





# President reviews 1980, looks ahead to 1981

Denver Aerospace President C. B. Hurtt in reviewing 1980 and looking ahead to 1981, had these comments:

We are ending 1980 having achieved the best year ever in the nearly 25-year history of Denver Aerospace. We are performing on more than 440 contracts, and we are performing well. We have completed another year with 100 percent mission success. Our sales, our orders, and our backlog are at historic highs.

In the past 12 months some 3000 men and women have joined our ranks and are rapidly assimilating the traits that make us an effective producer of important systems for the space and defense needs of the United States.

During 1980, we reorganized Denver Aerospace into four divisions to provide yet sharper focus on meeting our commitments to our many customers and to continue as a strong, aggressive force in the market place.

As we face 1981 and the decade of the '80s, our backlog is strong; programs such as Titan, Space Shuttle, MX, and various space systems provide assurance of a vigorous business environment. In excess of 80 percent of our five-year forecast is comprised of firm and follow-on business.

To keep pace with our business growth, more than \$26 million was allocated for improved facilities and equipment in 1980. Millions more will be committed next year to add new

laboratories, equipment, work space, and service facilities to accommodate further growth.

Our success in the past few years is the result of determined effort by our great team—all of our employees!

Your great dedication to mission success, your open communication, in-house and with our customers, and your aggressiveness in the market place breeds that kind of success.

This, of course, becomes our challenge for the '80s: to maintain our tremendous team effort; to continue to achieve 100 percent mission success in all areas; and, to win those significant new programs that are so important to a long-term, stable future.

## *Industrial relations busy hiring, maintaining employees' services*

"While we in professional and industrial relations felt we were spending all our time recruiting employees to keep pace with 1980 growth, in retrospect we have been able to maintain the service that makes Denver Aerospace a good place to work for all employees," said R. E. Burnett, professional and industrial relations director.

In 1980, more than 3000 people were added at Denver Aerospace. More than 40 percent of the professional employees were hired through the employee referral program.

"We believe the employees we have can help us find the good people we need to help us continue our growth in 1981," Burnett said.

More than one-third of the employees made recommendations through the referral program, according to the company-wide survey conducted in mid-1980.

The survey was a major undertaking to determine employee attitudes on a wide range of subjects. More than 7200 employees expressed their views on their jobs, supervisors, services, communication, facilities, and other functions that affect their work lives.

"As we reported in the special issue of Martin Marietta News," Burnett said, "we plan a number of steps to correct problems identified in the survey. We expect that our action will make this an even better place to work."

Efforts were made throughout the year

to increase communication with employees on the company, services, and benefits.

Meetings were held with all salaried employees to explain benefit improvements and a new booklet was distributed providing a brief look at the wide range of benefits.

Quarterly updates were also provided by the corporation on the performance sharing plan.

Among the accomplishments in 1980 to improve working conditions, several were in the area of personnel safety.

The lost-time injury rate, one of the key safety measurements, was reduced and safety goals were exceeded at all locations. The most significant improvement was achieved at Michoud.

At Denver, a computerized program to improve control of hazardous materials to assure compliance with existing and pending requirements, will be operational by January 1981. The system is being reviewed for use throughout Aerospace and possibly the Martin Marietta Corporation.

"Two other accomplishments deserve mentioning," Burnett said. "We achieved all the major goals in our affirmative action plans. And, for the second year, we surpassed the aerospace industry average in retaining employees. In 1980, at Denver for example, the attrition rate was 7.2 per 100, compared with an industry rate of 14.8 per 100. This is a tribute to the loyalty of our employees," he said.

## **Facilities, services added for employees**

More than \$26 million was earmarked in 1980 for additional and improved facilities and services for Denver Aerospace employees. In 1981, \$36 million has been committed for further additions and improvements.

Among major projects are a high-bay test area to be added to the new space systems building at a cost of \$5.7 million. The other major building project is a doubling of the size of the electronics manufacturing facility to accommodate the projected manufacturing increase. Cost: \$4.5 million.

Employee needs are being addressed in several ways: cafeterias in the engineering building and the SSB are being enlarged and modernized at a cost of \$1.3 million; new office furniture valued at about \$2 million will be added during 1981; and complete reproduction centers will be established at major offsite locations.

An extensive modernization also has been approved for the factory. Approximately \$1.3 million will be spent for modern, high-precision metal-working equipment. An environmentally controlled area will be created for this equipment and for all numerically-controlled operations.

Conversion of the plasma arc facility to a mechanisms laboratory also will generally upgrade the building for use in the '80s.

This year, construction was begun on two additions that will be opened early in 1981—the 142,000-square-foot addi-

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# Space launch systems benefits from mission success orientation

"We are now seeing the results of being a high-performing, mission success-oriented organization," said C. E. Carnahan, vice president and general manager of the space launch systems division. "For the most part, our new business in 1980 was in follow-on contracts or in expansion of current contracts. New business prospects in 1981 are based primarily on work already under way," he said.

In 1980 there were new sales of Titan launch vehicles; new consolidated launch services contracts; the payload integration contract was expanded; the liquid boost module work moved into a new phase; and the ground support system contract was realigned to a new operational date.

All Titan launches were successful in 1980 and the newest member of the Titan family—the 34D—was delivered to Florida on time and at a cost agreed to with the Air Force in 1977.

"Being able to add to our Shuttle-related contracts while continuing our Titan successes was probably our most significant 1980 accomplishment," said Carnahan.

Despite these successes, Carnahan believes "no reasonable manager can be without a concern for the future."

His concerns are, "that we continue to do our work competently and that we focus in 1981 on those things that will produce results in the mid-1980s so that we can provide consistent growth and secure and stable employment for all the very fine people we have."

Among the business areas in which space launch systems will focus in 1981 are the Titan 34D, other members of the Titan family, ground support systems, and the liquid boost module.

The 34D is scheduled to be flown for the first time in 1981.

At Vandenberg, a major shift in em-

phasis and new contracting is expected in the ground support system as the system moves to the integration and checkout phase.

A decision is expected by NASA on the performance augmentation for Space Shuttle. The liquid boost module proposed by Denver Aerospace is a contender.

Carnahan believes the future of Titan as an expendable launch system to complement Space Shuttle will become clear in 1981. "There is a growing contention," Carnahan said, "that there will be a need for an expendable launch system into the 1990s. Titan is a top contender for that role. We intend to be involved in both the expendable and reusable systems."

In 1981, space launch systems will be studying the need for, and the use of, upper stages or orbital transfer vehicles for Space Shuttle beyond current plans.

Also under study in 1981 will be Denver Aerospace's role in the combined space operations center to be built in Colorado Springs.

"We will also be preparing ourselves for a place in the Space Shuttle payload operations center in Florida," Carnahan said.

To accomplish the work that must be done in 1981 and the planning for new business, Carnahan sees a moderate increase in employment in Denver and an addition of 700 to 800 employees at Vandenberg.

The challenge of 1981, according to Carnahan, will be to continue to perform all our work very competently and to do solid strategic planning for the division's future.

"It is a challenge we can meet," Carnahan said. "We have a solid organization, many fine people, and real momentum; 1981 should be our best year ever."

## Strategic systems MX role is growing

"If there is a single word that characterizes both the past year and the forthcoming year for the strategic systems division, that word is 'growth,'" said Howard F. Keyser, vice president and general manager of strategic systems.

Full-scale engineering development of the nation's new, mobile ICBM sys-

tem—Missile X—was authorized in the fall of 1979, beginning a rapid expansion of Denver Aerospace responsibilities. The strategic systems division was formed in September 1980 largely as a result of the growth needed to meet MX project demands.

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The newest Titan family member—the 34D—rolls out of the factory on its way to Florida for check out and its first flight.

## Facilities

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tion to the Denver systems center and the 72,000-square-foot SSB addition.

Completed during the year was a major addition to the administration building and the expansion of the attitude control system laboratory.

A pedestrian bridge, connecting the upper SSB parking lot to the SSB fourth floor, was completed, making the lot more convenient for employees.

Also completed was a recreation area building, housing shower and changing room facilities for men and women athletes.

To aid proposal efforts and preparation of contract reports, three word processing centers have been opened with 120 keyboard terminals. Optical character readers have been added that also provide input for the new phototypesetting equipment installed in editorial services.

Significant changes were made to local telephone equipment at several Denver facilities, providing employees with such improved features as call forwarding, call holding, call waiting, and automatic call back—all without operator assistance.

The telephone improvements here will be teamed with a new communications network to be installed in 1981 by the Martin Marietta Corporation for its locations.

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## Strategic systems

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"Forming the division focused more management talent on the specific needs and goals of the MX project," Keyser said. "It also provides employees opportunities for promotion and assures management responsiveness to the MX program as it grows."

The largest expansion of MX responsibilities in 1980 came with the acquisition of a \$87.2 million contract to cover launcher development through June 1981. It is in addition to the ongoing assembly, test, and system support work. "Launcher production may evolve over five years into the largest single task Denver Aerospace has ever had," Keyser said.

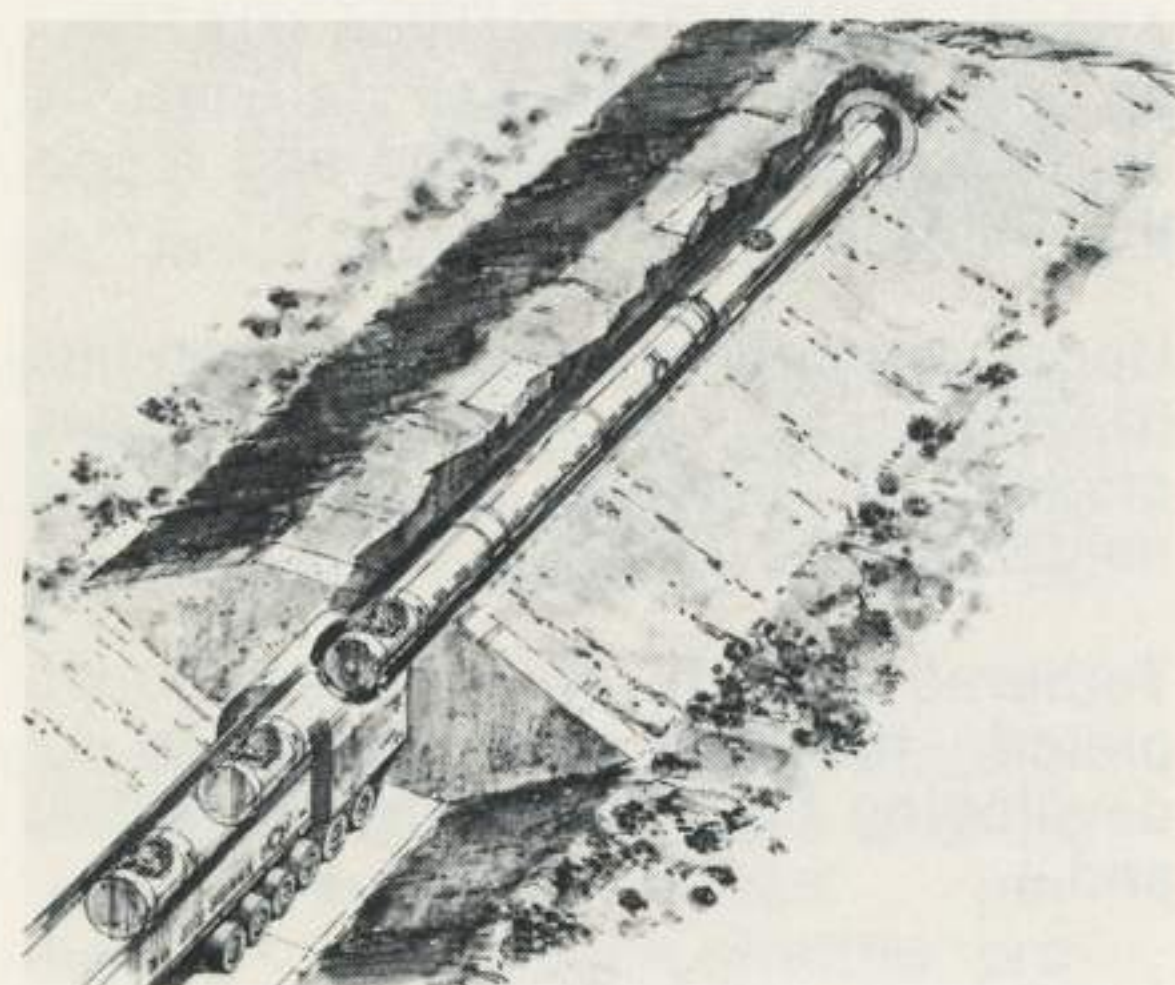
Another 1980 achievement was the completion of the system design review with engineering support from Denver Aerospace.

Among the milestones achieved during the year were the start of production of equipment for transporting and handling of missile components; bread-board development of instrumentation of test missiles and the flight safety system; and the start of test facilities construction at Vandenberg Air Force Base, the site for the MX test flight program scheduled to begin in 1983.

An advanced programs section was established in 1980 under the direction of Donald Gray. His organization will look at variations of ICBM use to possibly augment the mobile basing design for MX.

"The variations may develop into major business opportunities," Keyser said. "Among the things that will be examined are new payloads for MX, the use of MX in Titan silos, retrofitting Minuteman with MX, and providing overall weapon system data for the Department of Defense and the Air Force."

In the first half of 1981, attention will be focused on the initial launcher contract to assure continued work that carries



In this artist's concept, a 155-ft MX launcher is transferred from its transporter into a horizontal shelter.

design and fabrication through full-scale development.

"We also will assess the new administration's impact on the MX system's design," said Keyser. "Although President-elect Ronald Reagan has asserted firm support for MX, he has indicated he might order another look at basing alternatives."

Work on the instrumentation and flight safety system will go from engineering into production in 1981; associate contractors building the missile's solid fuel motors will begin using transportation and handling equipment to move components; and the first of several Vandenberg facilities will be completed.

"One of the greatest management challenges we have faced and will continue to face is the assimilation of hundreds of new employees," Keyser said. "We must train many new people, we must strive to make them feel welcome, and we must instill in them the vital elements of our work culture that ensures mission success."

This year, employment on MX in Denver has grown from 945 to 1700. By

mid-1981, Denver MX employment is expected to be 2400. At Vandenberg, the work force will grow from 53 to more than 400.

"Another major challenge in 1981," said Keyser, "is to hold all the diverse program elements on schedule, and to assure a successful first flight in the first quarter of 1983."

Keyser pointed out, "It is important to recognize that the goals we have set for MX are far broader than company business objectives in that timely development of MX is essential to the future security of the nation and its allies."

"MX is a highly visible project. It will continue to stimulate debate in Congress and elsewhere," Keyser said. "Because of its magnitude and growth aspects, it will be important that strategic systems employees avoid costly additions that are not fundamental to MX operation."

"We must not provide MX opponents with support for their opposition," he said. "The upgrading of the nation's ICBM forces in the face of the Soviet challenge is too important."

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## Technical operations focus is on excellence, productivity

Technical operations expanded and improved laboratories, added 1400 employees, won the largest contract dollar volume ever, and maintained independent research and development (IR&D) evaluations at a high level in 1980.

Two technical operations—developments became major product areas. Solar energy systems became a separate organization and large space structures was transferred to the space and electronics systems division. The faint object spectrograph became a significant contract activity.

"Our technology in 1981 again will be high," said Robert J. Polutchko, technical operations vice president, "but it will require a new emphasis—'better' in addition to 'more.' We will add more new people to help achieve the 'better' in engineering, manufacturing, and quality disciplines."

The expanded Denver Aerospace business base has allowed the IR&D program to be doubled. "It is essential that we continue the performance that earns the high evaluations from government agencies," Polutchko said.

The organization will use a number of techniques to increase the productivity and quality of its operations. Among

them are computer-aided design, computer-aided manufacturing, and computer-aided inspection (CAD/CAM/CAI); advanced manufacturing technology; automated schedule and cost systems; and the expanded use of quality of work life.

"We intent to maintain contractual R&D orders at a constant level and focus on pivotal technologies," said Polutchko.

With the increased product base, one of the major tasks of technical operations will be to provide the technical overview that assures the quality of all products.

"We in technical operations must be aware of what is going on in all areas," Polutchko said. "We are well on our way to a 100 percent increase in the electronic manufacturing facility activity and, with the MX launcher assembly, we anticipate a similar increase in factory services."

While providing the day-to-day support, technical operations will continue to look beyond today's technology to develop the technology of the future.

"We don't know for certain what may be needed or when," said Polutchko, "but we must continue research and

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## Technical operations

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technological development as we see needs. However, we have indentified what we believe are near-term technology needs."

A significant number of new, very competent people have been added to technical operations, bringing with them innovation and creativity.

Organizational changes have required an emphasis on training to help employees perform well in restructured functions.

Among important contracts won in 1980 were gimbal-flex fine pointing; NASA end-to-end data systems; Galileo attitude control system; focal plane array; atmospheric structure instrument; high rate data multiplexer; programmable power processor; orbital telescope assembly baffles for space telescope; software requirements engineering methodology; space systems analyzer; and manufacturing support services for Learjet panels and Cessna trunions.



Denver-produced heliostats at the Barstow Solar One facility flank central receiver construction.

## Solar energy systems becomes new product area in 1980

Creation of the solar energy systems product area has brought a higher level of full-time management attention to solar programs and has made management communication channels shorter and more direct.

"With the growing involvement in solar energy programs, these two changes are certainly beneficial to this business area," said A. E. Hawkins, vice president for solar energy systems.

The product area began 1980 with the award of two contracts and it added three more during the year. Initial 1980 contracts were for the photovoltaic power system for Saudi Arabia and the International Energy Agency small solar power system in Spain. The later contracts included the molten salt storage subsystem research experiment, the cogeneration/industrial process heat study project, and a desalination study contract.

During the year, tooling was fabricated and production was begun on heliostats for the power generation facility at Barstow, CA, and for the concentrator arrays to be used in Saudia Arabia. The world's first molten salt receiver was built, delivered, and tested. Designs were completed for the second-generation heliostats and for the second-generation photovoltaic array.

"For the solar energy business to grow and fulfill its expectations, it is essential that employee innovation in technology, production, and management be encouraged," said Hawkins. "Employees in solar energy are highly motivated, but it is important that this enthusiasm be supported and extended by careful attention to the balance between employees' personal interests and the interests of this product area.

"More specifically," Hawkins added, "in the growing solar business, external overtures to skilled personnel can

be expected from other companies. We must manage the area to minimize the loss of key personnel, while at the same time we are adding new people."

In the first half of 1981, the major business thrust will be significant proposals for repowering the Arizona Public Service plant at Saguaro; for renewable energy sources for MX installations using both the solar thermal central receiver and the photovoltaic power system; and for photovoltaic power system demonstration plants. Contract awards are anticipated in the last half of 1981.

A major effort will be made to obtain add-on production orders for photovoltaic arrays and Barstow-type heliostats.

## Space electronics systems combines key products

The establishment of the space and electronics systems division consolidates the spacecraft and the command and control functions in a single organization.

"We expect this consolidation to be a distinct asset in winning new business," said W. O. Lowrie, who heads the new division as vice president and general manager.

Among the new business efforts in the first half of 1981 will be writing a proposal for the Venus orbiting imaging radar (VOIR). The request for proposal is expected in the first quarter 1981, with the contract winner to be chosen in the summer.

The division also anticipates a request for proposal early in 1981 for the space defense operations center. Although principally a software engineering contract, the winner also will be responsi-

Major 1981 milestones include the installation and activation of the Saudi Arabia village power system in August, as well as the completion of a collector subsystem in Spain in April, and at the Barstow Solar One plant in September. Another milestone is the successful testing of the second-generation heliostats in the spring of 1981.

"Solar energy systems employees deserve praise for bringing the Saudi Arabia and Barstow projects into production in less than a year," Hawkins said. "They also had outstanding performances in the delivery of the molten salt receiver and for new designs of solar thermal central receivers and photovoltaic systems."

ble for fitting furnished hardware into the system.

Other new business opportunities in 1981 include:

Air command and control for the North Atlantic Treaty Organization (NATO)—an upgrading of NATO air defense, including building command and reporting centers;

Upper atmosphere research satellite (UARS) and a new science program, origins of plasms in the Earth's neighborhood (OPEN);

Tethered satellite—with phase B completed, there is the possibility of developing flight hardware for NASA; and,

A message-processing system for the

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## Space and electronics

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Army based on work done here on the commanders' information management system (CIMS);

During 1980, space and electronics systems was successful in obtaining substantial business. A \$50 million follow-on contract was awarded for checkout, control, and monitoring subsystem equipment to be delivered to NASA during the next four years. Negotiations are nearing completion for a major addition to the operational application of special intelligence systems (OASIS) contract with the Air Force's electronic systems division.

An important technology program contract was obtained from the Air Force's Rome (NY) air development center. Called flexible intraconnect, fiber optics are used to intraconnect both Air Force and Army communications systems.

A phase A study contract worth \$8.3 million was won from the Navy for an integrated tactical surveillance system. The eventual system will include both space-based and ground-based communications elements.

An advanced electromagnetic environment simulator contract was won to provide equipment to Sweden.

Completion of the engineering and delivery of the first test model manned maneuvering unit (MMU) to NASA's Johnson Space Center was a major 1980 milestone. The first flight unit will be delivered in January.

"This is a significant accomplishment in that man-rated flight hardware will have been designed, developed, and delivered in a little more than a year," Lowrie said. "The Space Shuttle tile repair kit and work restraint system are proceeding on a schedule similar to the MMU. Both are to be delivered in the first quarter of 1981."

Successful additional growth in the space and electronics systems division depends on "retaining the talented personnel we have and adding people with the skills we need who have the same dedication to mission success as those already working here," said Lowrie.

"We need engineers with a command and control and systems engineering background because of anticipated business opportunities in 1981," he said.

Major milestones in 1981 that employees also could help achieve are the mission success-oriented performance on all Space Shuttle programs; delivery of the first major software package for OASIS; and winning the signal analysis program.

# Lightweight external tank work begins at Michoud

The first quarter-dome of the new lightweight external tank for Space Shuttle has been welded, marking a step forward in the program to reduce tank weight from 76,000 pounds to 70,000 pounds. The weight reduction will increase Space Shuttle payload-carrying capacity by nearly 6000 pounds.

Michoud division received a \$42.9 million contract in June for the design and production of the first lightweight tanks.

In the same month, the division received a \$230 million follow-on contract to build seven more complete tanks and to procure components for 24 others.

However, with the launch of the first Space Shuttle only months away, employees are working towards a primary goal of assuring the successful operation of the external tank as part of that first flight and the success of each external tank that will follow.

"The successful flight of Shuttle is our chief goal," said Kenneth P. Timmons, Michoud division vice president and general manager. "Our greatest concentration is on launch preparation, but we are also preparing for high-rate production with an emphasis on ways to reduce the cost of each tank.

"At the same time, we intend to continue our unparalleled safety record," Timmons said. "We don't want people to get hurt, and we don't want to damage our hardware. We are finishing 1980 without a single lost-time injury at Michoud."

External tank modifications to assure mission success include the ice-debris modification in which additional thermal protection was added to the tank and thermal coating to protuberances to reduce cross-flow air loads.

The modifications were made at Kennedy Space Center as were preflight tests.

The Space Shuttle was completely assembled November 25 with the mating of the orbiter, the solid rocket motors, and the external tank. Rollout to the launch pad is planned before year's end.

Capability to produce tanks at a production rate is being increased by adding new tools and facilities as well as revised computer fabrication instructions. Cost-reducing producibility methods are being implemented, such as innovative techniques that eliminate

handpacking and machining of cork-like ablator on hundreds of tank components.

The Shuttle-derived vehicle contract won in October was a highlight of the new business effort.

"This contract is an important part of our future," said Timmons. "As we go into production of many external tanks, we can use our design and development talent to help develop a Shuttle-derived vehicle."

The division also received an additional \$350,000 to continue design work on the liquid boost module.

Reflecting on 1980, Timmons praised two groups:

"Tom Wirth, director of our Kennedy Space Center operations, and all the employees there deserve special recognition," said Timmons. "Their record is impeccable. Each of the past seven evaluations by NASA have been superior, resulting in seven straight awards of 100 percent of the available award fee."

Timmons also commended the engineering groups that solved problems of ice-debris and the design of the thermal protection systems for tank protuberances, but he emphasized it was a good year for all people at Michoud.



The gaseous oxygen vent hood, center, seals over the external tank nose cone to prevent ice formation. The tall structure is an 80-ft-high, 5-ft-dia lightning rod.