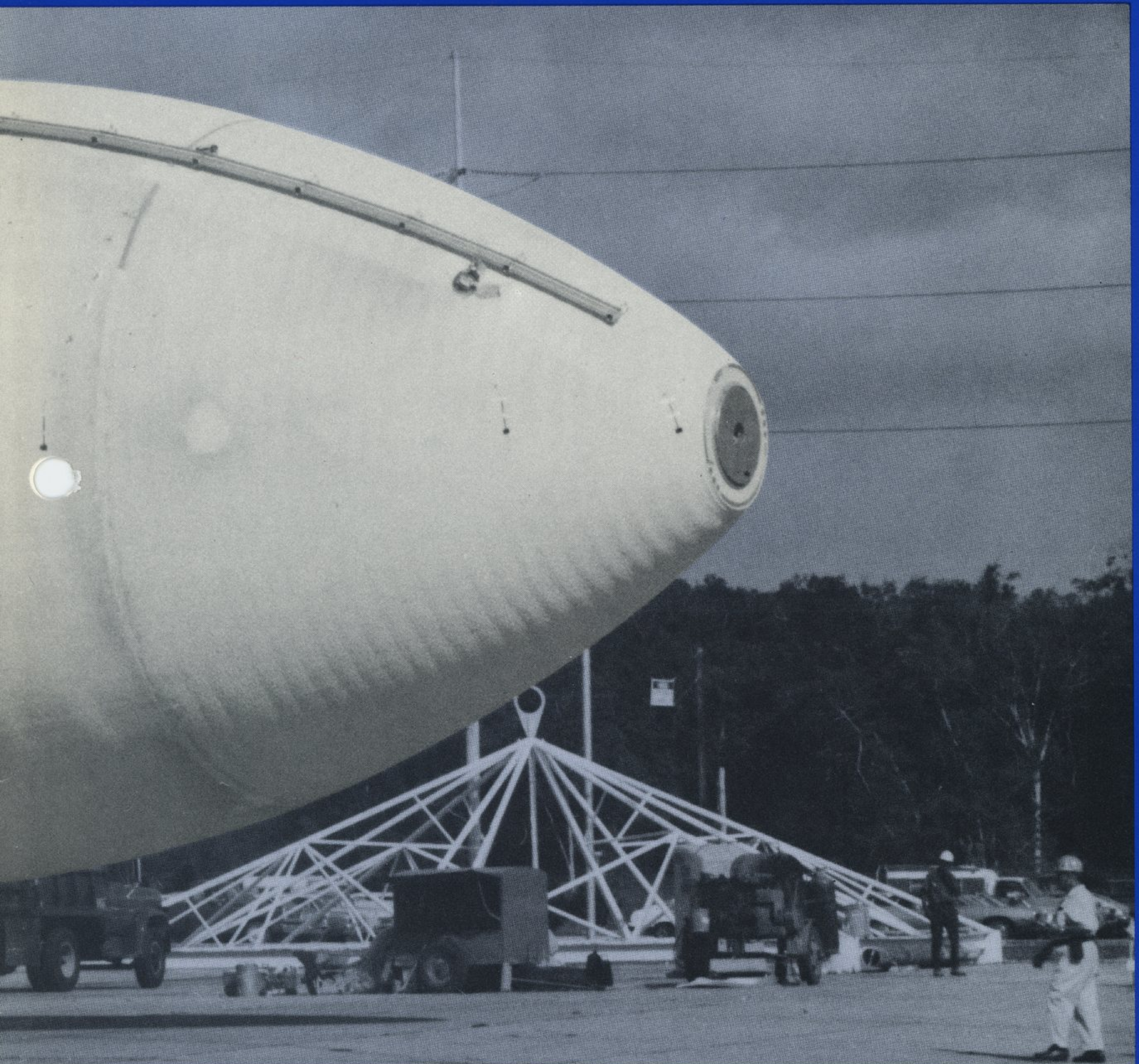
MARTIN MARIETTA
news
DENVER DIVISION

NUMBER 13/1977



The first external tank for NASA's Space Shuttle Transportation System began its journey today, September 9, to the National Space Technology Laboratory at Bay St. Louis, Mississippi for testing with the Shuttle orbiter's three main engines. Ceremonies at the Michoud assembly facility marked the rollout and delivery of the first completed external tank.

External tank vital to Shuttle flights

Emergence of the first Space Shuttle external tank from NASA's mammouth Michoud assembly facility moves the United States another step closer to a major goal of this country: regular manned space flights in a reuseable spacecraft.

The external tank is an integral part of the Space Shuttle mission, performing two vital roles:

- It will store and deliver fuel — liquid oxygen and liquid hydrogen — to the engines;

- It will serve as the structural backbone of the Shuttle as well as the link that ties together all elements of the space vehicle during launch operations.

"This rollout is most significant," said George E. Smith, vice president and project manager of Michoud operations for the Denver division of MartinMarietta Aerospace, prime contractor for NASA for the external tank. "It marks delivery of the first complete tank to the National Space Technology Laboratory in Mississippi where it will be used for propulsion system testing with the Shuttle's main engines."

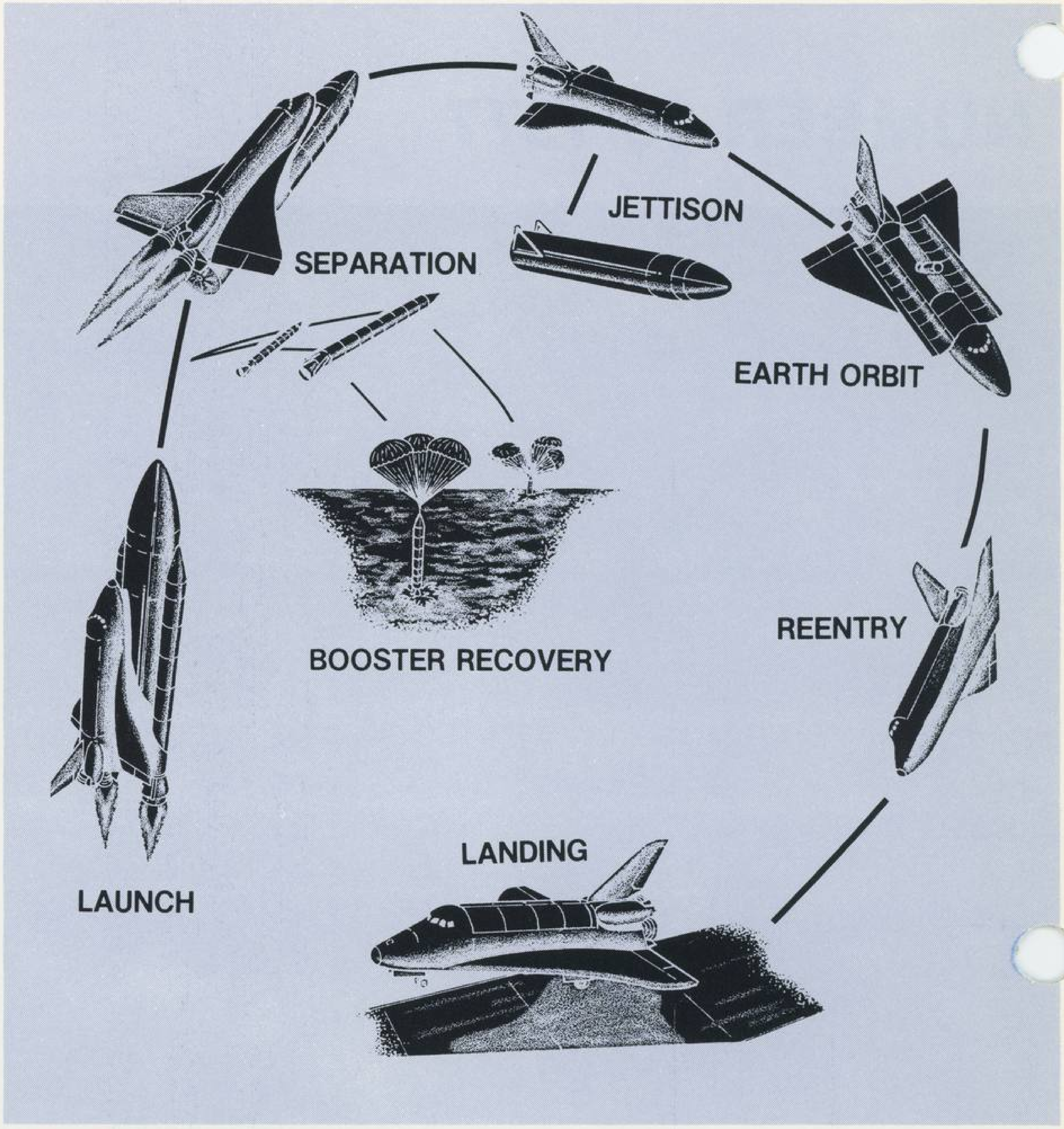
The tank, first of three test articles to be produced at the Michoud plant, measures almost 155 feet in length and is nearly 28 feet in diameter. It is actually two huge tanks joined by an intertank that houses the external tank instruments. The forward tank will hold nearly 1.4 million pounds of liquid oxygen and the aft tank, about two and one-half times as large, will be filled with 226,000 pounds of liquid hydrogen.

Precision manufacturing will help the external tank, which will weigh 1.6 million pounds at launch, withstand the strain of nearly 7 million pounds of thrust generated by the orbiter's three main engines and two solid rocket boosters that will fire together at lift off.

Spray-on foam (polyurethane) insulation about one inch thick, which also contains a charring ablator, applied to the outside of the tank enables it to withstand temperature extremes inside and outside the tank.

The solid rocket boosters will be jettisoned after burnout about 28 miles up and will parachute into the ocean for recovery and reuse. The solid rocket booster recovery system is being developed by the Denver division.

The external tank will be dropped from the orbiter just before orbit entry and reenter the atmosphere on a ballistic path for safe impact in the ocean. Those launched from Cape Canaveral will land in the Indian ocean and those launched from Vandenberg AFB will land in the South Pacific.



Mission sequence for Space Shuttle is depicted in this artist's concept.

The sleek Space Shuttle orbiter is designed to fly like a spacecraft and like an airplane. When it completes a mission, the 75-ton craft, roughly the size of a twin-engine medium-range commercial airliner, will reenter the Earth's atmosphere and glide to a landing on a runway. It is capable of carrying a seven-man crew and a variety of technical gear and other cargo into Earth orbit and returning the crew and cargo to Earth for an airplane-like landng.

In orbit, the Shuttle orbiter will be able to fly for 30 days, its crew performing a whole new generation of exciting and useful space tanks. These include retrieving, servicing, and even repairing satellites; launching unmanned probes to distant planets; carrying space stations into orbit; and ferrying scientists to experiments that cannot be performed on Earth. Among uses being discussed is possible manufacture of some pharmaceuticals and other products that must be produced in a weightless atmosphere.

After its return to Earth the orbiter's return payload will be removed and the spacecraft refurbished and made ready in about two weeks for another flight and another cargo.

The external tank is the only part of Space Shuttle that is not recoverable. However, the tank is reuseable in space and possible future employment is being studied. "The external tank is three to four times the size of Skylab," Smith said. "It would make an excellent space lab, repair shop, or storage facility for solar cells or other material."

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, Colorado 80201
September 1977

Tank rollout is milestone in Michoud's colorful history

The external tank rollout marks another milestone in the colorful history of NASA's Michoud assembly facility, one of the largest plants in the aerospace industry.

The New Orleans facility has three million square feet of work space, most of it air conditioned. The main factory building covers 43 acres under one roof, all air conditioned.

Originally a royal land grant from the King of France, the Michoud tract was used for decades as a plantation. The huge plant, built in World War II, has been used at various times for the production of Liberty ships, a type of plywood cargo airplane, and tank engines.

The plant closed following the Korean War and reopened for Project Apollo and the production of major components of the Saturn rockets. At the conclusion of the Apollo program in 1973, the mammoth facility turned its attention to Space Shuttle with Martin Marietta becoming the occupant as the external tank contractor for NASA.

The Michoud facility was considered ideal for the production of the external tank. Its gigantic size was compatible with the 154.2 ft. external tank. Its access by rail and road allowed prompt parts delivery from all areas of the United States. Its water connections between Marshall Space Flight Center, National Space Technology Laboratory, Cape Canaveral and Vandenberg Air Force Base were essential for the movement of the massive external tanks.

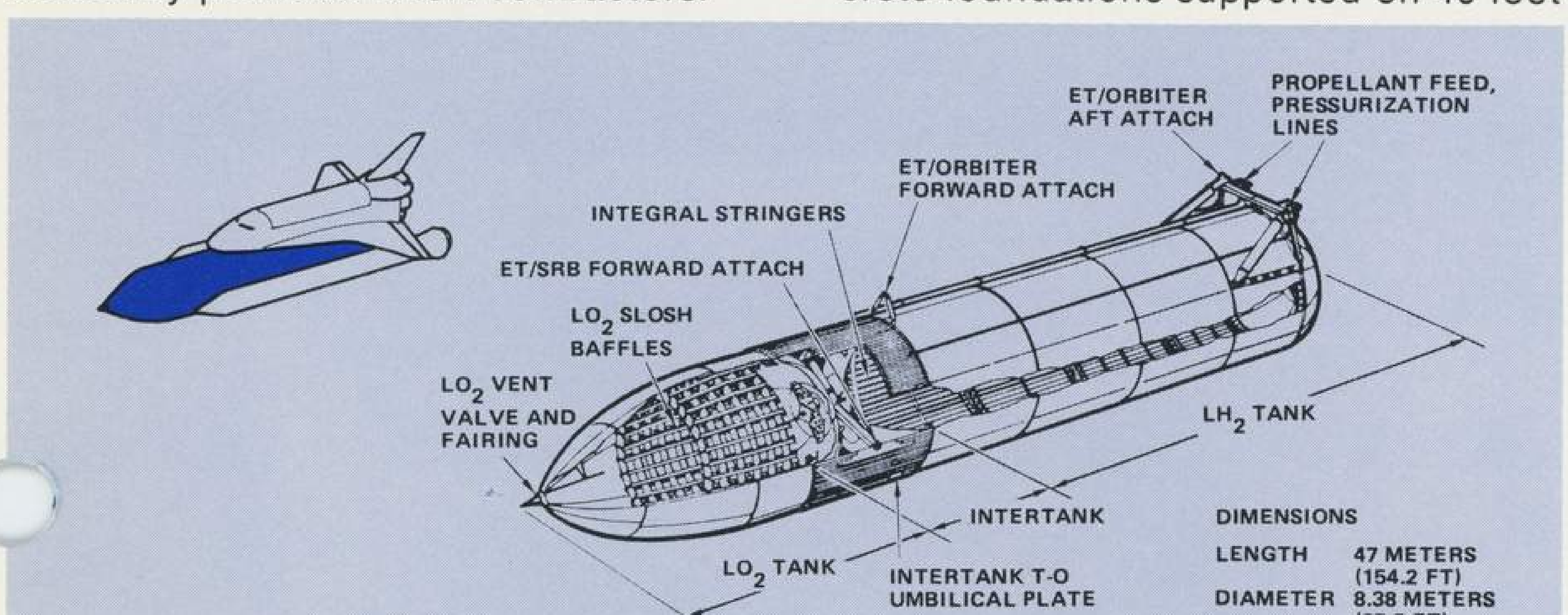
Randall A. Tassin, facilities and plant services manager for Martin Marietta who has been at Michoud since 1962, noted that the company has been able to use the existing $600 million plant "essentially as is," using many facilities installed by previous NASA contractors.

A number of large scale modifications were needed to augment the facility to provide the unique facilities and tooling required for the external tank. Modifications were required to support space fuel cleanliness requirements, high speed welding requirements, unique test requirements and for application of the thermal protection system (TPS) which is required so that the tank can withstand the space environment with its temperature extremes.

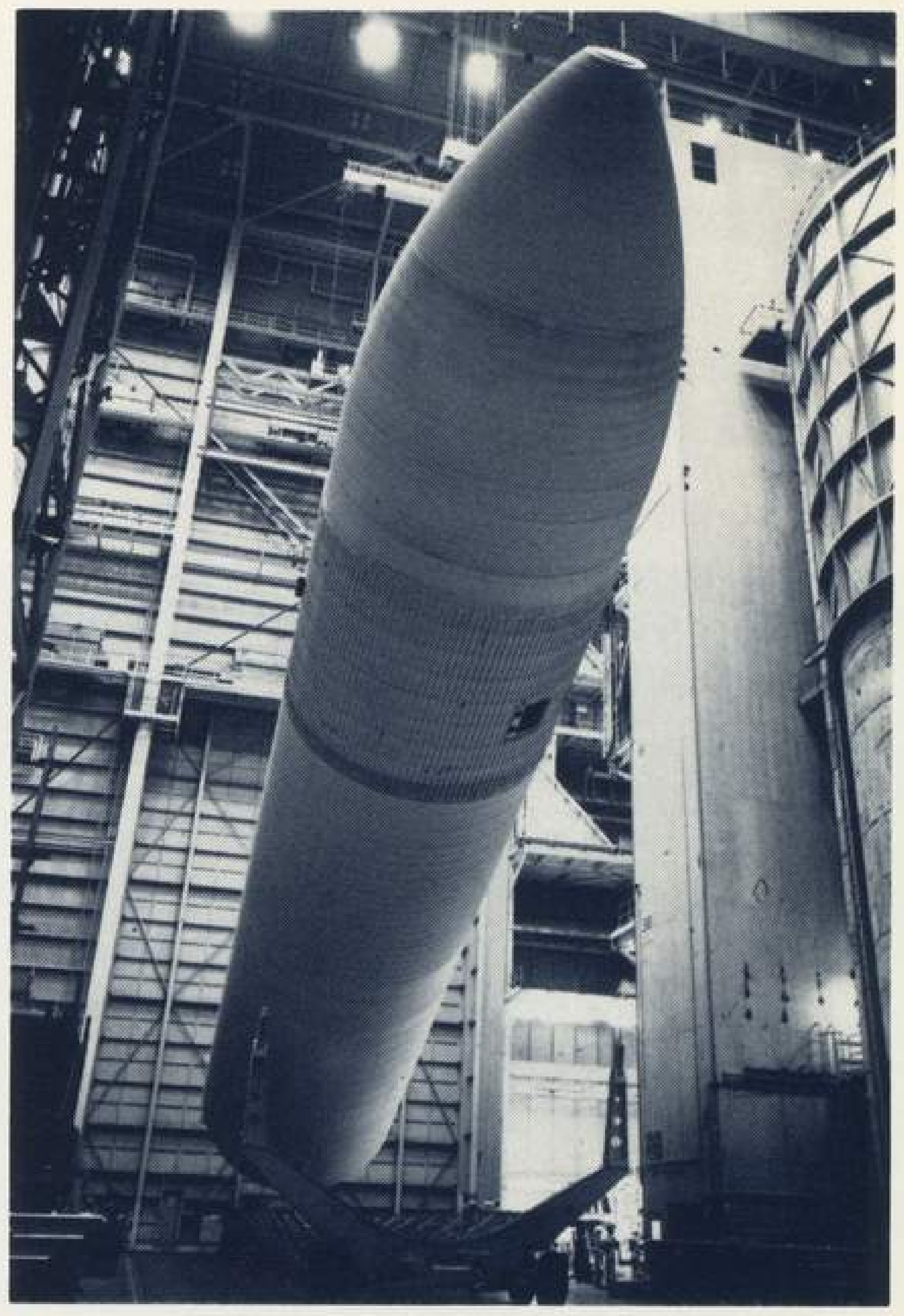
Martin Marietta has spent about $81 million for modifications, including about $17 million to modify and construct buildings and another $14 million for equipment and $50 million for tooling. NASA has programmed $75 to $80 million for additional construction, equipment, and tooling for future phases of the external tank project. The most significant of these is a new building which will cost approximately $10 to $12 million to build to handle higher production rates as the Space Shuttle matures.

One Michoud facility, inherited from previous contractors, was described by Tassin as "the world's largest dishwasher." It is a massive facility which was modified slightly by Martin Marietta engineers to spray the external tank major components prior to welding. Martin Marietta has constructed another dishwasher which is capable of cleaning, internally and externally, either the entire hydrogen tank (which is 105 feet long by 27 feet in diameter) or the entire liquid oxygen tank, which is slightly smaller. This new facility is the new "world's largest dishwasher" since it is 10 times larger than the facility used for cleaning major components.

The floor areas required to support the massive weld tools and other gigantic equipment and tools were excavated and replaced with large post-stress concrete foundations supported on 40 foot



This drawing shows location of various elements of the external tank. Small drawing at left shows position of tank, orbiter, and solid rocket boosters.



Completed external tank is lowered from a vertical position to the transporter that will carry it to a barge on the Pearl River.

composite piles which are necessary in the New Orleans area to reach proper sand-strata for proper support.

A new remote building, using a sophisticated computer control system and pneumatic testing equipment, was constructed at a cost of $6 million, including tooling. The equipment can exert 1.2 million pounds of force on a liquid hydrogen tank while maintaining an internal pressure of 43 psig which simulates the forces, with a safety margin, that will be experienced by that tank during flight conditions.

Another unique facility is the large vertical Thermal Protection System (TPS) cells that are environmentally controlled to stringent temperature and humidity conditions and house computerized spray tools and equipment. Application of the spray-on foam insulation is extremely sensitive to time and environment. Without the use of this sophisticated facility, the insulation could not be applied so it will adhere sufficiently to withstand the outside heat and rigorous space environment as well as the super cold (-300°F range) of the liquid hydrogen and oxygen required as space fuels.

Facilities, tooling, and equipment either activated or currently under construction are sufficient to produce External Tanks for the Design, Development, Test and Evaluation Program. Modifications programmed through 1978-1979 will allow the facility to produce tanks at rates as high as 24 per year and, ultimately upon completion of all programmed requirements, this facility will be capable of production as high as 60 of the gigantic tanks per year.

Future looks bright for external tank production

What's ahead for the Space Shuttle and Michoud?

Even as the huge external tank nosed out of the main plant and headed for the barge that will transport it to the National Space Technology Laboratory in Mississippi, two more tanks being manufactured for test purposes were moving steadily through construction stages.

The three test articles will be followed by six flight models that are in various stages of construction or design at Michoud.

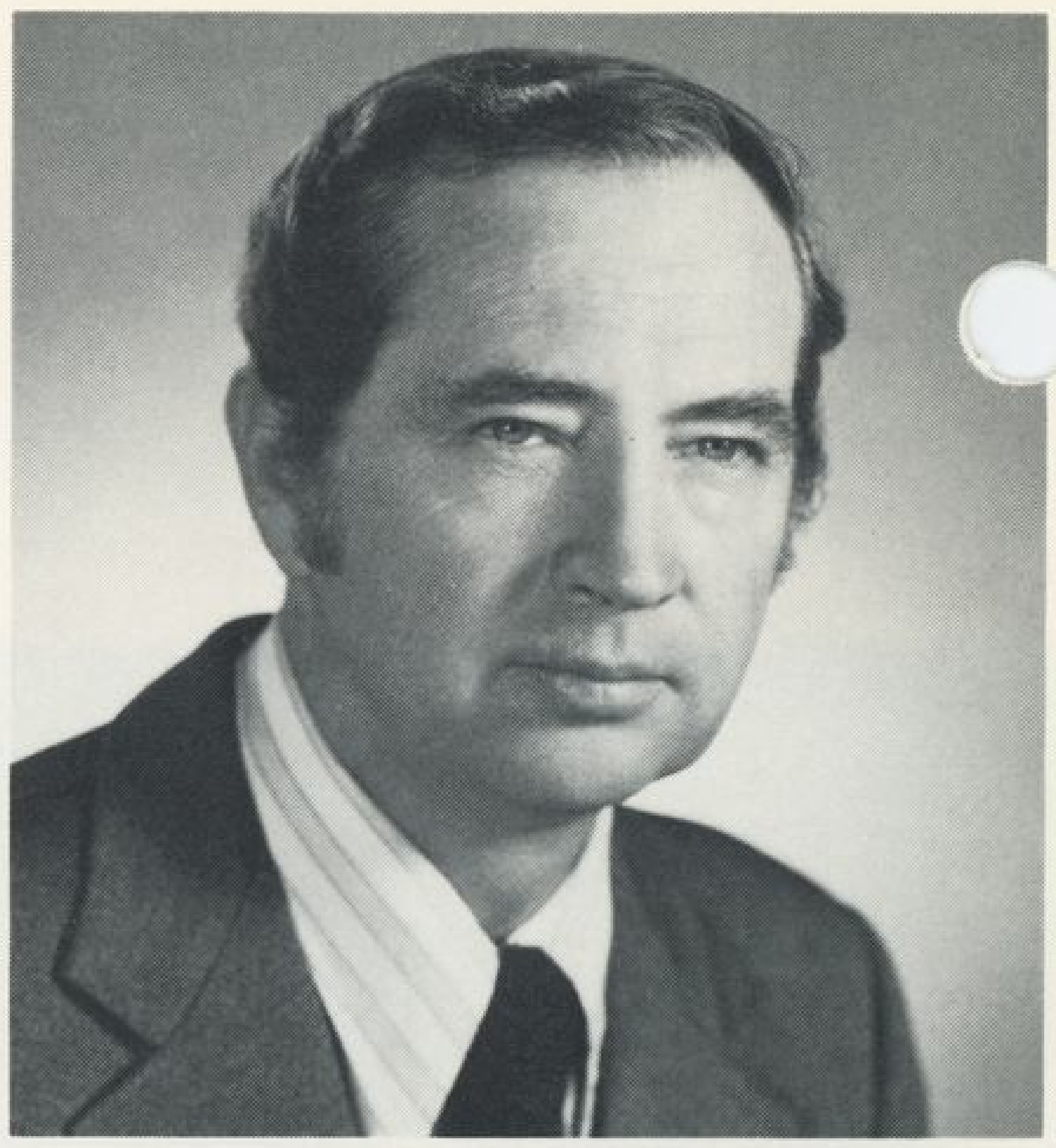
Phase II, designated as initial production, entails the production of 54 more tanks between the fall of 1978 and the end of 1982. This would bring on the Phase III follow-on production period, calling for the construction of 60 external tanks a year for a total of 506 more through 1991.

"We have proposals with NASA for long lead procurement approval and we expect authorization to proceed with the manufacture of the 54 tanks in Phase II," George E. Smith, project director of Michoud operations, said.

This would create an expenditure of approximately $52 million a year in payroll and service contracts, an important infusion of funds to the South Louisiana — South Mississippi area.

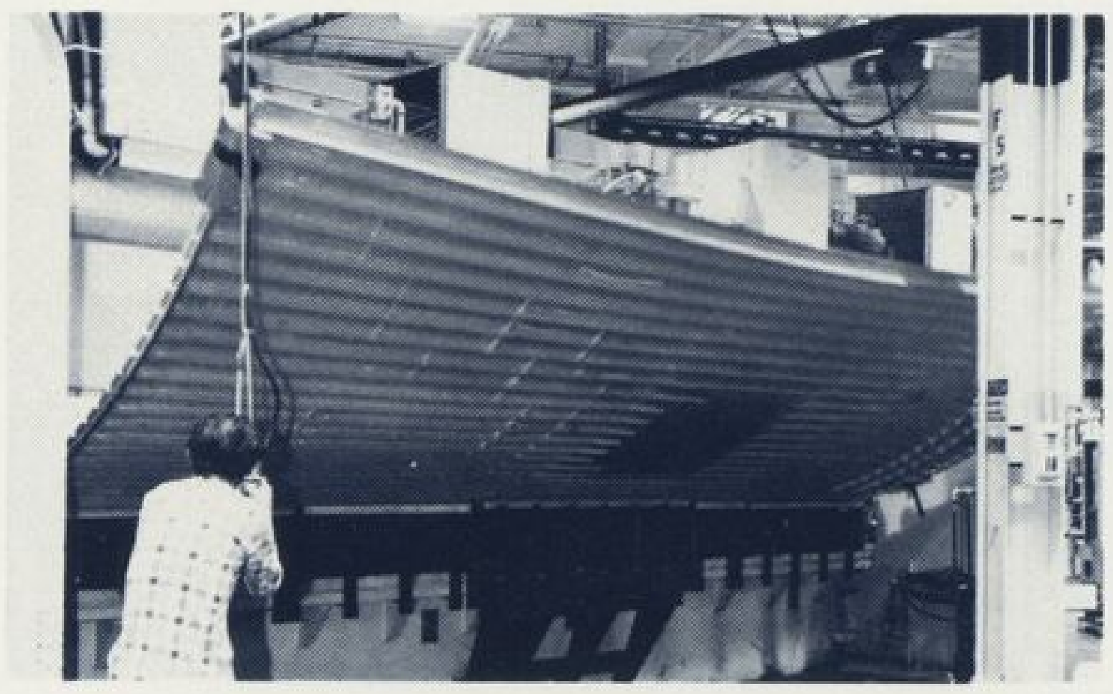
"The external tank program represents a unique oppotunity for New Orleans," Smith said, "because it involves at least a 10 year term of employment for approximately 2,500 people, 2,000 with Martin Marietta and perhaps 500 with NASA and with supporting services, compared with the Saturn program which involved more personnel but peaked in a shorter period.

"The external tank constitutes a good use for a government facility," said Smith, who noted that Michoud is unique because of its enormous size and excellent rail, road, and water access linking it to Cape Canaveral, Vandenberg AFB, Huntsville, Ala., and the National Space Technology Laboratory in Mississippi.

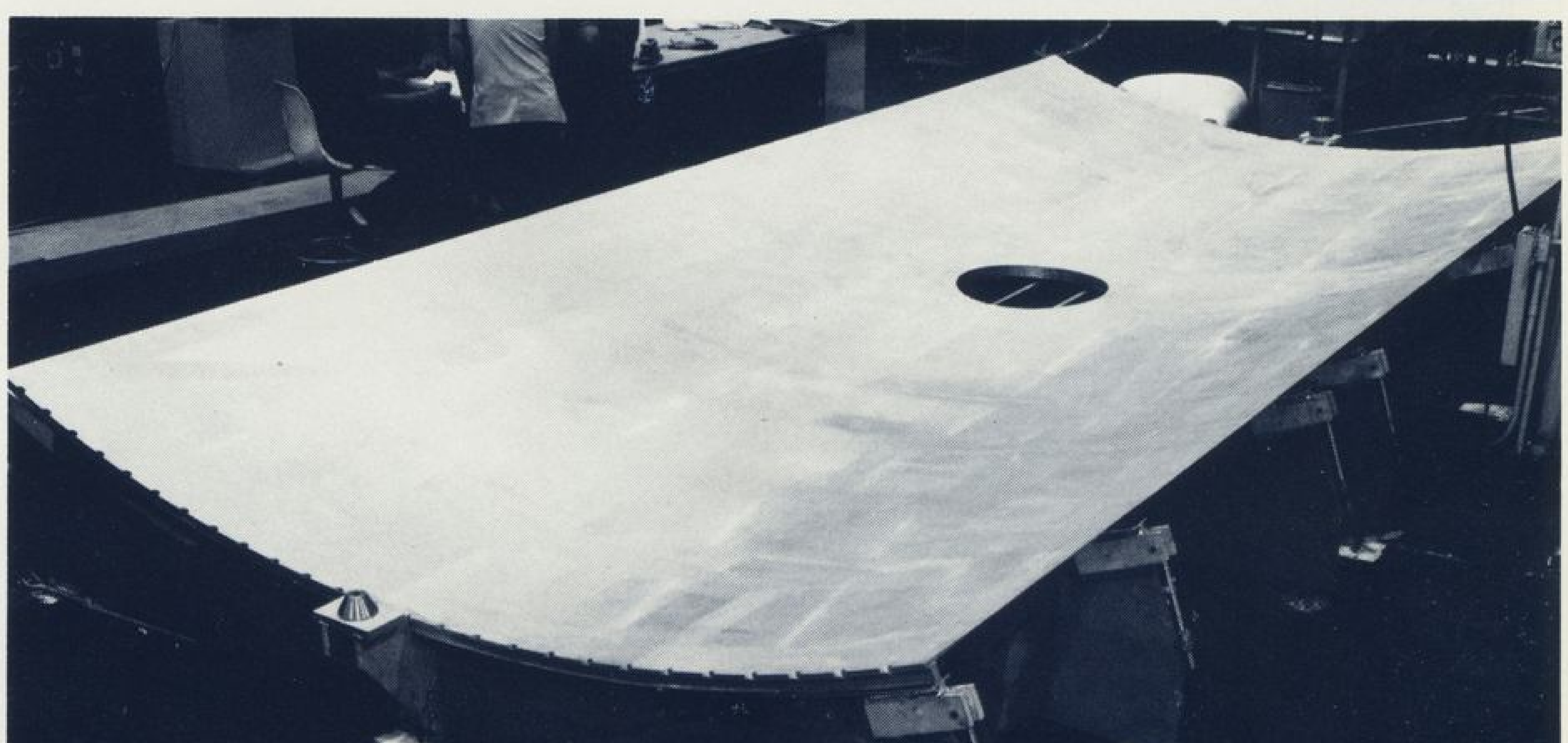


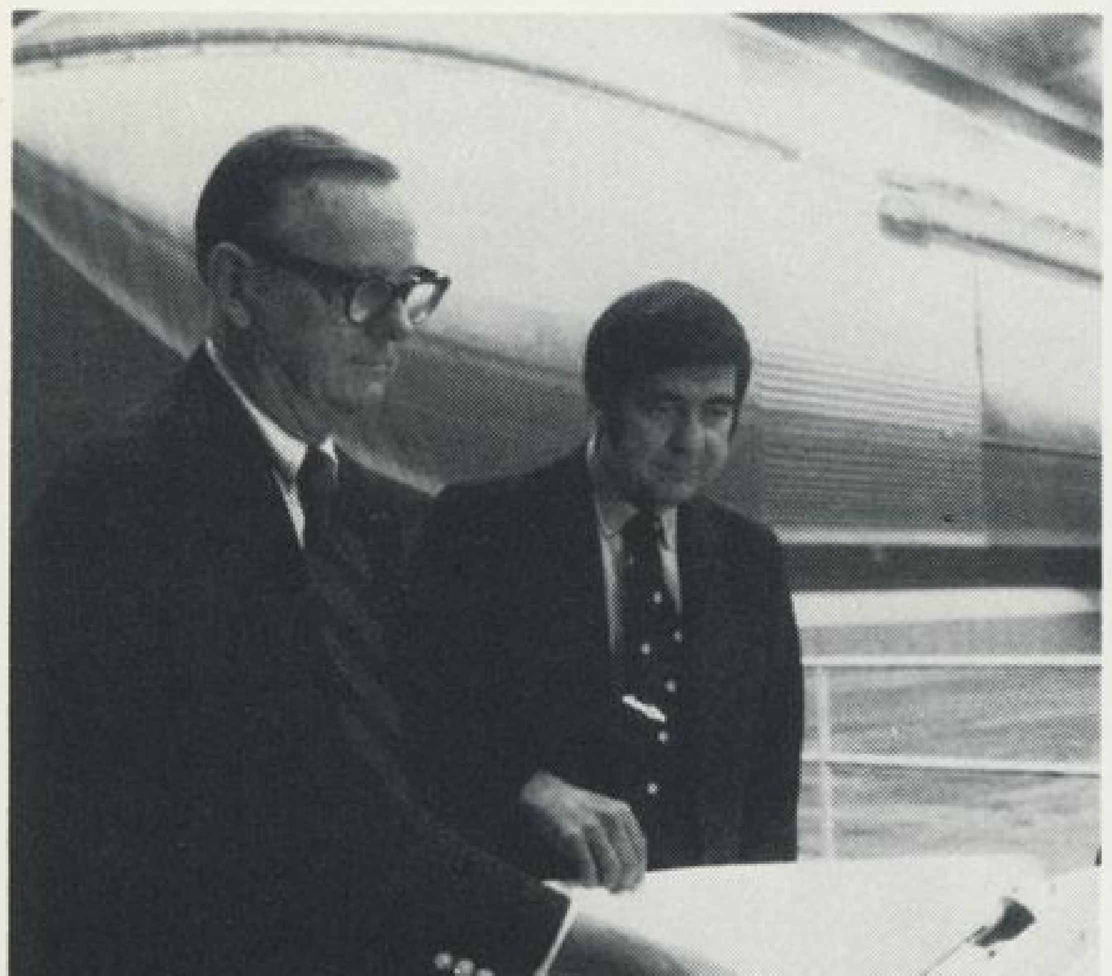
Robert C. Littlefield is manager of the Michoud assembly facility for NASA. Since 1975, he has been responsible for the overall management of the facility in New Orleans which covers 891 acres and has about 4000 employees. Before coming to Michoud, he was executive assistant to the director of manned space flight at NASA headquarters in Washington.

SPACE SHUTTLE



Thrust panel for the external tank was formed in the manufacturing facilities in Denver (top photo). The completed panel, formed, aged, and with the attachment access door cut in, is shown in the bottom photo.





George E. Smith, vice president and project director for the Denver division's Michoud operations, and James W. McCown, deputy project director, view a model of the Space Shuttle. Behind them is a full-scale painting of the external tank being manufactured by Martin Marietta at the Michoud assembly facility.

Cross beam for the external tank was manufactured in Denver. It is part of the detailed interface hardware and is one of the connection points between the external tank and the Space Shuttle orbiter.