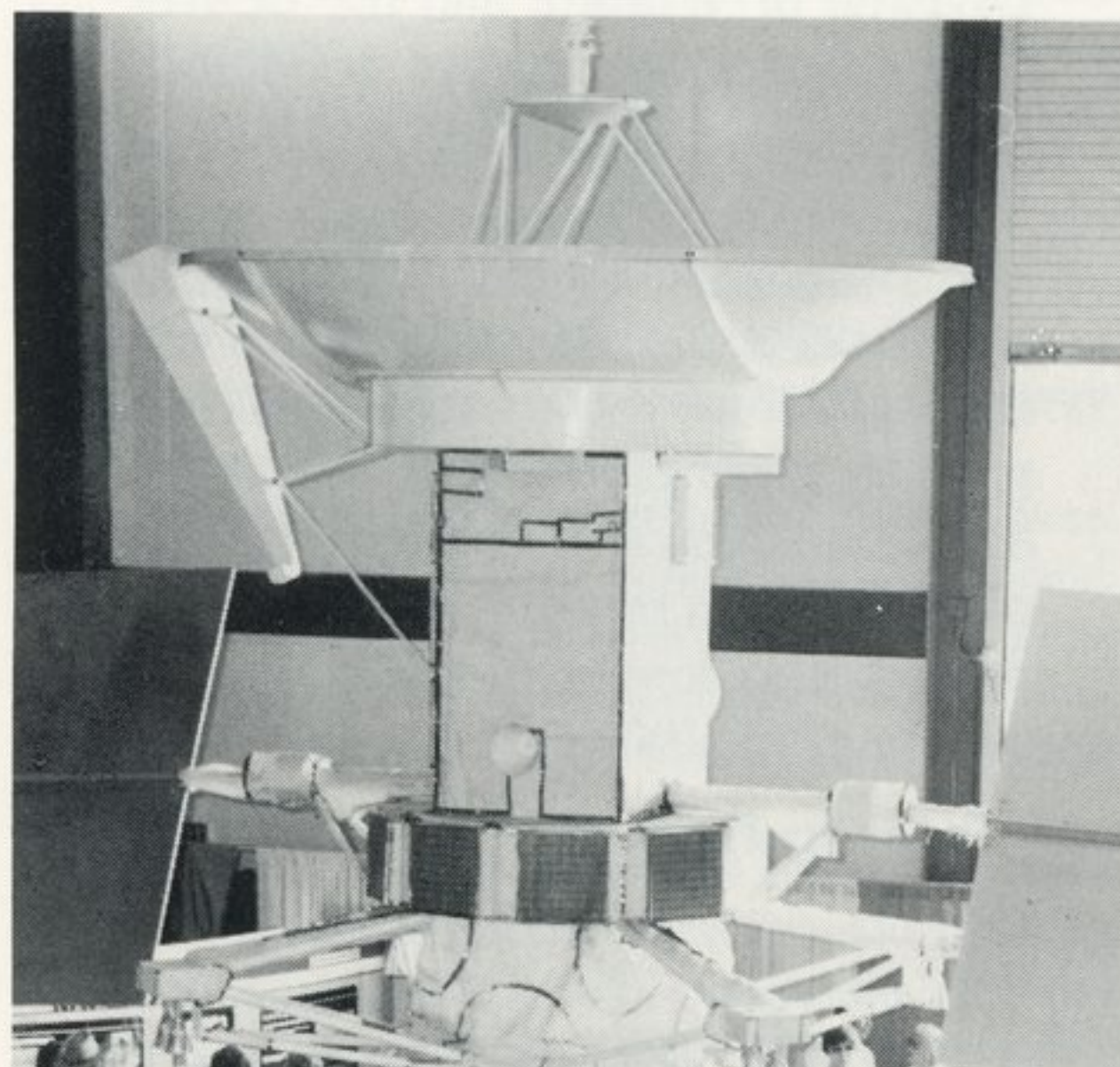
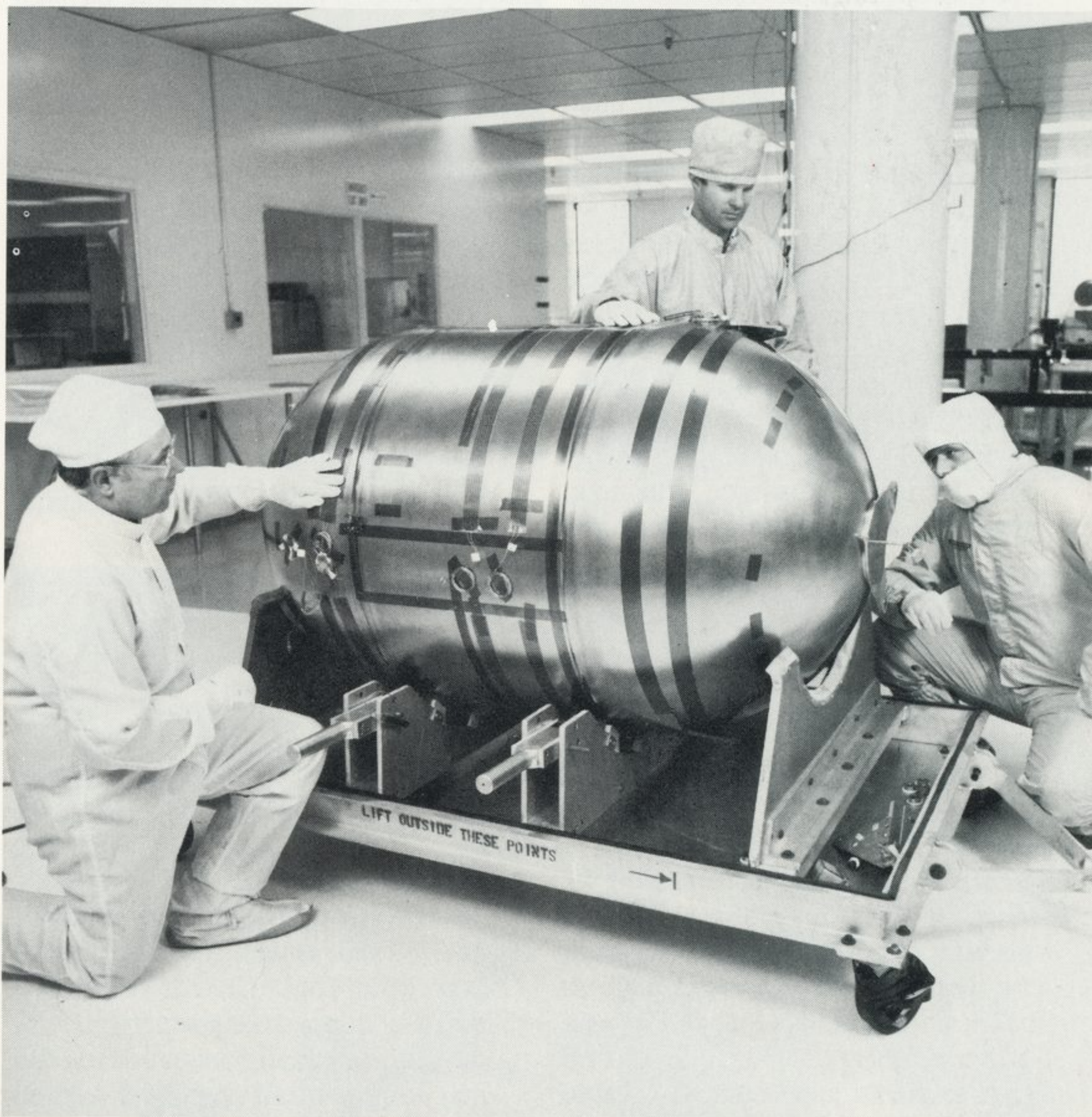


December 15, 1989

Year in Review

What a year!



Teets thanks employees for year of Mission Success

Dear fellow employees:

What a year! Thanks to each of you, we can look proudly at the accomplishments of this past year and pat ourselves on the back for achieving 100 percent Mission Success.

This Mission Success included launching the first Titan IV, the last two Titan 34Ds, and the second Titan II. Also contributing to our success was the deployment of the Magellan spacecraft to Venus. In addition, we performed flawlessly in our role as flight test contractor for both the Peacekeeper and Small ICBM programs.

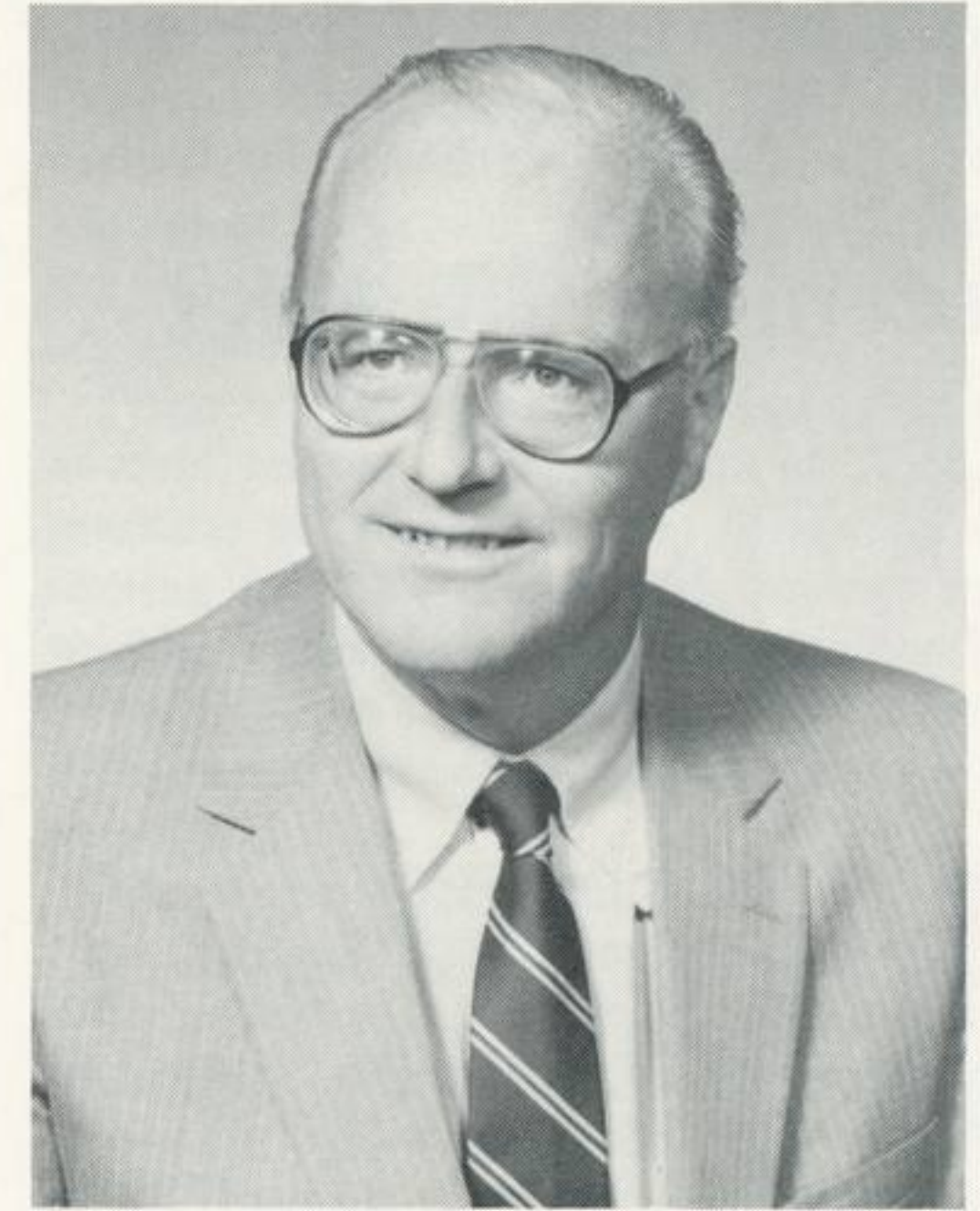
This also has been a year of change. Total Quality Management and concepts like Cultural Diversity Training, Manufacturing Resource Planning, High-Performance Work Teams, and

committed people like you, that trend will continue.

New business wins in 1989 included obtaining the Flight Tele-robotic Servicer contract; a contract award to build 18 additional Titan IVs, with an option for eight, through 1995; a contract to launch an SDI experiment on a Titan II with added solid rocket motors; and a NASA contract to launch the Mars Observer spacecraft on a Commercial Titan in 1992.

The list goes on, and I encourage you to read more about our year in this special issue of the *Martin Marietta News*.

Thanks also for helping us record our highest ever IR&D (Independent Research and Development) score, and for working to obtain an all-green COR (Contractor Operations Review) from the Air Force.



Peter B. Teets, president

Savings Bonds and also maintained our partnership with the Colorado Division of Wildlife and the Denver Water Board to improve conditions for bighorn sheep, deer and elk in Waterton Canyon.

As we say goodbye to another year of 100 percent Mission Success, I encourage all of you to commit to improving some part of your job every day. Thank you for helping us to succeed as a team in 1989, and let's continue that positive momentum into the decade of the '90s.

Very truly yours,

A handwritten signature in red ink that reads "Peter B. Teets".

“Our ability to find ways to do our jobs better will enable us to achieve and maintain a competitive edge as we enter the new decade.”

—Peter B. Teets

people empowerment are helping us to adapt to the changing world and workforce. We have begun to change, and I fully expect us to continue to build on the solid foundation that we've laid this year. Our ability to find ways to do our jobs better will enable us to achieve and maintain a competitive edge as we enter the new decade.

Along with this edge, my personal goal is to make the Astronautics Group a better place to work. I feel we are on solid ground, and with

The Astronautics Group accomplished great things for our community in 1989, as well. We had our best ever Mile High United Way campaign, continued our partnership with the Colorado Trail Foundation to keep that 462-mile trail open, and worked with the Denver Botanic Gardens to help them broaden community outreach programs to educate the public about their efforts to improve the environment. We continued our long-standing tradition of investing in U.S.

Astronautics Group tops last year's record IR&D score

For the second straight year, the Astronautics Group's Independent Research and Development (IR&D) program has recorded its highest score ever. The 1989 score from the government's evaluators was 8.77, up from 8.60 last year.

"This score puts us in the 99th percentile of the 141 industries participating in the Air Force-managed IR&D program," Ron Bena, IR&D program manager, said. "This is significant because we continue to demonstrate to the government the high quality of our technical programs."

A score this high gives the Astronautics Group the ability to negotiate favorably with the

government when setting the reimbursable dollar ceiling for the IR&D program. "Basically, this enables us to obtain more technology dollars," Bena said.

As with last year, Space Systems, under the guidance of James W. McNally, played a key role in the Astronautics Group's overall score. "They recorded a 9.17," Bena said. "However, it's important to note that this is most certainly a team effort, and everyone who participated to make this year's score the best ever should be congratulated."

The IR&D Technical Plan (brochure), containing documentation on 94 projects, was

distributed to more than 50 government organizations that expressed interest in the projects.

Thirteen Astronautics Group employees received a perfect 10 in their role as IR&D principal investigators. They are Peter McInnes, John Coyner, George Haynes, Brian Gallagher, Bill Brown, Damon Ostrander, Bob Beardsley, John Oss, Mike McKinner, Iver Igelsrud, Al Wudell, Bob Christian and Dave Willett. In addition, the following principal investigators were significant contributors to the high score: Gerald Johnson, Sam Dominick, Joe Martin, Steve Price and Jim Lowrie.

Space Launch Systems continues tradition

Space Launch Systems said goodbye to one era in 1989 and proudly introduced a new one.

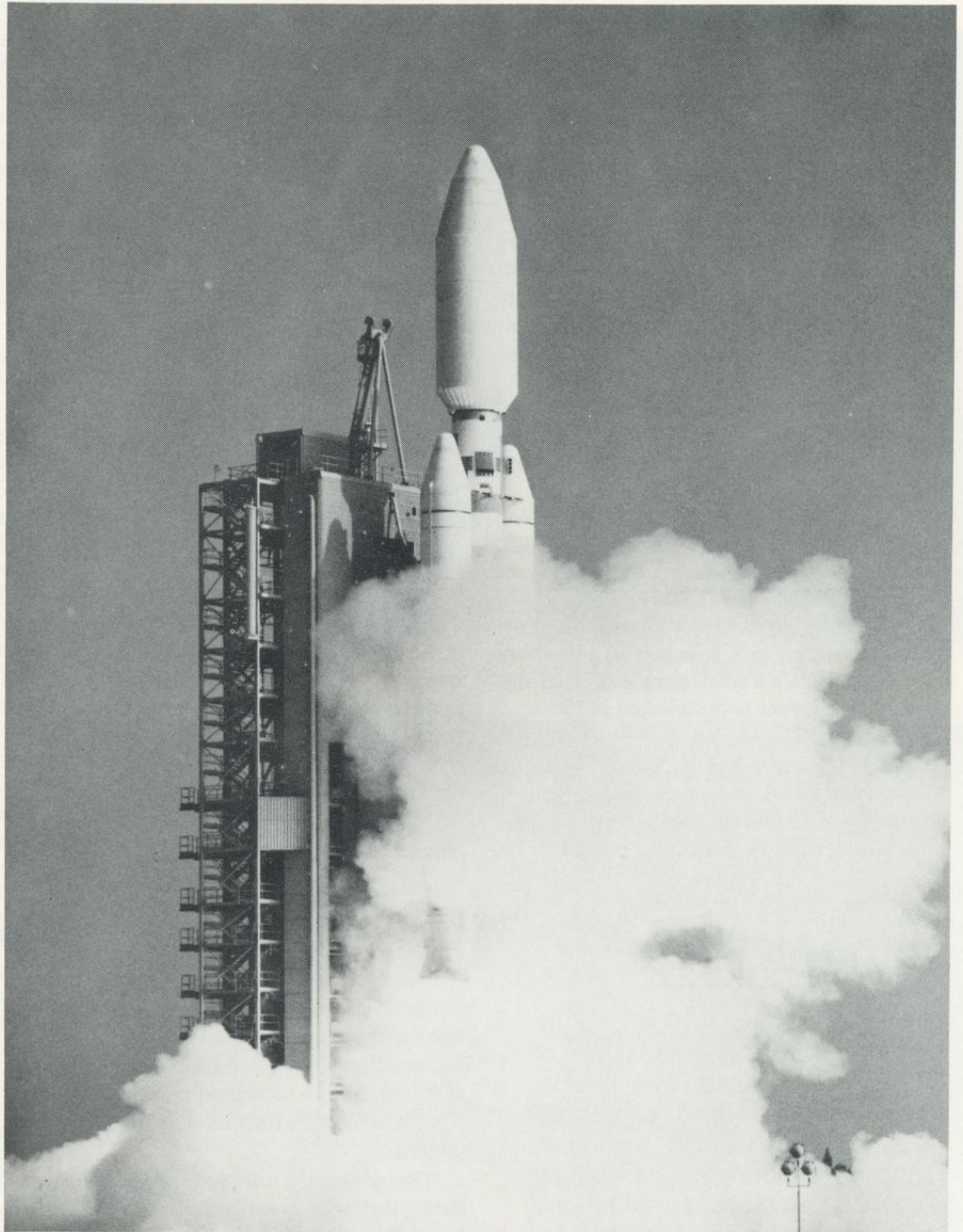
The maiden flight of the Titan IV space launch vehicle on June 14 assured the Air Force will have access to space for critical national security payloads well into the 1990s. Moreover, the Air Force affirmed its commitment to the Titan IV program by awarding Space Launch Systems a \$1.6 billion contract extension for 18 additional Titan IVs, with options for up to eight more, through 1995. The contract brought to 41 the number of Titan IVs on order.

Meanwhile, the Titan 34D era came to end on Sept. 4 with its successful final launch from Cape Canaveral Air Force Station, Fla. Titan 34D, a version of the Titan III used by the Air Force and NASA for 25 years, has a 96 percent success record in 141 launches.

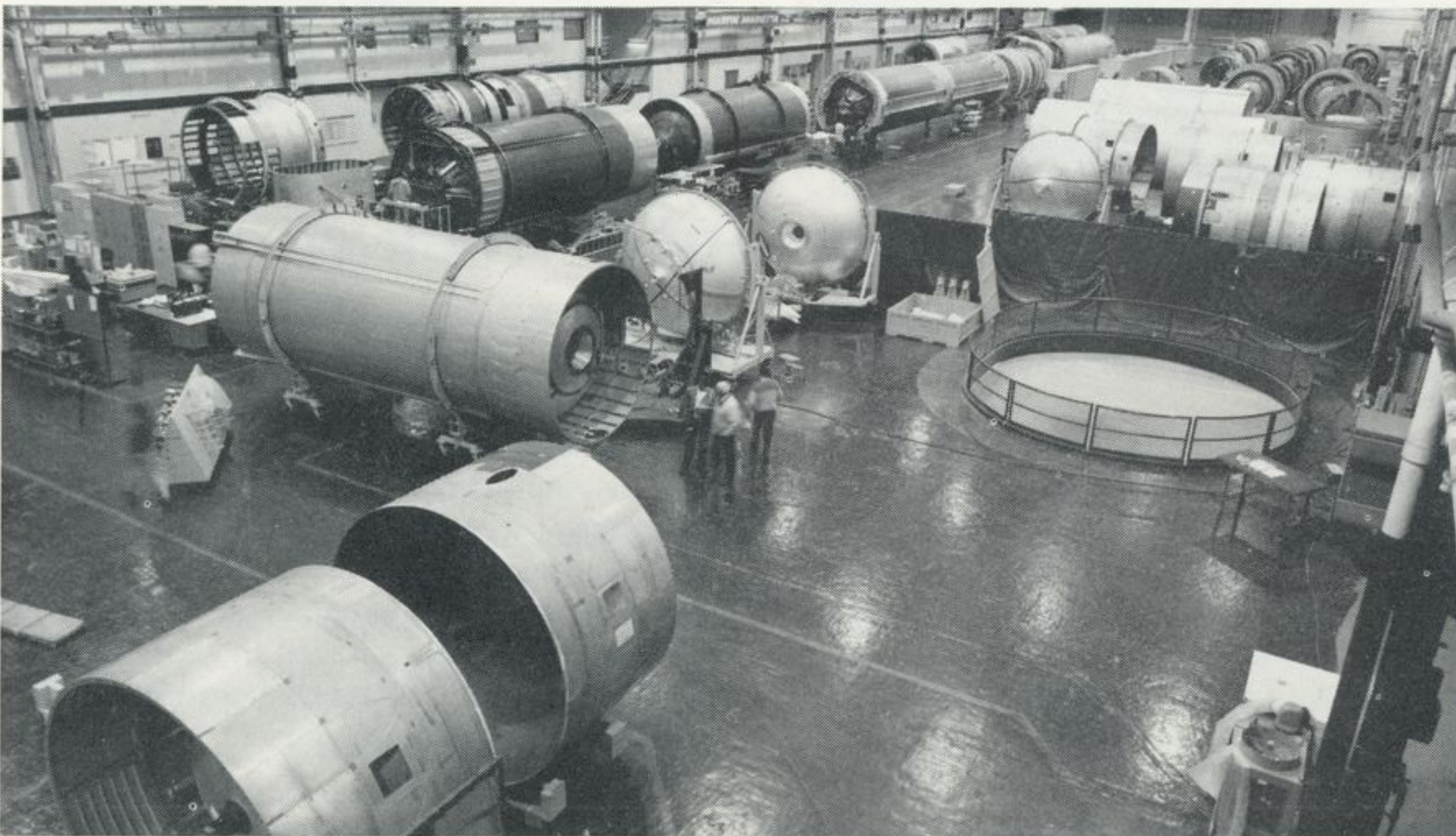
Titan II recorded its second successful launch from Vandenberg Air Force Base, Calif., on Sept. 5. The company has an Air Force contract to refurbish and launch 14 Titan IIs that have been decommissioned as ICBMs. Also, Space Launch Systems is developing an enhanced version of the Titan II to support Department of Defense and Department of Commerce missions. With solid rocket motors added to increase the payload capability, the Titan II was chosen by the Strategic Defense Initiative Organization to launch an SDI experiment in 1992. The experiment is designed to collect target detection and tracking data.

Space Launch Systems also was awarded a \$372.5 million add-on to its Titan IV contract for payload integration work involving classified payloads on Titan IV. Work will be performed at Vandenberg and the Cape.

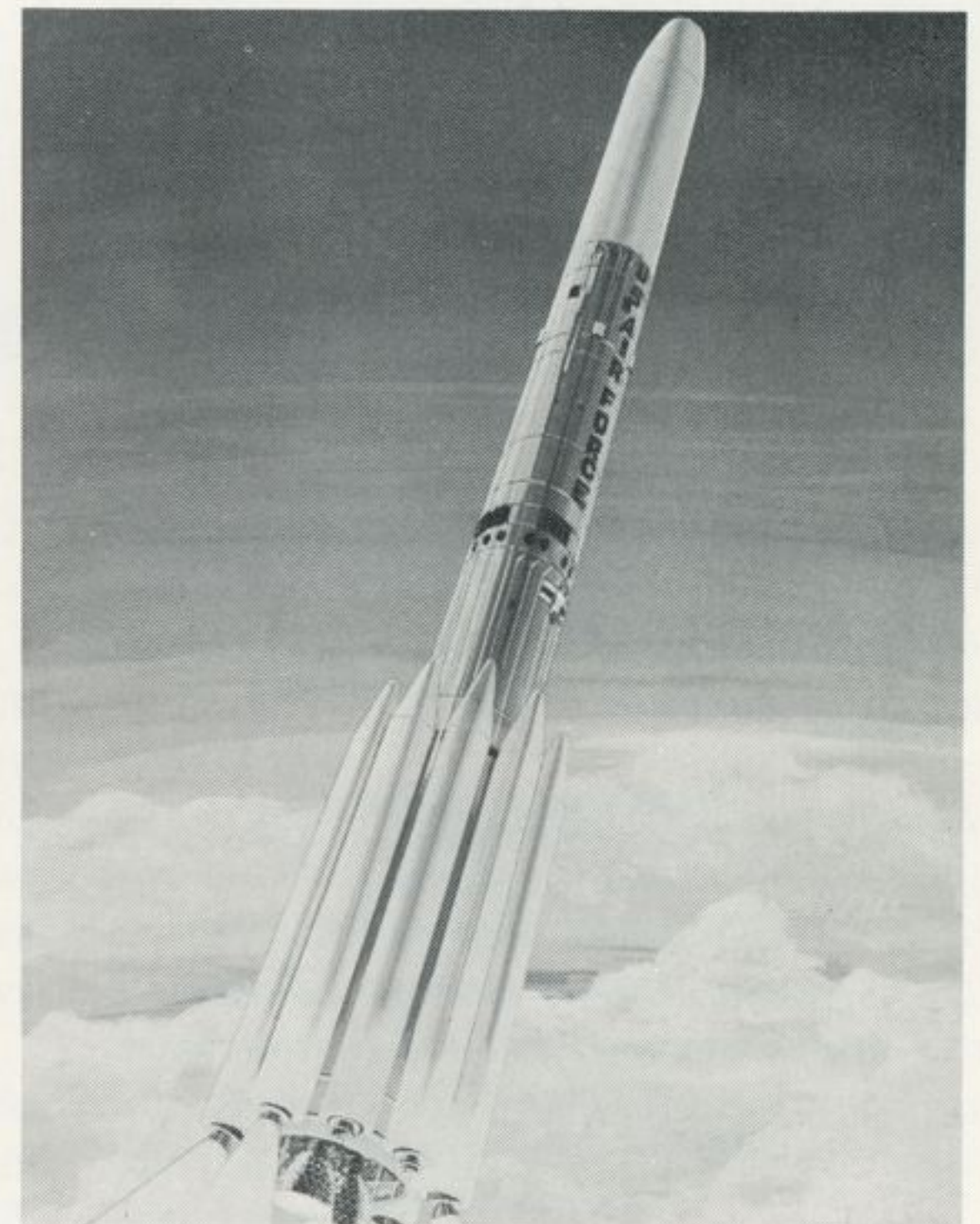
To facilitate more Titan launches, modification and buildup of the Titan IV infrastructure on both coasts continued in 1989. The first Titan IV pad was activated at Cape Canaveral, work progressed at Vandenberg on a launch pad and associated facilities to allow the Titan IV to be launched from the West Coast, and Space Launch Systems was awarded a contract to modify a second pad at the Cape so that Titan IV and Commercial Titan can both be launched from that location.



Titan IV



Titan Factory



Titan II MSX

Strategic Systems completes solid year

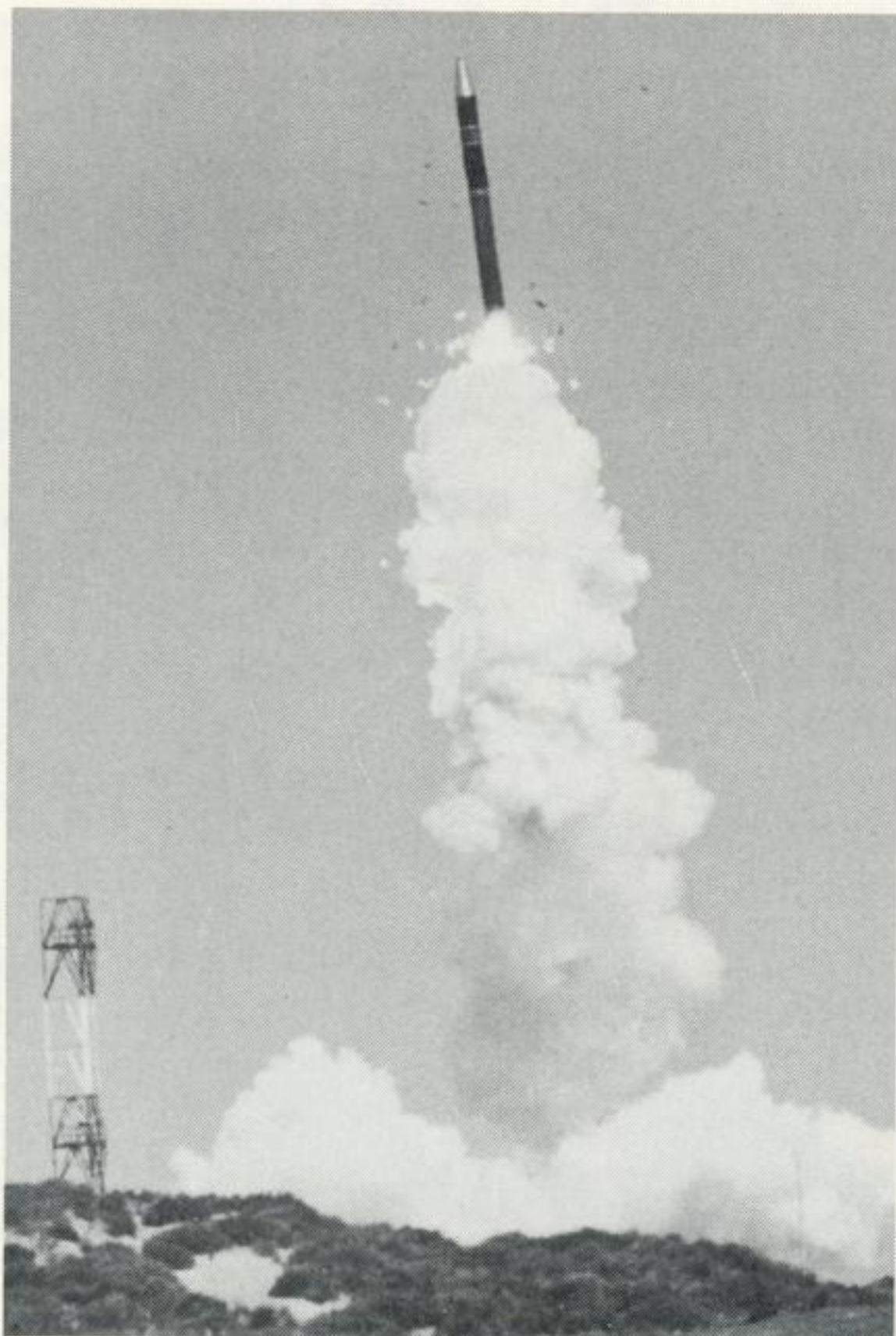
Strategic Systems continued its key role in the Peacekeeper and Small ICBM programs, and progressed in many other areas this year.

For Peacekeeper, the company—the assembly, test and system support contractor for the program—continued flight tests through the last development launch in March, when the Strategic Air Command took over operational testing. During the year, Peacekeeper was flight tested twice, with the flight test record standing at 18 successes in 19 flights.

Strategic Systems has a similar assembly, test, and system support role for the Small ICBM, which had its first flight test on May 11 from Vandenberg Air Force Base, Calif. The Air Force said the test achieved 80-85 percent of the mission objectives before a performance anomaly occurred.

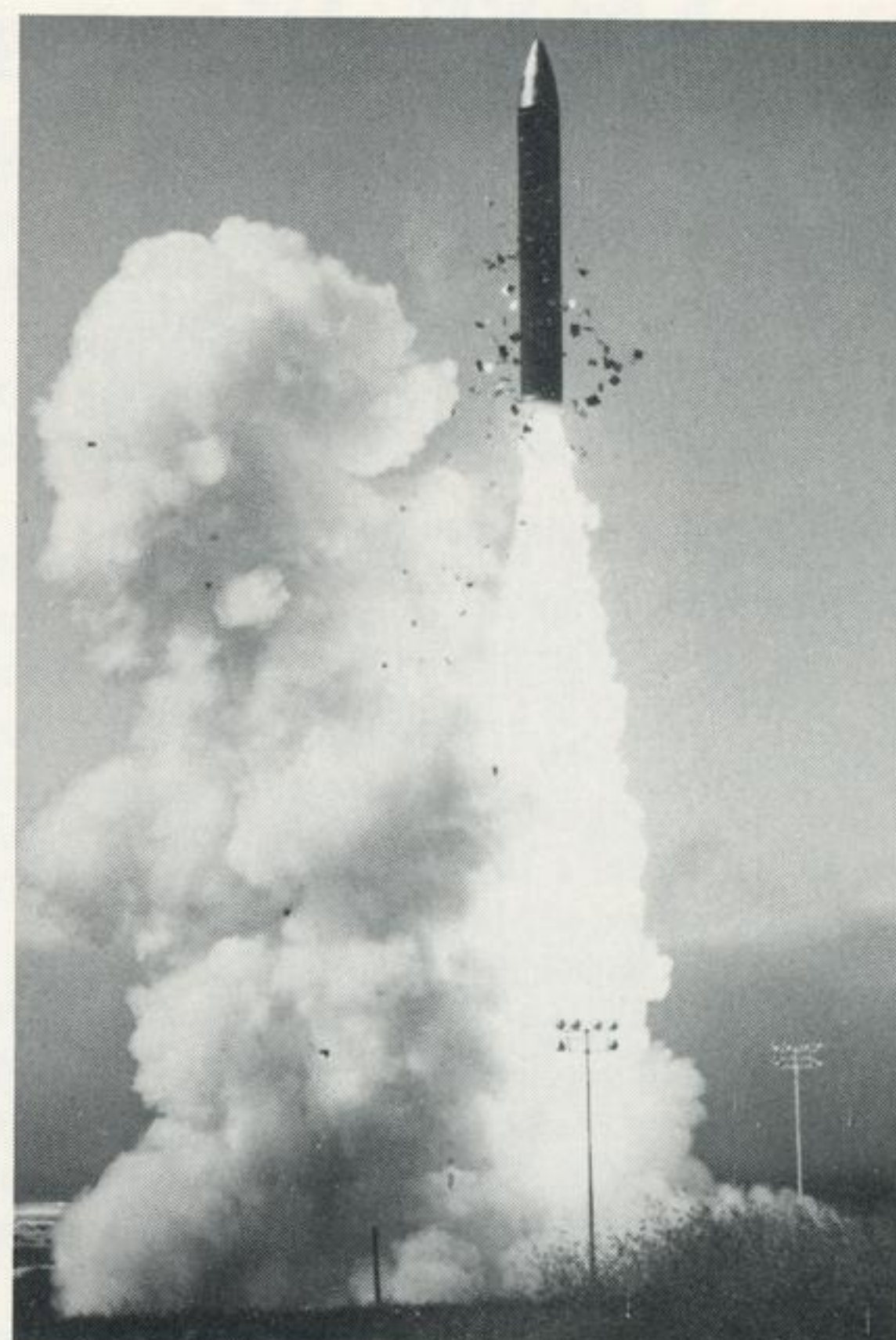
For Small ICBM, Strategic Systems also designed and builds the postboost vehicle, its shroud, and the instrumentation and range safety system. During 1989, the company delivered three postboost vehicles and shrouds and two instrumentation and range safety systems.

In addition to its roles on Peacekeeper and Small ICBM, the company is developing or studying upper stages and advanced propulsion systems for use with existing launch systems. Under a contract to Orbital Sciences Corp., Strategic Systems is developing the Transfer Orbit Stage—an expendable upper stage that



Small ICBM

will be used with the Commercial Titan to boost the Mars Observer into an interplanetary trajectory in September 1992. The company has a contract for two of the upper stages. The first TOS is scheduled to launch the Advanced Communication Technology Satellite (ACTS) in May 1992.



Peacekeeper

The company also won a three-year, competitive NASA contract for initial design of a Space Transfer Vehicle, a reusable rocket system scheduled for operation in the 1990s. The system would be used to support both manned and unmanned exploration of the Moon or planets such as Mars. ■

Commercial Titan, Inc., gains Mars Observer contract in 1989

Highlights of 1989 for Commercial Titan, Inc., included preparations for the first launch, scheduled next week, and winning a contract to launch the Mars Observer.

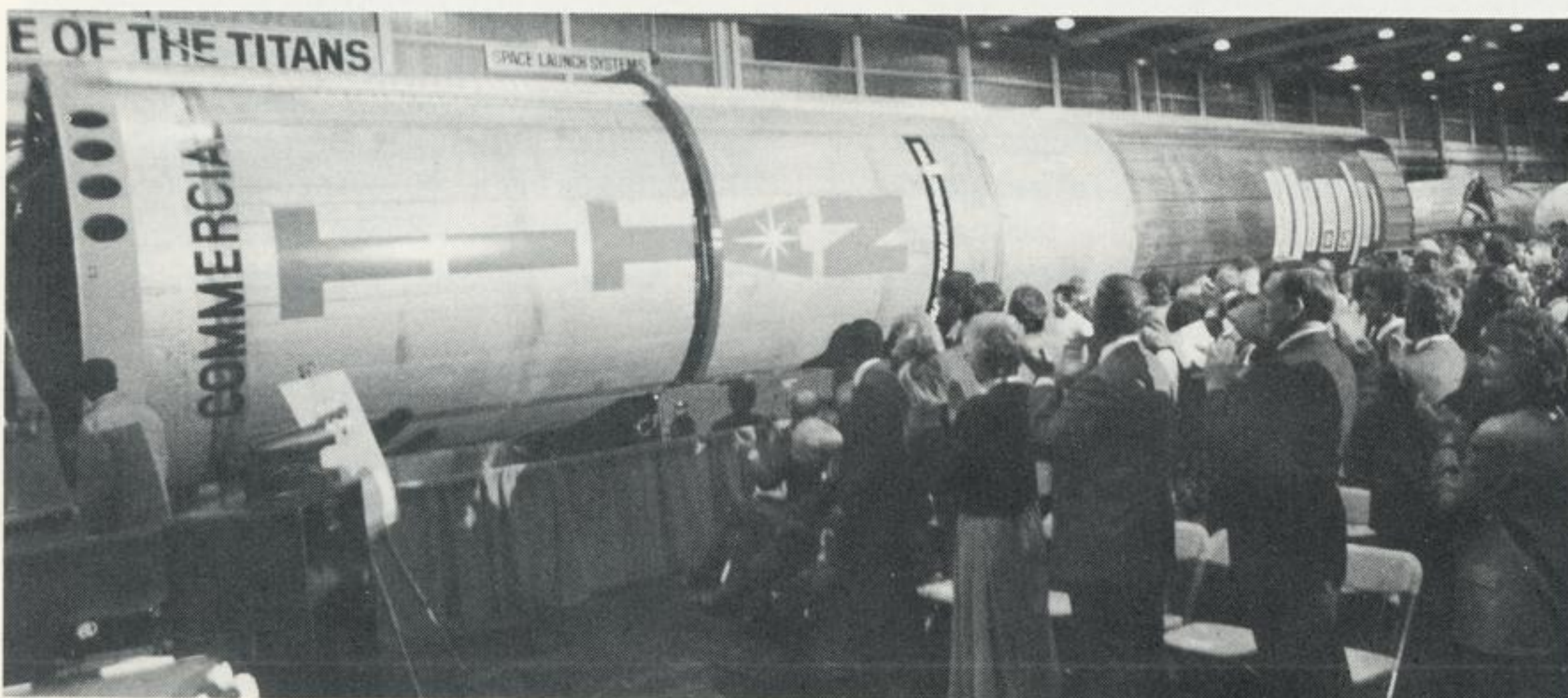
Last month, the company signed a contract with the National Aeronautics and Space Administration to launch the Mars Observer spacecraft on a Commercial Titan booster in September 1992. The contract brings to five the number of satellites or spacecraft scheduled for launch on Commercial Titans.

The Mars Observer, to be launched from Cape Canaveral, Fla., will orbit the planet, measure its surrounding atmospheric and magnetic environments, and transmit the data to Earth for analysis.

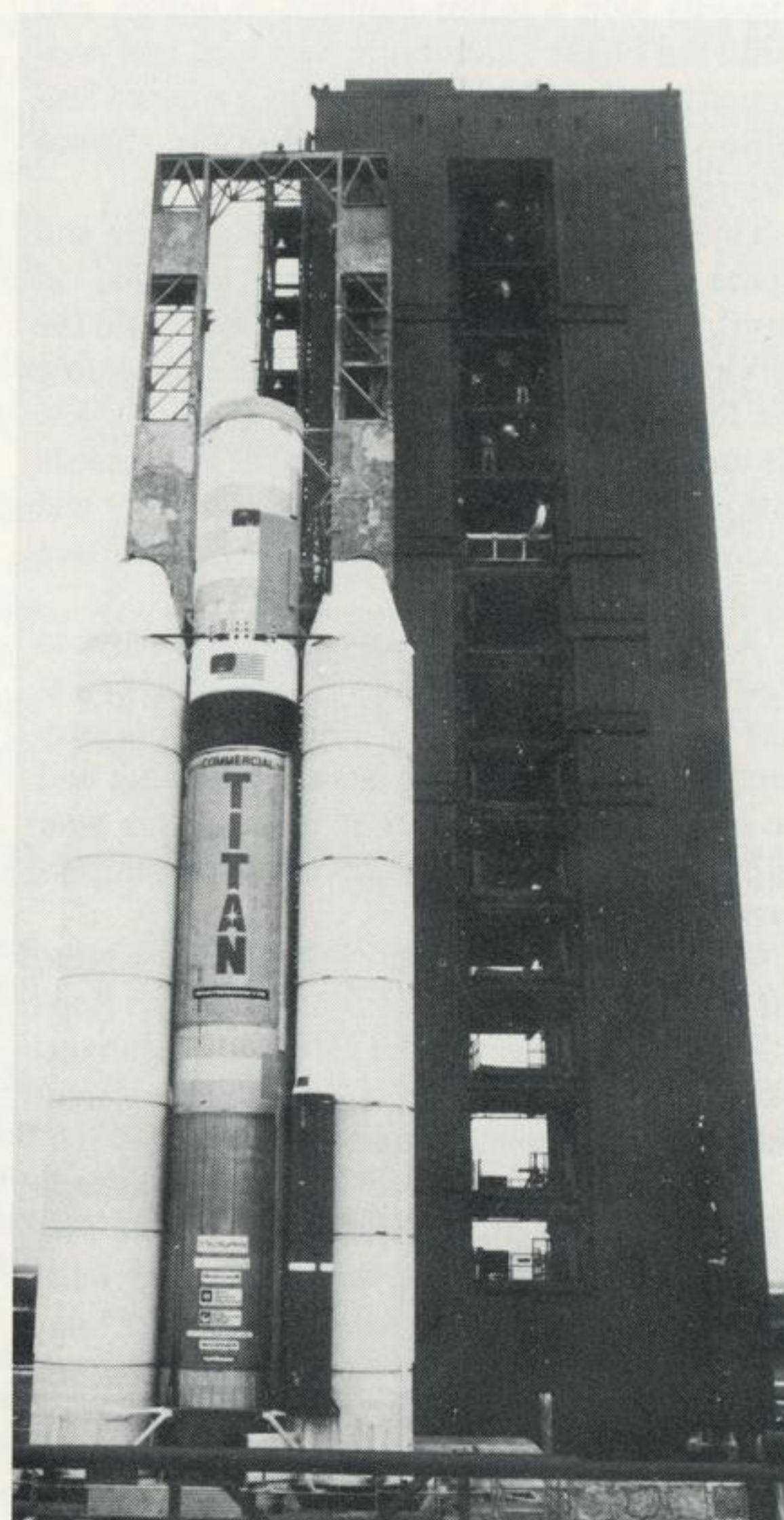
On board the first Commercial Titan will be the Skynet 4A for the United Kingdom Ministry of Defence, and the JCSAT 2 for the Japan Communications Satellite Co. The company also has contracts for the launch of two INTELSAT VI communications satellites for the International Telecommunications Satellite Organization in the first half of next year.

Commercial Titan is the first U.S. launch vehicle with major European subcontractors. Contraves AG of Switzerland manufactures the payload fairing, while Dornier GmbH of West Germany provides the extension module.

The Commercial Titan, a derivative of the reliable Titan III, can place up to 32,500 pounds into low-Earth orbit. It is produced, integrated and launched by Martin Marietta. ■



Commercial Titan rollout



Commercial Titan

Space Systems helps America explore the solar system, SDI

The Magellan spacecraft, built by Space Systems, was sent on its 795-million-mile journey to Venus on May 4.

In August, the Voyager spacecraft passed within 3,000 miles of Neptune after cruising by Jupiter in 1979, Saturn in 1981, and Uranus in 1986.

And on Oct. 18, the Galileo spacecraft was boosted toward Jupiter.

These three examples show how Space Systems contributed to a banner year for planetary exploration in 1989.

Magellan represented America's return to exploration after a 10-year absence. Currently more than a third of Magellan's journey is complete, as the spacecraft is scheduled to reach Venus next August. Magellan will map the planet with a sophisticated radar capable of penetrating the planet's perpetual cloud cover.

For Galileo, Space Systems built the attitude and articulation control system electronics and three of the six instruments on board its probe—a section of the spacecraft that will be released into Jupiter's atmosphere to study its composition and properties. Galileo's 2.5-billion-mile journey will take more than six years to complete.

A 12-year-old guidance system, elements of which were built in Denver, steered the Voyager spacecraft through its grand tour of the planets, culminating with this year's pass by Neptune. Voyager also benefited from a propellant control system and radio astronomy receiver built by Martin Marietta.

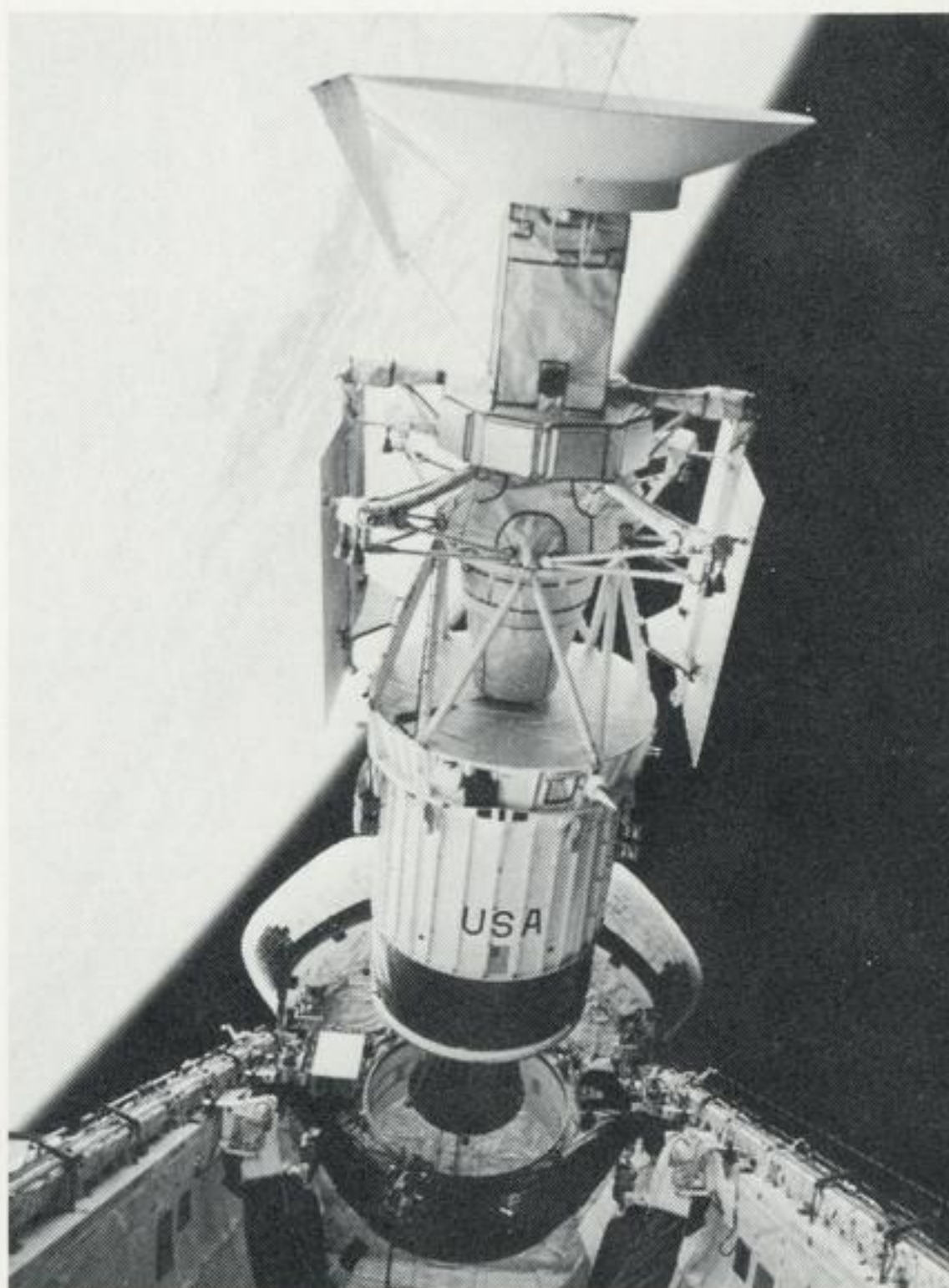
In addition to work completed in 1989, Space Systems won a major contract to design and build the Flight Telerobotic Servicer, and continued its role in Mars studies, the Tethered Satellite program, and the Hubble Space Telescope.

Under a nine-year National Aeronautics and Space Administration contract, awarded in April, Space Systems will design and build the servicer—a space robot that will help assemble the Space Station Freedom in the mid-1990s. As envisioned by NASA, the robot will enable astronauts to accomplish routine assembly and maintenance work without leaving the Space Shuttle or Space Station.

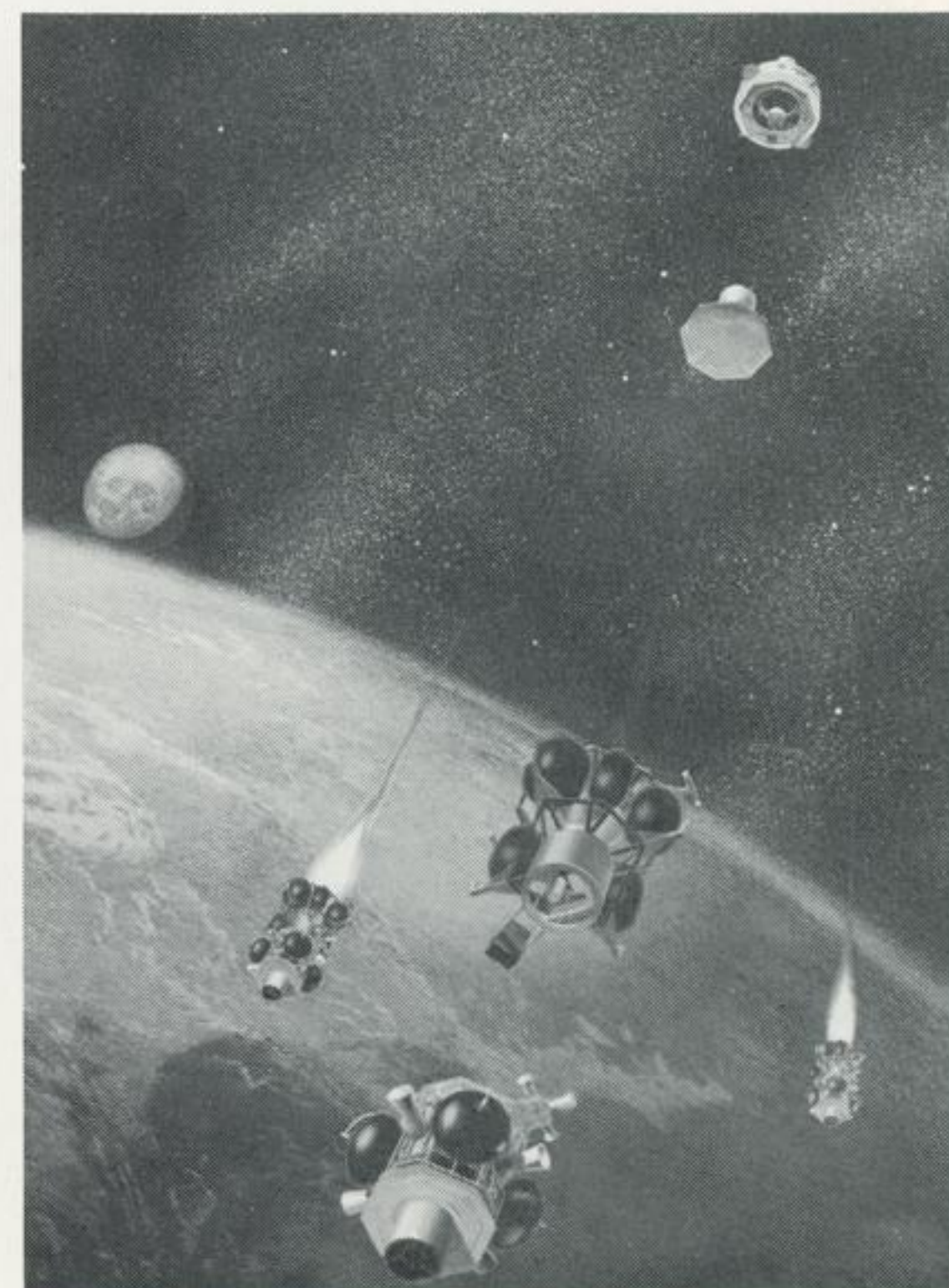
Also for NASA, Space Systems continues to study concepts for the Mars Rover/Sample Return mission, planned for 1998. The company has proposed a "walking beam" robot that will be landed on Mars where it will spend a year collecting and analyzing soil and rock samples to return to Earth.

The Tethered Satellite system is scheduled for launch in 1991. Space Systems is developing flight hardware for the satellite's deployer, including the tether, reel, reel mechanism, boom, and boom deployment.

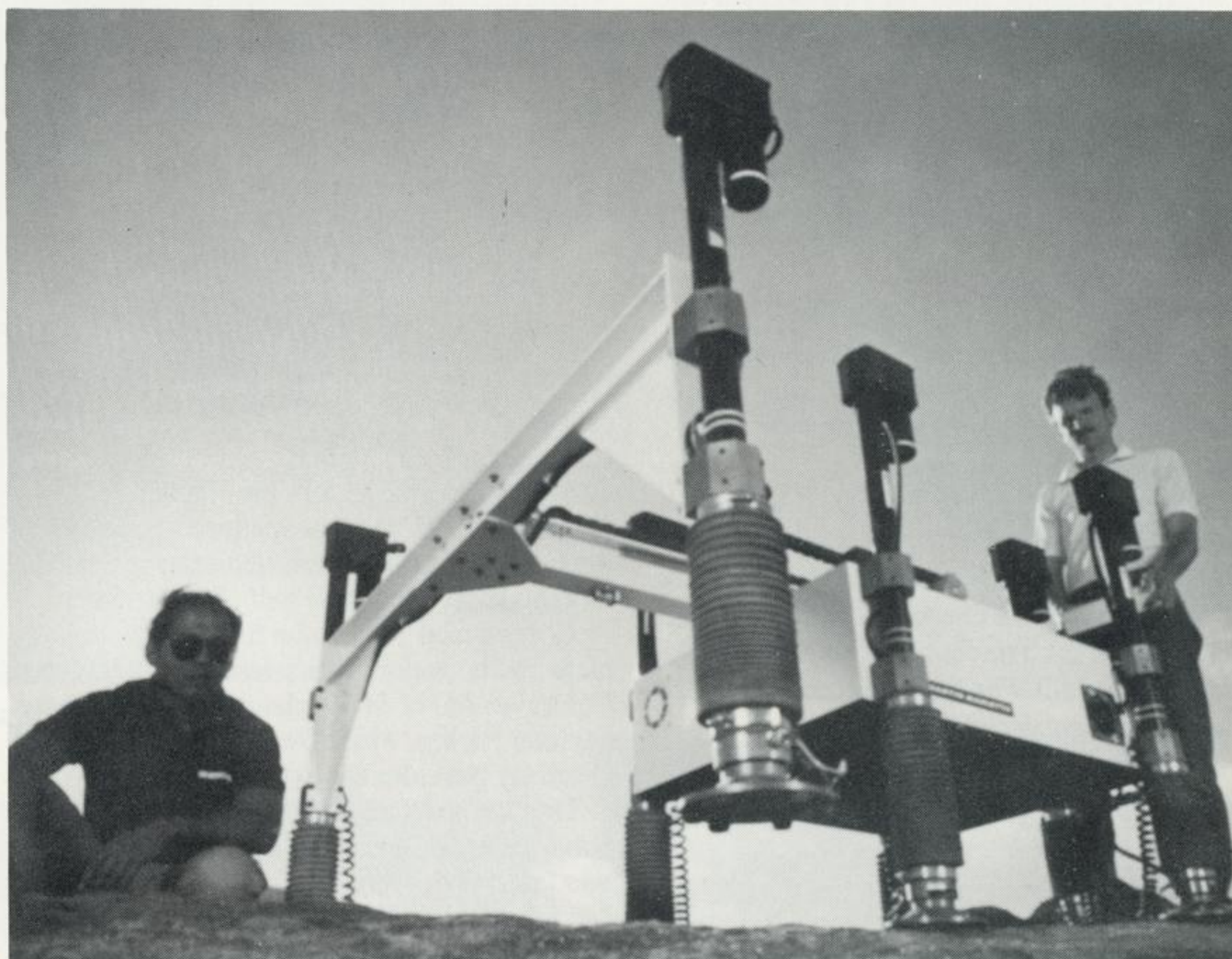
Early next year, the Hubble Space Telescope will be launched on the Space Shuttle. For that mission, Space Systems developed and built one of five major instruments aboard the telescope—the Faint Object Spectrograph, an instrument able to detect sources 50 to 100 times fainter than can currently be seen by the most powerful Earth-based telescope.



Magellan



Space-Based Interceptor



Mars Walking Beam Model

Space Systems research programs for the Strategic Defense Initiative also progressed in 1989.

In May, the company won a contract for preliminary design of a solar power system that can withstand both natural and man-made hazards in space. The Survivable Power Subsystem (SUPER) will use mirrors to deflect lasers, and special coating and materials to protect the system from space debris and projectiles.

Space-Based Interceptor technology, under study by Space Systems and the Electronics and Missiles Group in Orlando, was successfully

demonstrated in two key tests during the year. The company has a two-year contract to explore the use of the Space-Based Interceptors to destroy hostile ballistic missiles by force of impact.

Design work continued on Zenith Star, the space-based laser experiment that is studying the use of lasers in strategic defense. And in the Rapid Retargeting and Precision Pointing Laboratory, simulator experiments contributed to significant improvements in control strategies and faster retargeting times for directed energy systems. ■

Astronautics Group takes first step with TQM

An ancient proverb says that even the longest journey must begin with the first step, and 1989 was the year of the first step on the journey to continuous improvement for the Astronautics Group.

The Astronautics Group adopted Total Quality Management (TQM) as a way of life in 1989. TQM is "a philosophy and a strategy for continuously improving performance at every level and in all areas of responsibility," according to a Corporate policy statement issued in May. Peter B. Teets, Astronautics Group president, says TQM is simply "quality in everything we do."

Even as the Astronautics Group was busy preparing a formal Group-level TQM plan, High-Performance Work Team (HPWT) training got underway.

The first group to undergo HPWT training was from the wire line in the factory. Since then, some 5,500 Astronautics Group employees have gone through HPWT training.

By empowering employees to make key decisions about their jobs, tremendous gains have been made. Here's a small sample of what empowered employees accomplished in 1989:

- The Space Systems tank fabrication HPWT in SSB, which builds propulsion tanks for the space shuttle, has turned a projected behind-schedule build into on-schedule, on-cost performance, with no sacrifice in quality;

- The boattail HPWT in the commodities shop in Space Launch Systems has cut the actual hours required to build a Titan IV boattail assembly from 2,500 hours to just 600;
- The major weld High-Performance Work Team in Space Launch Systems recently produced its first zero-defect tank dome;
- A white-collar High-Performance Work Team in Strategic Systems Finance reduced non-value-added work in their contract status report cycle from 2,000 hours a quarter to 750 hours. Most of the eliminated time was overtime, so they improved the quality of their work life as well their company's financial performance;
- Two HPWTs in the Payroll Department improved their processes and their productivity. They're using statistical process control techniques to control their processes and have reduced their overtime by seven percent and reduced reporting errors as well.

Another key to continuous performance improvement is training. Technology Training, which is responsible for training in TQM-related subjects, provided 125,000 contact hours of TQM-related training in 1989. More training is planned for 1990, including a TQM Concepts course that will anchor the TQM curriculum and is slated to be introduced in the first quarter.

Under the TQM banner, the company moved toward full implementation of Manufacturing Resource Planning (MRP II) in 1989. This initiative—the lead TQM technical initiative—is a structured approach to planning and monitoring all the resources of a manufacturing organization.

Progress also was made in concurrent engineering, another major element of TQM. The practices of holding tabletop reviews of engineering products before their release and of working in design teams were strengthened. As a result, liaison calls have been reduced by half over the past two years—and by a factor of 10 in some programs.

The major TQM event of the year was the First National TQM Symposium, which was held in Denver in November. This event won widespread admiration for the Astronautics Group throughout the aerospace industry. More than 850 people came to the symposium, making it the largest first-of-a-kind event ever sponsored by the American Institute of Aeronautics and Astronautics and the largest event ever held at Denver's Hyatt Regency.

As 1990 approaches, every organization has for the second year formalized its improvement plans through the Annual Performance Improvement Program (APIP). The APIP is a one-year "slice" of multiyear TQM plans and is helping people define their next steps along the path of continuous improvement. ■

On the cover

The past year's highlights include the implementation of High-Performance Work Teams, top right; the most successful Family Open House ever, left; and a gathering of more than 22,000 employees and their families at Mile High Stadium for a summer's evening Denver Zephyrs game, bottom right. During 1989, 5,500 employees went through High-Performance Work Team training. The Aug. 5 open house saw more than 30,000 people visit Astronautics Group facilities, and the Denver Zephyrs family event continued to be one of the most popular happenings of the year.

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ALS gets 'world class' review in 1989

In a major technical review of the Advanced Launch System (ALS) conducted at year end in Denver by the ALS Joint Program Office, the Astronautics Group's ALS program received rave reviews in a number of areas, according to Richard W. VandeKoppel, director of the ALS program.

"One of these is a systems engineering database that was described as 'world class,'" VandeKoppel said.

Progress in the information systems area also was cited as outstanding, VandeKoppel said, as was the program's insertion of the results of the technology work into the ALS system design.

A major part of the ALS program has been development of technologies that would benefit

not only an all-new launch system but existing launch systems as well.

"We have selected several technologies developed under the ALS program to investigate for possible transfer to Titan programs," said Andrew J. Stofan, vice president of Technical Operations.

Some technology areas being investigated include, avionics, paperless management, and mission analysis simplification.

Meanwhile, also at year end, the Air Force announced that it will terminate the design engineering part of the Advanced Launch System program and rescope the technology contracts.

Termination of design engineering elements of the program is set to happen by March 1, 1990. ■

Facilities, environmental work continue

During the past year, the Astronautics Group expanded existing facilities and built several new ones.

For example, the Integrated Robotics Facility opened its doors this year to house work for the Flight Telerobotic Servicer contract. Also, the pedestrian tunnel at the Deer Creek Facility was opened, and the Reverberant Acoustic Laboratory underwent a facelift.

Additionally, construction began at Waterton on the Advanced Test Bed, a 90,000-square-foot facility featuring a 5,000-square-foot high bay, and a 5,000-square-foot terraced presentation room.

To help treat water discharged from Waterton facilities, the second phase of the Wastewater Treatment Plant went into effect this year, and the Final Polishing Building began operating. That building can treat one million gallons of wastewater per day.

Also, an aggressive waste minimization program continues in Environmental Management with an anticipated reduction in waste generation of 42 percent from levels recorded in 1987. That equates to a cost savings of \$676,000 for operations at Waterton. ■