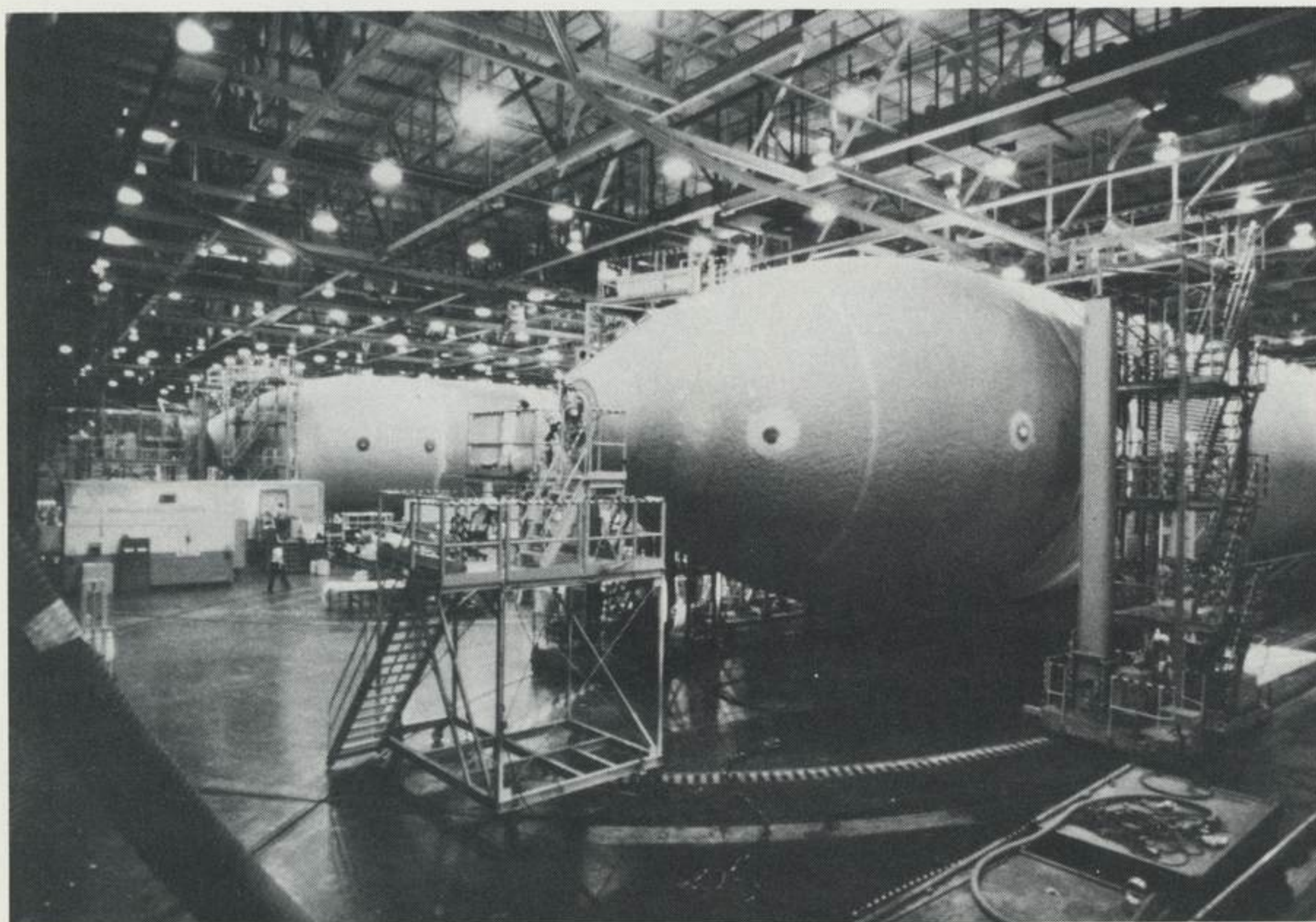
Strategic systems

The strategic systems division passed some key hardware milestones in 1981 with the delivery of solid stage transporters and a missile launch canister for use in the MX flight test program.

The integration testing of instrumentation and flight system safety equipment got under way. Also, the elevator and hydraulic power system for stage assembly and canister erection and rotation were completed.

The government's decision on MX is a high point, not a low point, for 1982.

"Even though the new administration decided to take a fresh look at MX," Howard F. Keyser, division vice president and general manager,



The fourth and fifth external tanks recently spent three weeks side by side in the final assembly area at Michoud.



Artist's concept of MX missile.

said, "it supported the program, with a change in the basing mode. We will continue to be the major aerospace contractor on the program."

During the year, a group began studying alternative basing modes such as deep basing, or placing MX in existing Titan or Minuteman silos.

Throughout 1981, MX facility construction at Vandenberg Air Force Base continued and the integrated test facility there was readied for use.

In 1982, the remainder of the Vandenberg facilities will be completed and there will be a test of the MX launch system in the Nevada desert. In this phase of the canister assembly launch test program, a simulated missile will be propelled out of the canister using a cold gas ejection technique. The test is an important milestone along the road to the first MX flight test from Vandenberg in 1983.

Solar energy systems

Solar energy systems had a busy year in 1981. In Almeria, Spain, and Barstow, California, it finished building and installing heliostats and control equipment for two solar thermal power plants. The Barstow plant uses 1818 heliostats controlled by a computer to track the Sun's rays and concentrate them on a boiler that produces steam to generate electricity.

The Barstow project is the world's largest and this country's first commercial solar power plant.

"We expect the Barstow plant to establish a benchmark in solar thermal technology — a large-scale harnessing of the Sun's energy for the production of commercial electrical power," said A. E. Hawkins, solar energy systems vice president.

Solar energy systems also built another, different type of energy system that uses photovoltaic cells to convert sunlight directly into electricity. This plant supplies power to villages near Riyadh, Saudi Arabia. A similar project at Sky Harbor Airport in Phoenix, Arizona, is under construction and will be completed in 1982. These projects

make Denver Aerospace the world's largest manufacturer of photovoltaic concentrator array power systems.

Marketing studies are in progress to determine the best direction in which to apply the knowledge and experience gained through the work on solar power generation of electricity.

Technical operations

With the award of a third experimental project, technical operations, under the leadership of Robert J. Polutchko, its vice president, became the key contractor for the on-board experiments on the Galileo-Jupiter probe.

A net flux radiometer will be built to measure energy being radiated from Jupiter and the Sun at different levels in the planet's atmosphere.

Also being built is an atmospheric structure instrument to tell scientists more about Jupiter's atmospheric temperature, density, pressure, and molecular weight.

The nephelometer to be built for the probe will determine the location of the planet's cloud layers and the size of the particles within each.

Technical operations also played an important role on the second Columbia mission with responsibility for the feature identification and location experiment. FILE, as it is called, is a key development tool for future Earth resources and global monitoring systems.

The past year also saw technical operations involved in:

- The expansion of the computer software facility.
- The MX assembly, test, and systems support laboratory at the Denver systems center.
- Expansion to word processing, computer-aided design and manufacturing capabilities, business management distributed systems, and the analog/hybrid facility.
- And a new mechanism test facility.

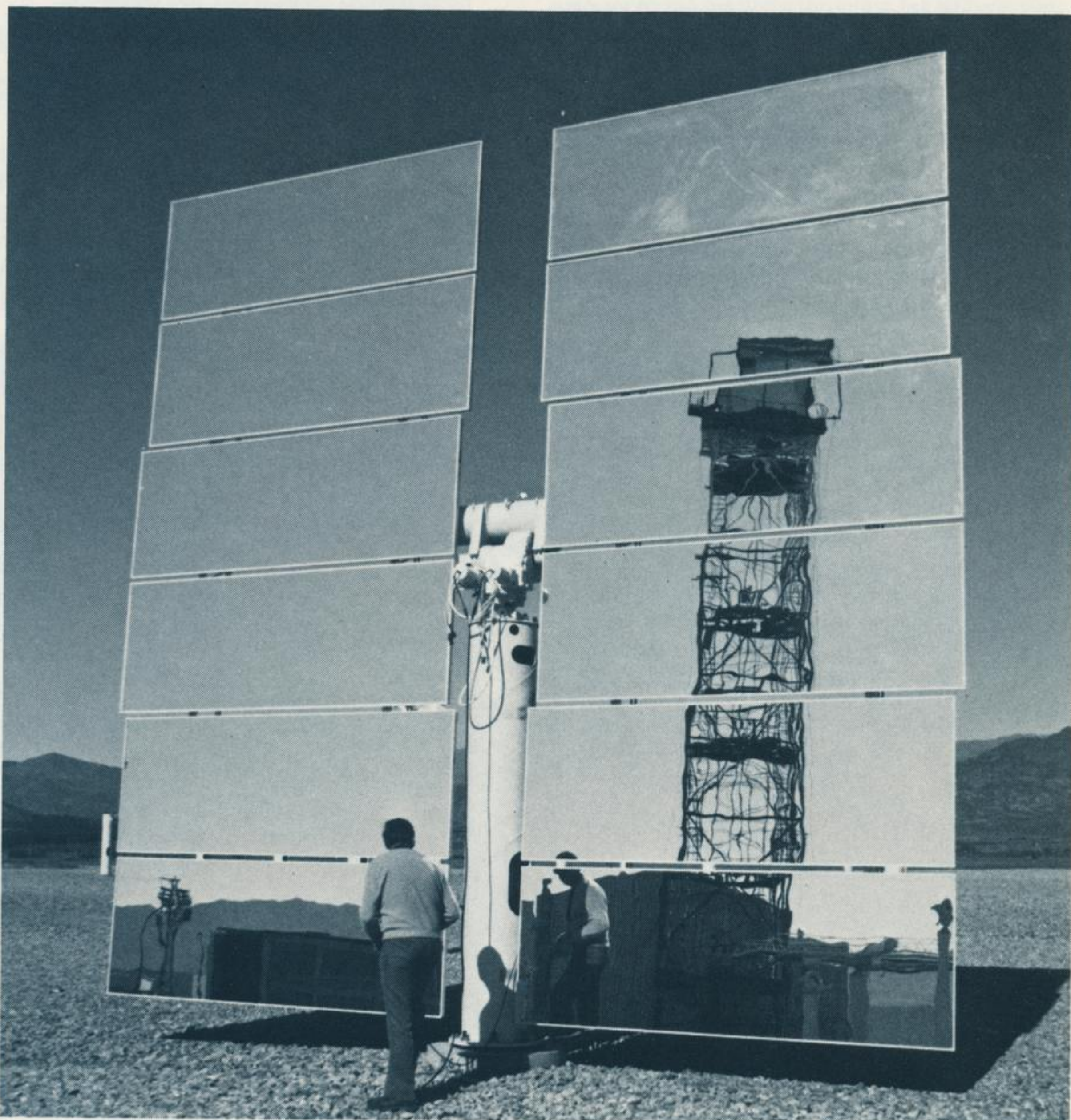
"A continuing, fundamental goal for technical operations," said Polutchko, "is to improve the Denver Aerospace technology base through increased independent and contractual research and development."

Employees active

Working for mission success was the prime goal of each employee in 1981. Many participated in career development programs to be better prepared for the present and future requirements of their jobs.

For example, more than 900 continued their education at local colleges and universities under the tuition reimbursement program.

Another 4700 — almost twice as many as in 1980 — participated in the evening education program directed by the personnel department.



Heliostats have been installed at Almeria, Spain, above, and at Barstow, California.

Others were involved in seminars and workshops to aid them in their present and future jobs.

Successful efforts were made by all functions, with the aid of the personnel department, to overcome the problems and concerns employees described in the survey taken in 1980.

But all was not work for Denver Aerospace employees. Nearly 70,000 employees and family members attended the special events sponsored during the year, which included basketball and baseball games, a circus, and a family day at an amusement park.

Another 3000 took part in the club activities, and 6000 participated in the sports program offered by the recreation office.

Highlight of the year for employees was the special 25th anniversary celebration at McNichols Arena developed by the public relations department. While all employees were honored for their contributions to Denver Aerospace, more than 300 who have been with Denver Aerospace since its beginnings in 1956 were given special recognition.

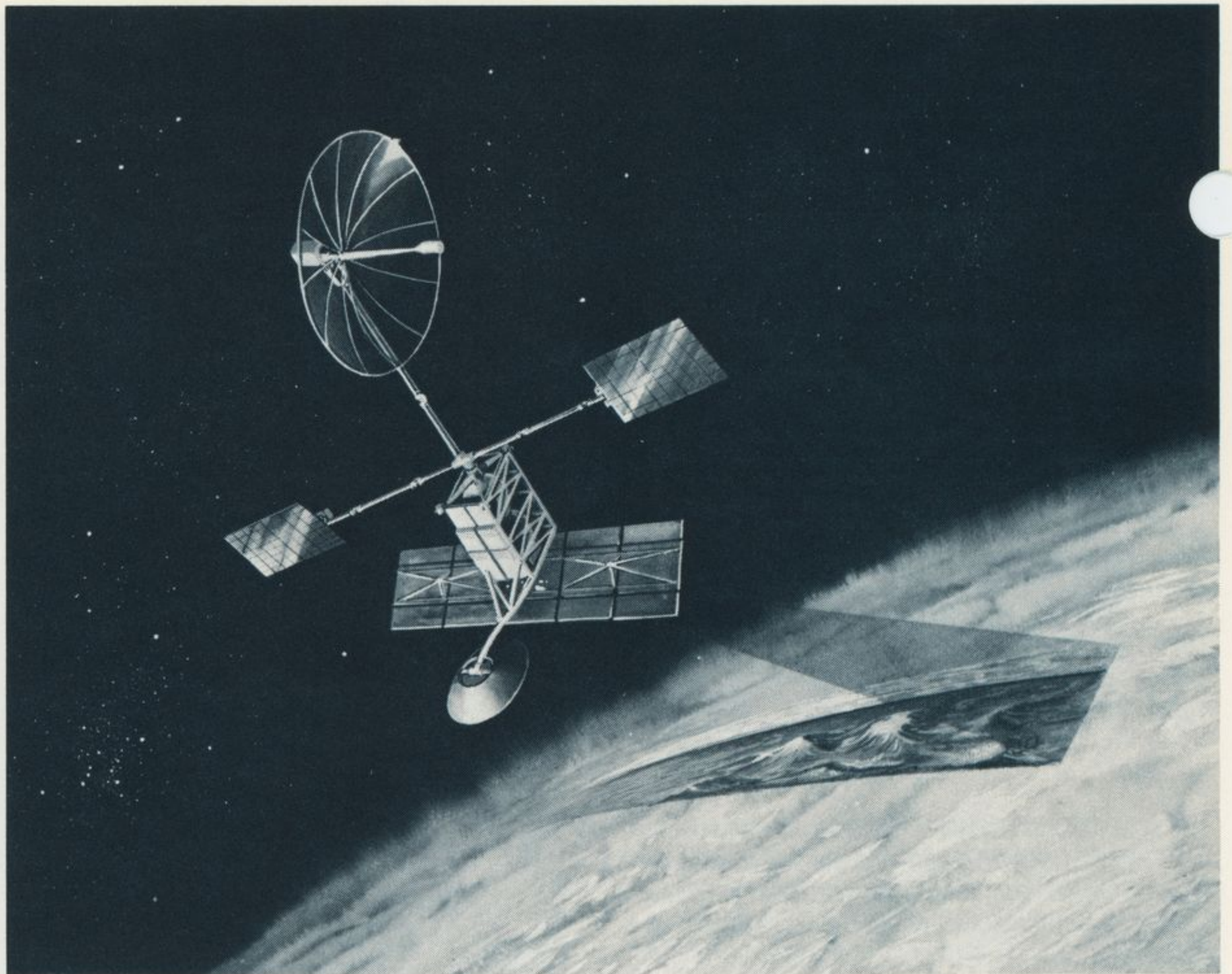
Martin Marietta's chairman and chief executive, J. Donald Rauth, and Denver Aerospace's president, C. B. Hurtt, took the podium to review past accomplishments and commend employees for their dedication.

Said Rauth, "These first 25 years . . . have only begun to open our eyes to the great things that are possible in the next 25 years, and beyond . . ."

He added, "I know what can be done by an excellent group of people when they have foresight and enthusiasm coupled with dedication and ingenuity. These are the virtues that we associate with this Denver operation . . ."



Galileo atmosphere structure instrument will be used on Jupiter probe.



The Venus orbiting imaging radar spacecraft in this artist's concept could be important new business.

Team effort means leadership

In the history of business, 25 years really isn't a very long time. Yet, in 25 years, Denver Aerospace has become one of the world's leaders in aerospace technology. The "foresight and enthusiasm coupled with dedication and ingenuity" cited by J. Donald Rauth helped develop the team effort here. And success is a team effort, built of skill, hard work, imagination, and a dedication to mission success.

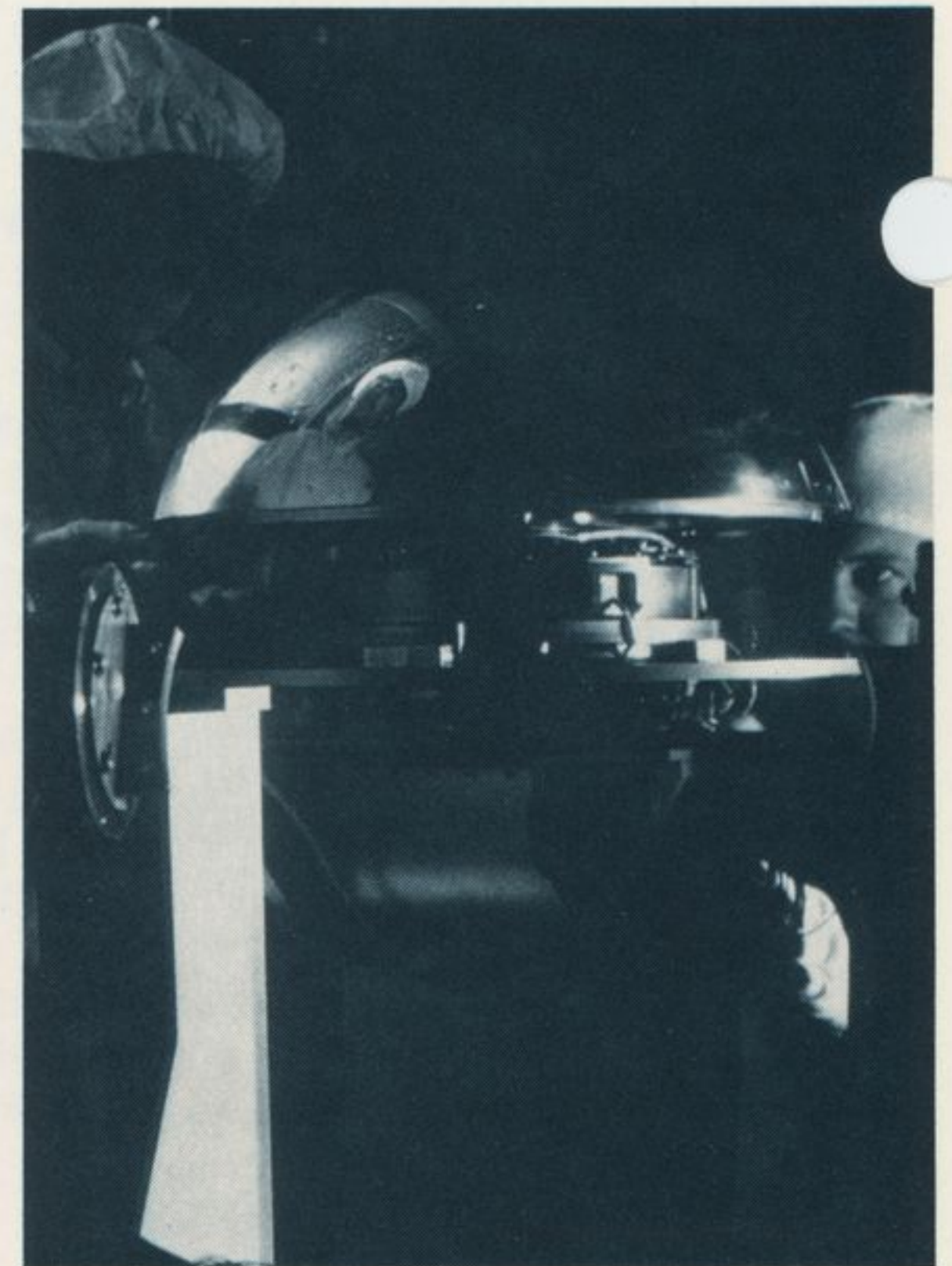
Social security taxes increase

Social Security (FICA) deductions will be increased in the first paychecks received in 1982 — for wages and salaries earned in 1982.

The rate increases to 6.70 percent from 6.65 percent and will be withheld from gross earnings up to \$32,400, up from \$29,700.

Maximum amount that can be withheld is \$2,170.80.

The company will pay an amount equal to each employee's deduction.



Space sextant proved its capabilities in 1981 tests.

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Call Ext. 5364 with information or suggestions for articles, or call one of the following coordinators.

Technical Operations: Kenneth E. Sedlmayr 6872
Solar Energy Systems: Leon E. Taylor 0660
Business Development: Leonard G. Taigman 4466
Space/Electronics Systems Division: J. H. Guilfoyle 6944
Strategic Systems Division: John H. Pond 9165
Space Launch Systems Division: Steven L. Cohen 1798
Michoud Division: Evan D. McCollum 3788
Canaveral Operations: Donald T. Beck 9108
External Tank Operations (KSC): Melodie deGuibert 3160
Vandenberg Operations: William Leary 2202

DENVER AEROSPACE

P. O. Box 179—Denver, CO 80201

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