

MARTIN MARIETTA

news

DENVER DIVISION

NUMBER 6/1977



THE
NELSON P. JACKSON
AEROSPACE AWARD
Presented to
THE DENVER DIVISION
OF
MARTIN MARIETTA AEROSPACE
April 1, 1977

PACE to produce hands-off launch countdown for Titan

By early 1978 three small minicomputers will be checking out the Titan III booster rocket systems and controlling launch countdowns, providing a hands-off countdown for the launch crew.

The new system — called PACE, an acronym for programmable aerospace control equipment—is being developed by the Denver division under a \$10.5 million contract from the U.S. Air Force Space and Missile Systems Organization (SAMSO).

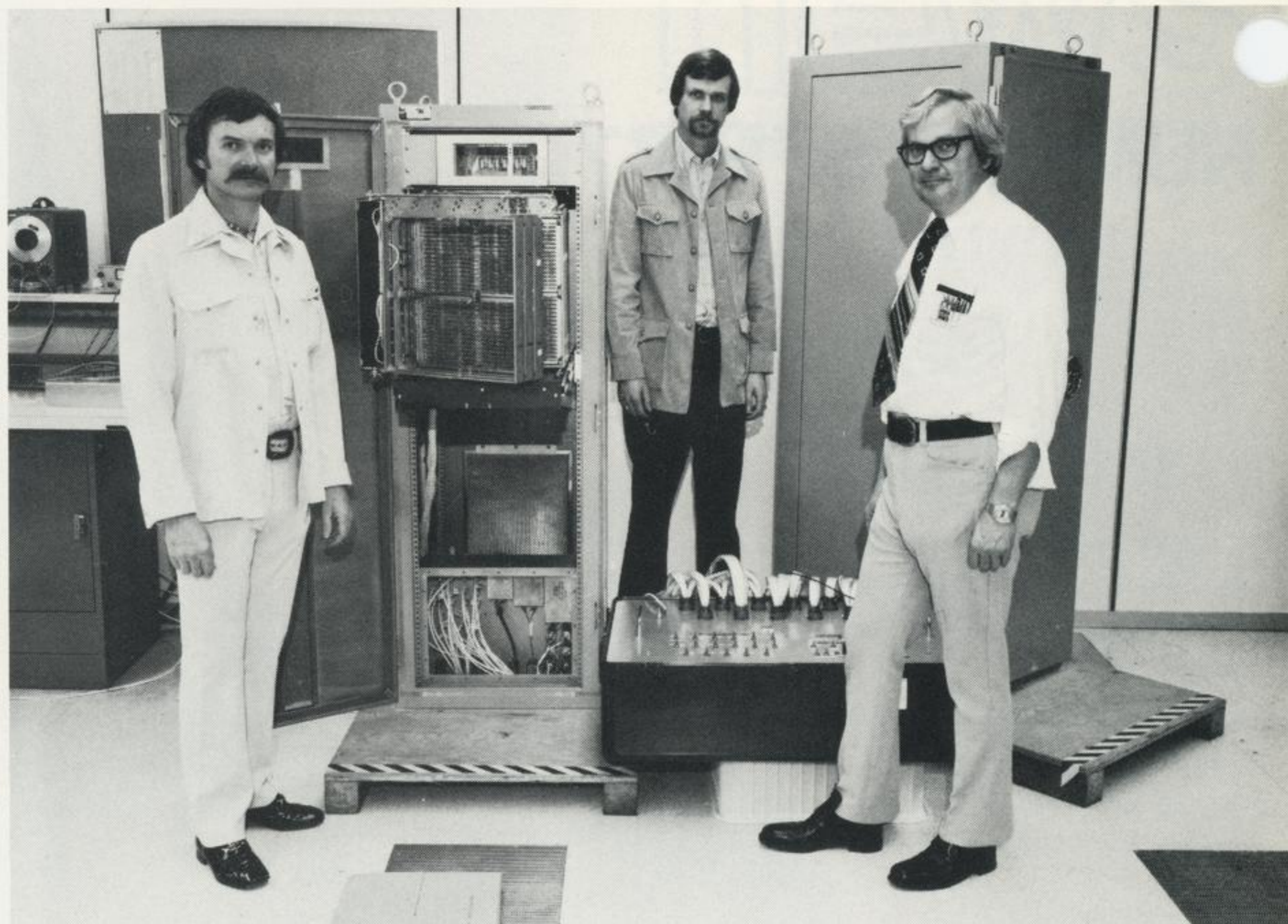
While PACE provides automated, hands-off support to the launch crew, it will not eliminate the crew. The crew can override the system at any time. The system is being designed to replace present aging launch control, checkout, and data recording systems at Denver, Cape Canaveral, and Vandenberg Air Force Base.

Program manager for the project is Horton Steinmeyer. Earl Sobisek is leading the hardware effort and James Hill is in charge of software.

PACE development began late in 1975 and will be completed with the marriage of the PACE prototype system to a launch vehicle in the vertical test facility late this spring. Three production systems will be delivered in late 1977 and early 1978 to complete the current contract.

Heart of the new system is a general purpose minicomputer with 48,000 words of core memory. Three of these Modular Computer Systems computers interconnect to provide majority voting for all launch critical signals. Two sets of peripherals (cathode ray tube/keyboard, lineprinter, magnetic tape drive, and moving disc head), two sets of division-designed vehicle interface racks, and a special Martin Marietta input/output processor complete the PACE hardware system. Software programming allows the test engineer to write test sequences in "near-English" language, an approach originated by the division on the Viking program. Computer software and a data file complete the PACE software system.

The system does an amazing amount of work. It generates stimulus signals to the airborne vehicle, monitors critical vehicle test points, evaluates all monitor points, displays anomalies, records all data, controls the launch sequence, and automatically takes corrective or alternative action if a vehicle system problem or malfunction is detected.



Tom King, Jim Leach, and Earl Sobisek, left to right, of the PACE program, are shown with

division-designed equipment racks that will interface with the launch vehicle.

SRB decelerator system tested

A subsystem to provide impact survival and reuse of solid rocket boosters (SRB) for space shuttle had its initial pyrotechnic test recently at the division. Object of the test is to literally cut away a portion of the SRB nose assembly so it can be pulled away by a drogue parachute and free three main parachutes so they can open and safely return the reusable SRB to Earth.

A second test is planned for early May.

The division is developing the subsystem — called Solid Rocket Booster Decelerator Subsystem — for NASA's space shuttle under contract from Marshall Space Flight Center. Twelve subsystems along with support equipment and mass simulators will be delivered beginning in mid-1978 for use on space shuttle test flights in 1979.

Each decelerator subsystem is composed of a pilot parachute, a drogue parachute, three main parachutes, a main parachute support structure with attachment fittings, and a parachute location aid for each main parachute.

The drogue parachute is 54 feet in diameter and weighs 1,250 pounds. The main parachutes are 115 feet in diameter and each weighs 1,600 pounds. The para-

chutes are produced by Pioneer Parachute Co., Inc. of Manchester, Conn. under subcontract to the Denver division.

The subsystem is installed in the SRB nose cone assembly.

Following SRB separation from the Shuttle and entry into the lower atmosphere — at about 18,000 feet — the boosters are slowed by the decelerator subsystem's drogue parachute and finally by the three main parachutes, resulting in a water impact of about 60 mph. The boosters, designed for survival at this impact velocity, and the parachutes are retrieved, refurbished, and reused for subsequent shuttle flights. The reuse saves as much as \$10 to \$15 million per space shuttle flight.

The subsystem will be further tested through a series of 13 air drop tests from a B-52 over the National Parachute Test Range at El Centro, Calif. The B-52 will be from the Dryden Flight Research Center at Edwards Air Force Base. To test the subsystem, drop test vehicle weighing about 48,000 pounds will be assembled in Denver and shipped to the test site. The first vehicle is scheduled to be shipped early in May for the first test drop scheduled for June 15.

Congressman Wirth supports division's space telescope bid

U. S. Representative Timothy E. Wirth of Colorado's second congressional district, following House passage of the NASA authorization bill which included funds for space telescope, told newsmen, "I think Martin Marietta has a good shot at being chosen (for a role in space telescope) because of its strong records and the Viking project."

The division is bidding on the portion called the support system module, the overall systems engineering, and integration responsibilities for the project.

In speaking for the authorization bill, Rep. Wirth said the space telescope is one of the most exciting projects man has ever undertaken. "With it we will be able



Timothy E. Wirth

to see 500 times more than man has ever seen before—an exciting potential for discovery.

"Better understanding of the universe could lead to the discovery and development of new energy sources so important to Coloradans."

In his address to the House, Rep. Wirth said, "There are no frills or fat on this budget."

Representative Don Fuqua of Florida said in his support of the bill, "According to NASA, this space telescope is the No. 1 priority item this year."

The NASA bill approved by the House includes an initial outlay of \$36 million for the space telescope project.

"We will know this summer if NASA gives the contract to Martin Marietta," Rep. Wirth said.

On the cover

The Nelson P. Jackson Aerospace Award was presented to the Denver division at the 20th Annual Goddard Memorial Dinner April 1. It was presented by the National Space Club and accepted for the division by W. O. Lowrie, who headed the Viking project for the division. The citation accompanying the the plaque said, "The Nelson P. Jackson Award is presented to the Denver division of Martin Marietta Aerospace for its superb technical achievement in successfully operating two spacecraft on the planet Mars. The automated explorers carried delicate instruments over 400 million miles on a journey that spanned almost a year. Viking's systems surveyed the planet from orbit and sought a safe landing site, executed the intricate maneuvers that separated orbiter from lander, and achieved two perfect landings. The data returned has fundamentally changed our knowledge of Mars."

The coveted Dr. Robert H. Goddard Memorial Trophy was presented to the entire Viking Project team and the Astronautics Engineer award was presented to James S. Martin Jr., formerly of NASA and now a vice president for Martin Marietta Aerospace.

General Marsh AFA speaker

Lt. Gen. Robert F. Marsh, vice commander of the U.S. Air Force Systems Command, was the featured speaker at the recent meeting of the Red Rocks chapter of the Air Force Association.

General Marsh spoke on the latest developments in Air Force systems, including aircraft and weapons.

The AFA Red Rocks chapter was chartered earlier this year by Martin Marietta and Air Force Plant Representative office personnel. Membership is open to all. However, only those who have served in one of the military services may hold office. Those without military service may join as patron members. Active duty Air Force personnel may be members, but cannot hold office or vote on AFA matters.

The local chapter, with Stanley F. Albrecht as president, has 52 members. Other officers are Robert Taylor, vice president; Geogre Hawkinson, secretary; and James Zalmanek, treasurer. C. B. Allison, ext. 3029, is membership chairman.



A silver medal struck in honor of the Viking mission to Mars by Matsumoto Kisko Industry Co., Ltd., Japan, has been presented to W. O. Lowrie, who headed the Viking project for the division. Lowrie was selected to receive the award by NASA. Justin L. Bloom, counselor for scientific and technological affairs at the U.S. Embassy in Tokyo, in his letter to Lowrie accompanying the medal, said, "You are aware . . . of the enormous interest that exists at both the professional and lay level in Japan in the U.S. space program. Press and TV coverage of the Viking mission was continuous and complete. I and my colleagues at the Embassy join innumerable Japanese in expressing our admiration for the sophisticated and scientific accomplishments of the Viking program."

"April is membership month," Albrecht said, "so we are actively seeking new members. Those interested may call any of the officers or the membership chairman."

General Marsh was appointed vice commander of the Air Force Systems Command in 1975. He is a graduate of the U.S. Military Academy and later earned master of science degrees in instrumentation engineering and aeronautical engineering. Among his Air Force assignments are ones in the Office of Deputy Chief of Staff, Research and Development; as a staff officer with the Directorate of Reconnaissance and Electronics Warfare; later with the newly organized Directorate of Space as Chief of the Projects Division; and served as Executive Officer to the Deputy Chief of Staff for Research and Development.

Denver data center has new director

Mrs. Shirley F. Prutch, who began her Martin Marietta career as a trainee computer programmer in 1964 with the Denver division, has been named director of Martin Marietta Data Systems Denver data center. She replaces Stanley F. Albrecht who has been assigned full time to the Denver division to assist in pursuing a major new business opportunity.

The Denver data center provides computing resources for the Denver division, assuring that all business and scientific systems work is accomplished and that all computing services necessary to meet division needs are provided within specifications and budget.

Mrs. Prutch left the Denver division in 1968 to accept a management position with another firm. She was named vice president for operations of a computer service in Denver in 1971 and remained with that firm until 1973 when she joined Martin Marietta Data Systems as director of regional technology.



In 1975, she was appointed director of network operations for the Denver data center, the position she held until her recent promotion.

Mrs. Prutch has a BS degree in mathematics from Heidelberg College, Tiffin, Ohio, and has done extensive graduate work in mathematics at the University of Illinois.

She has represented Martin Marietta on SHARE—an international organization of IBM computer users—and was president of the organization from 1974 through 1976. She was the U. S. representative to the International Federation of Information Processing (IFIP), a United Nations' organization, from 1972 through 1974.

Mrs. Prutch was secretary for a technical committee of the IFIP while representing the U. S.

She is married to Sam Prutch, director of computer services for a Denver firm.

Mrs. Prutch's father, K. Earl Frock, was a supervisor in the Denver division's facilities group until his retirement in 1967.

Co-op students doing 'real work'

The division's cooperative education program has been designed to give qualified college students an opportunity to get practical experience in a variety of technical and engineering fields. Is the program working?

The answer is, "Yes," according to students currently working at the division.

Six of the eight now on co-op assignments recently discussed the program with a *Martin Marietta News* representative. The two not present were on offsite assignments.

For most of the students, the time at the division is a welcomed change from the classroom environment and assignments here are "a little surprising." Few of the students had expected they would be given "real work to do" almost immediately.

"I thought I might be given some papers to read or told to look over someone's shoulder," one student said. "That wasn't the case. I was assigned a job to do that contributes to the project where I am working."

Another student approached his arrival at the division with some fear. "I was afraid I might be asked to do something that was too tough for me to handle. That didn't happen. I can do what I have been asked to do and the guys I work with have accepted me as part of the team."

The students who met with the *News* and their assignments at that time were:

Gary E. Deschaines is a sophomore in the aerospace engineering program at the University of Cincinnati. He has been assigned to the SCATHA payload integration group preparing technical documents for 12 scientific experiments.

Michael Hartle is also a University of Cincinnati sophomore in aerospace engineering. His assignment is in the systems engineering department supporting engineers performing research in spacecraft contamination technology.

Thomas G. Haskins, a junior at Drexel Institute of Technology studying electrical engineering, is working with aerothermal and propulsion engineering on the analysis and design of solar heat systems.

Richard J. Hetley, majoring in mechanical engineering as a junior at Colorado State University, is in the thermophysics sec-

tion of aerothermal and propulsion engineering.

Randall S. King is a junior aeronautical engineering student at Embry-Riddle Aeronautical University. The advanced space transportation systems is his department where he supports senior engineers conducting computer analysis and technical reports for flight mechanics, vehicle performance, vehicle sizing, and other vehicle programs.

Roy M. Sebring, a junior electrical engineering student at the University of Washington, is in the systems control section. He has been working on the solar thermal program helping to build and operate the collector subsystem.

The two on offsite assignments are Robert P. Wessels and Duncan B. Smith. Both are electrical engineering students at the University of Washington. Smith is a junior and Wessels a senior.

The work experience here, especially for those who have been exposed to the solar energy programs, may mean they will consider changing their field of interest.

All six stressed the practical aspect of their assignments and were certain the experience would "make class work more interesting, and in some cases easier."



Nadine Senn has received the Air Force Plant Representative Office's Top Lady award for her outstanding performance during the period July through December 1976. The semiannual award recognizes AFPRO clerks, typists, and stenographers for their service. Mrs. Senn is secretary to the Air Force Plant Representative.

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Published by Public Relations
MARTIN MARIETTA AEROSPACE
Call Ext. 5364 with suggestions
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Denver Division
P.O. Box 179
Denver, Colorado 80201
April 1977

On the move

Recent position changes include:

K. B. Davis: from senior estimator for Phase B Space Telescope study to estimating chief for major new business programs.

E. A. Euler: from senior staff engineer in mission operations and software to chief, mission operations and software, replacing John F. Flater who has been assigned to command and information systems.

R. J. Pulutchko: from manager, Viking lander support office to technical director for special programs.

V. G. Wilson: from senior specialist in finance to chief, cost management command and information systems.

J. R. Bigelow: from overhead budget control resource to chief of cost management for special programs.

Sloan fellowship awarded employee

Peter B. Teets, who is responsible for the division's Titan III transition program, has been named a 1977-78 Alfred P. Sloan Fellow at the Sloan School of Management, Massachusetts Institute of Technology.

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

Teets, who will begin study at MIT in June, joined the Denver division in 1963 following graduation from the University of Colorado with a BS degree in applied mathematics. He had been employed as a student engineer for three summers at the division before completing his undergraduate work. He earned an MS degree in applied mathematics from the University of Colorado in 1965.

Except for brief assignments on proposal preparation, Teets has been part of the Titan program through out his career



Peter B. Teets

with the division, working primarily in guidance and control positions.

Teets was named Corporate Engineer of the Year in 1974 for development of a Titan guidance and flight control system and has been honored as an author and for new business contributions by the Denver division.

From Michoud

Expendable external tank may become space platform

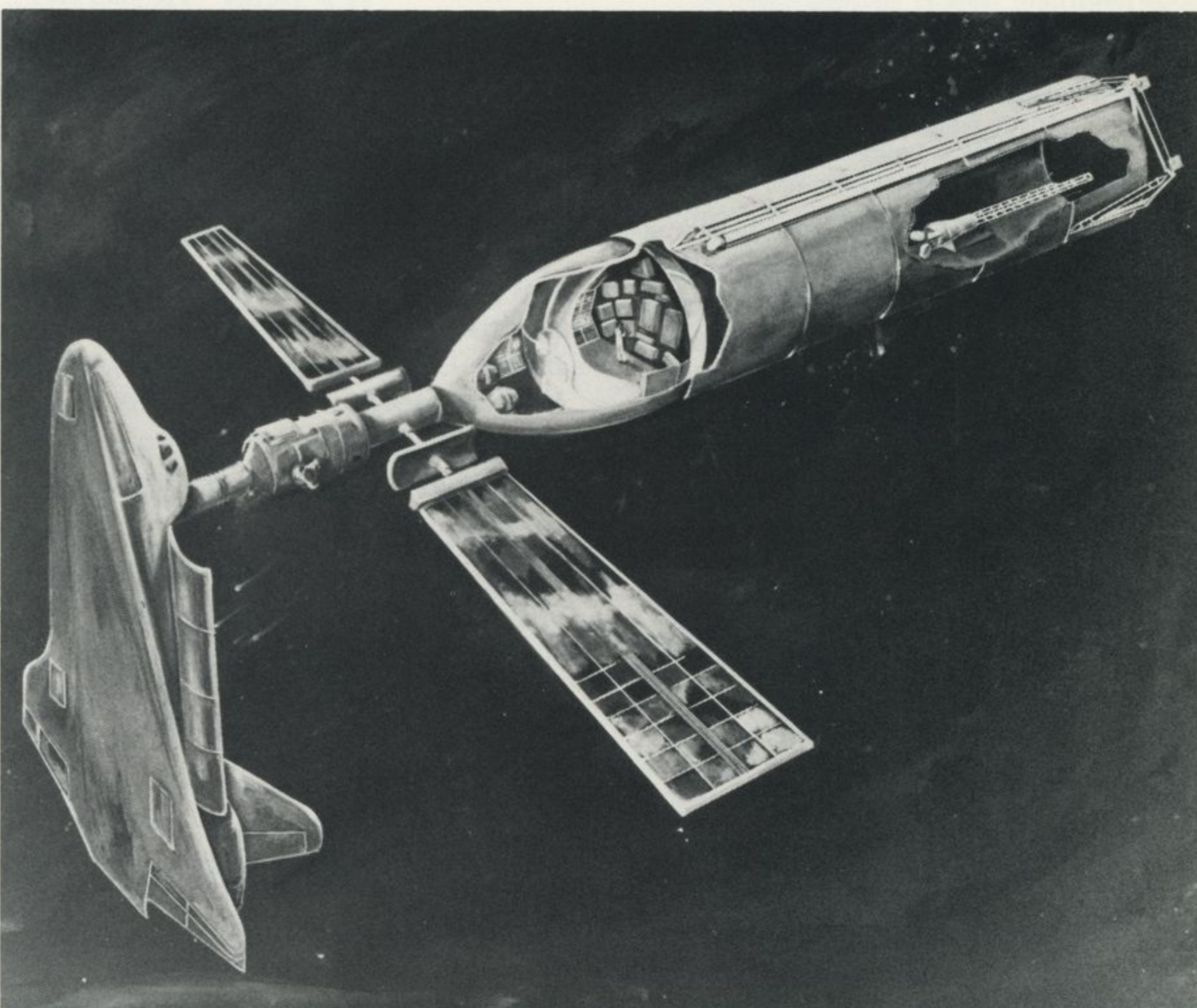
(Editor's Note: The following article, describing what perhaps may be a new use for the external tank produced by Michoud Operations, is reprinted from the *Marshall Star*, a publication of the NASA Marshall Space Flight Center.)

The only major element of the Space Shuttle designed to be expendable may instead become a very important part of a permanent space platform.

James E. Kingsbury, director of S&E has said that in order to realize the full potential of space it will be necessary to develop a space platform to accommodate man's continuing presence in space.

One of several options being studied at the Marshall Center is the possibility of the Shuttle External Tank (ET) going into orbit with the Orbiter, separating and becoming an orbiting vehicle. It could then become the nucleus of a permanent space platform.

see back cover



This artist's drawing from NASA shows the Space Shuttle's external tank used in Earth orbit as the first step of a space platform. For

this purpose, 2000 cubic feet in the forward area of the external tank would be equipped on the ground for crew habitation in orbit.

news

MICHLOUD OPERATIONS

Liquid Oxygen
tank proof
test successful

Proof test of the liquid oxygen tank for the main propulsion test article (MPTA) for the external tank has been completed successfully.

The 12,499-pound all-aluminum tank, built to hold 1.3 million pounds of liquid oxygen, was filled with 145,832 gallons of demineralized water containing a trace of chromate to prevent corrosion. The air surrounding the vacuum chamber surrounding the exterior aft dome was pumped down.

To satisfy pressure requirements, a water stand pipe connected to the tank ogive test cover was filled to an elevation of 185 feet. This positive internal pressure was complemented by the vacuum chamber external pressure of 4.6 psia to develop the correct total pressure of the tank aft dome. Proof pressure was applied for one minute.

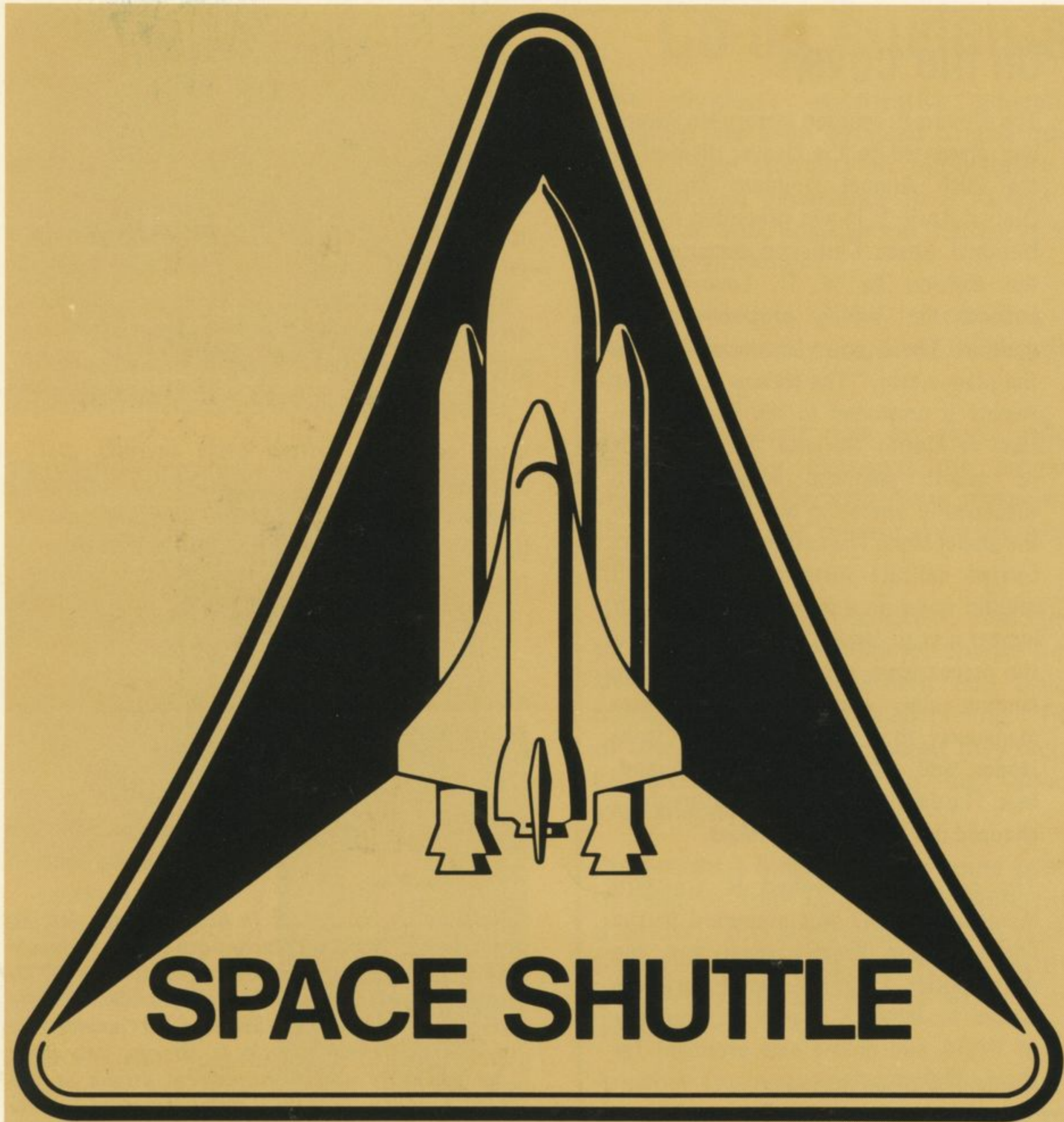
The tank has been moved for cleaning.

elements so far investigated appear to be most promising.

As a target, the studies are directed to an initial launch in calendar years 1983-84.

Stressing extensive use of space-qualified hardware, Kingsbury said that it is believed that a major space platform could be placed in Earth orbit in an early time frame at a fraction of the cost associated with a new developmental program.

"One can readily recognize that the concept being studied does not differ significantly from that pursued by Marshall Center in the development of Skylab," Kingsbury said. "It is anticipated that the lessons learned from experience gained during that program will have direct application here, and the benefits and experience derived from Skylab can be applied by many of the same people in the development of an early space platform."



from inside page

"From this permanent space platform," Kingsbury said, "the real business of space utilization can begin."

In the external tank use option some of the liquid oxygen propellant would be off-loaded prior to launch. This off-loading would provide a separate compartment of approximately 3,000 cubic feet that could be equipped on the ground for 90 days of crew habitation in orbit. A first Shuttle would carry such a tank into orbit and park it.

A second Shuttle launch would carry into orbit a Skylab Airlock Module and Multiple Docking Adapter along with a solar electric conversion wing. These elements would be docked and clustered to the waiting ET. This launch would also bring up the crew to inhabit the platform and an additional 90-day supply of expendables to support a crew of three for six months without resupply.

In Michoud

Call Ray Lacombe at 3606 with suggestions or information for articles for Martin Marietta News.

NASA has adopted this official design of an insignia for its Space Shuttle and Space Transportation System. The triangular shaped emblem pointed upward shows an overhead view of Space Shuttle on a field of two shades of blue with the entire emblem outlined by a gold stripe.

The work of the first crew would include construction of additional crew quarters in the remaining volume of the liquid oxygen propellant tank.

"Employing this concept," Kingsbury said, "studies have shown that a permanent space platform can be placed in a three-to-five year orbit with re-boost capability. The platform can be expanded in a number of ways, using additional expended ETs or Spacelab modules or both."

This space platform would provide ample laboratory space to begin at least pilot production of the kinds of products envisioned in the Space Processing Program. In addition, the ET hydrogen tank could be converted into a large space structures manufacturing facility.

Kingsbury said that the studies are far from complete at this time but that all