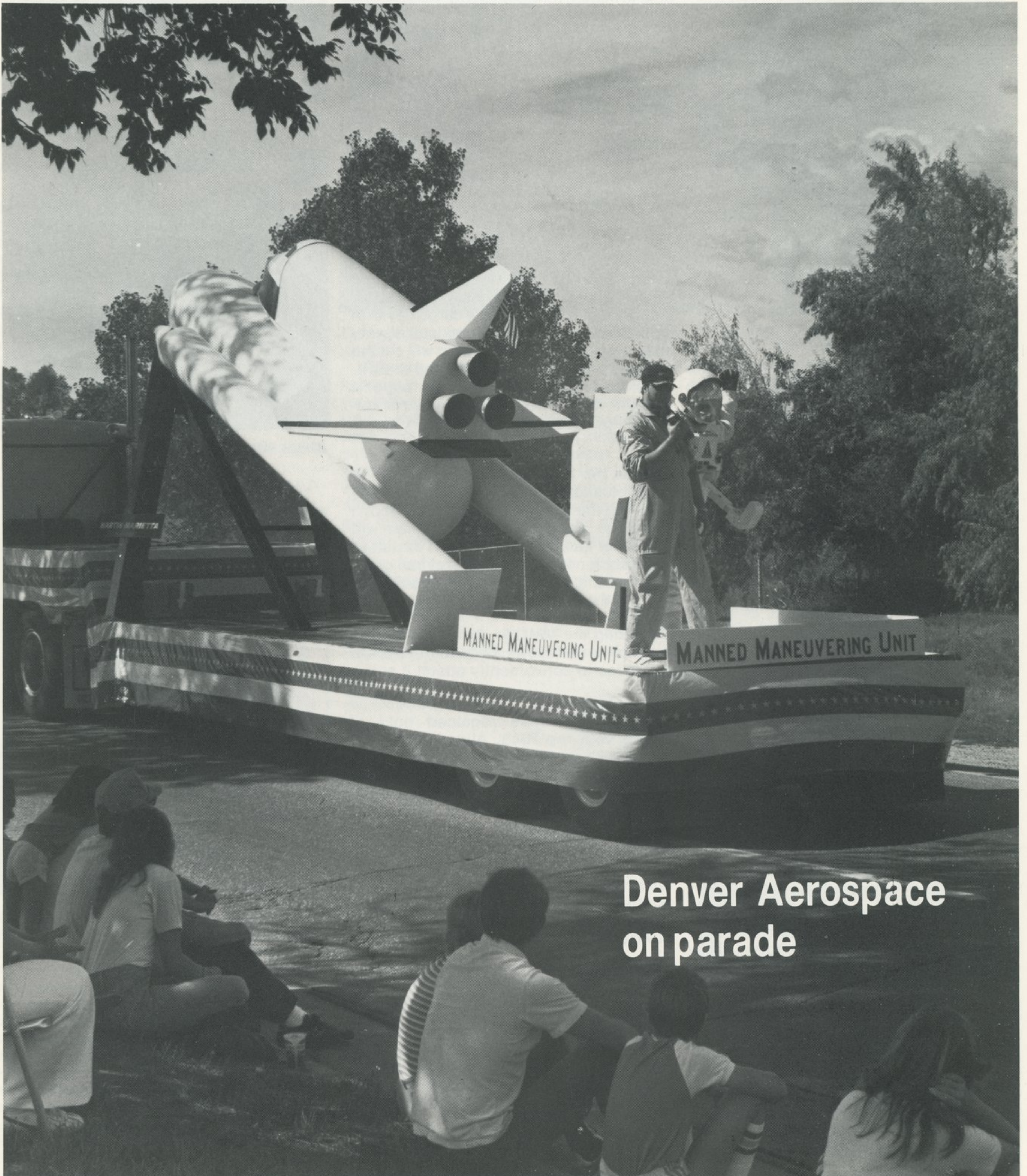


NUMBER 19/1984



Denver Aerospace  
on parade

# Palapa rescue mission step by step

Space shuttle mission 51A, scheduled for launch November 2, will mark the first time NASA has conducted extravehicular activity (EVA) for a commercial user. It also will be the first time a satellite previously deployed will be returned to Earth.

The manned maneuvering unit (MMU), designed and built by Denver Aerospace, will play a key role in those historic firsts, aimed at rescuing the Palapa B-2 communications satellite.

That Indonesian satellite was launched during last February's space shuttle mission, but failed to achieve proper orbit after its booster engines malfunctioned. A second satellite, Westar 6, encountered similar difficulties during that same mission, and it, too, may be in line for rescue next November.

Just before space shuttle Discovery's rescue mission, both the Palapa B-2 and Westar 6 communications satellites will be commanded to fire onboard propulsion systems to maneuver them down to an altitude of approximately 200 nautical miles. In addition, the satellites' spin rate of 50 rpm will be reduced by hydrazine jets to about 1 rpm (6 degrees per second). For an early November launch date, those maneuvers likely will be performed in mid-September.

After launching two other satellites on that same mission, the orbiter Discovery will proceed to a rendezvous orbit with Palapa, flying an approach pattern similar to that used to rendezvous with the Solar Maximum Mission observatory satellite last April. On mission day five, astronaut mission specialists Joseph P. Allen and Dale A. Gardner will begin an EVA phase, entering the cargo bay through the orbiter's airlock.

Current planning calls for Allen to take an MMU and fly out of the cargo bay toward Palapa. Attached to the arms of the MMU will be the apogee kick motor capture device (ACD), the mechanism to enable him to dock with the satellite. The key section of the device is a 4-foot "stinger" pole with three spring-loaded toggles near the tip. A 36-inch diameter guide ring is mounted near the base of the stinger to mate with the satellites' aft ends.

Allen will maneuver the MMU, with ACD attached, to the bottom of the satellite where the nozzle cone of the apogee kick motor (AKM) of Palapa will be visible. He then will close in, inserting the stinger pole into the AKM nozzle. Once the pole has penetrated past the throat of the motor, he will deploy the three toggles manually, achieving a soft dock with the satellite. The next step is to operate a torque wheel manually, retracting the stinger pole to pull the ACD guide ring onto the aft end of the satellite. That will secure the astronaut, MMU, and capture device rigidly to the satellite.

Once securely docked, Allen will activate the automatic attitude hold system on the MMU. That procedure will command the MMU gyros to fire thrusters in a sequence designed to nullify all remaining spin rates of the satellite. Thus, Palapa will be stabilized, and Allen will be able to maneuver it with MMU thrusters into position for subsequent capture by the orbiter's remote manipulator system (RMS) arm.

While Allen is performing the capture, Gardner will be preparing equipment in the cargo bay for securing the satellite and astronaut Anna L. Fisher, the third mission specialist, will be preparing the RMS arm for the retrieval phase.

With MMU capture completed, Discovery will maneuver closer, so the manipulator arm can grasp Palapa at the RMS grapple fixture secured to the front of the ACD. Fisher then will grapple Palapa with the RMS arm at the grapple fixture, and lower it into the cargo bay with its top facing down, and Allen still attached to the bottom. Gardner then will cut the extended antenna on Palapa and stow it. Next, he will attach a special support bracket—the antenna bridge structure (ABS)—over the dish antenna on top of Palapa.

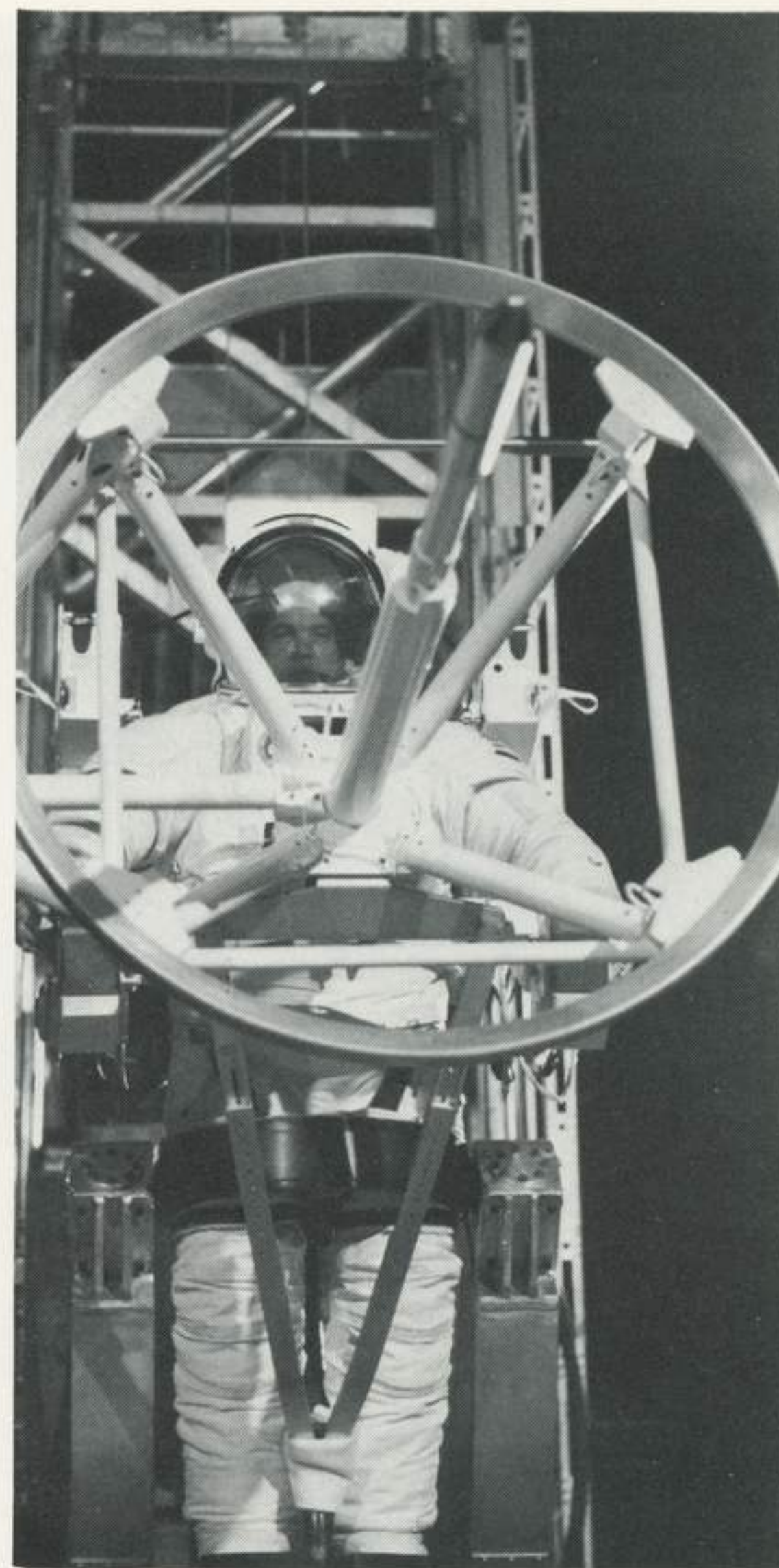
When the ABS support bracket, which includes another RMS grapple fixture, is secured, the satellite will be raised above the cargo bay and released. Allen will maneuver Palapa with the MMU thrusters to reposition it so the RMS arm can grapple it at the newly installed attachment point on the ABS.

Docking the MMU to the bottom of the satellite is necessary because there are no places to conveniently attach it at the top.

Once Fisher has regained hold of Palapa with the RMS, Allen will detach manually from the bottom of the satellite, leaving only the tip of the ACD still in the AKM. Fisher then will bring Palapa down into the cargo bay so Gardner can clamp a special adapter fixture to the bottom of the satellite. That adapter fixture will enable Palapa to be latched to a pallet in the cargo bay for return to Earth. Allen will return to the orbiter, secure the MMU in its flight support station, and proceed down the cargo bay to assist Allen.

After Palapa has been latched to the pallet, the ABS will be removed from the top of the satellite. Allen and Gardner then will stow EVA equipment and return to the cabin.

If the Westar satellite is to be retrieved on that mission, Discovery will begin rendezvous procedures the following day. The second EVA will begin on mission day seven. Similar procedures will be followed to capture and secure Westar,



Palapa simulation photo by Pat Corkery

which is almost identical in size and external characteristics to Palapa. Westar will be secured to another pallet in the cargo bay and both satellites will be returned to Earth on the ninth day of the mission.

## On the cover

Denver Aerospace's participation in the annual "Lakewood on Parade" two-day Labor Day holiday celebration featured a public relations department float with a 1/10th-scale space shuttle model and a full-sized manned maneuvering unit (MMU). "Lakewood on Parade" is a non-profit organization that each year stages the weekend of parade, entertainment, and concessions to raise funds to give two or three graduating seniors from the city's four high schools university scholarships. Money comes through donations from business and community organizations and from the food and beverage concessions. George E. Hoerter, chief of the company's editorial section, this year was executive vice president and parade chairman for the event. He becomes president of "Lakewood on Parade" next year. Pictured on the float is David G. Welch III, member of the special projects section of Denver Aerospace public relations.

## 21 earn awards

# Inventions, innovation are lifeblood of Denver Aerospace

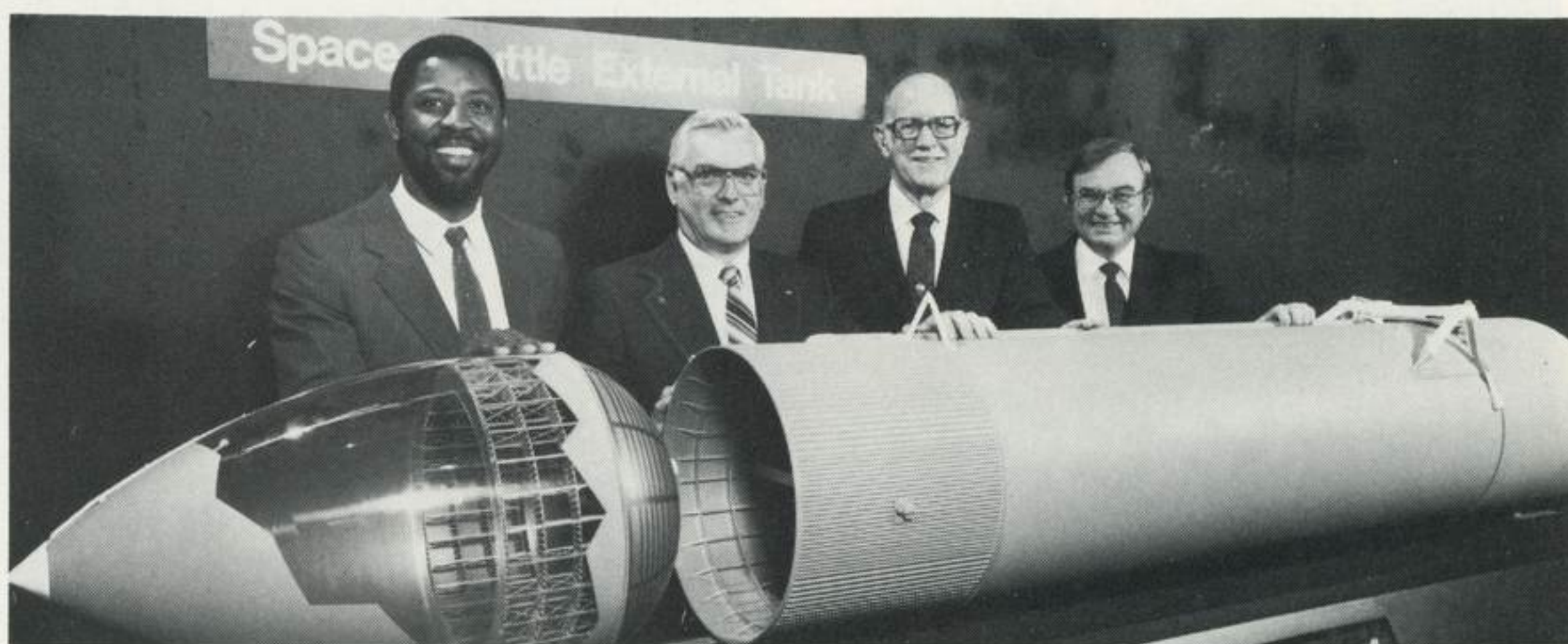
When asked the purpose of an invention, Benjamin Franklin once countered: "What is the use of a newborn child?"

Innovations are the lifeblood of Denver Aerospace, vital to maintaining the company's stature as a leader in technological and scientific breakthroughs.

The 21 most recent winners of cash awards from the Denver Product Development Review Board for their inventions:

Carlos A. Ramirez, production operations/Michoud: "Intelligence Safety System—Forbidden Volume (ISS-FV);" Carlos A. Ramirez and Donald C. Frazier, production operations/Michoud: "Robot Self-Programming End Effector;" Donald A. Thomas, engineering mechanics: "A Sprayable Elastomeric Adhesive for Bonding Elastomeric Materials," "Sprayable Ablative Heat Shield Materials," and "Spray System Solvent Flush;" Dr. Robert K. McMordie, engineering mechanics: "Hybrid Thermocline Thermal Energy Storage Tank," and "Rotating Solar Receiver Tube;" Frank N. Stone, Michael A. Badinger and Dr. Brahmanpalli N. Ranganathan, product assurance/Michoud: "Computerized Mathematical Procedure for Comparison of Scans and Traces Obtained from Instrumental Analysis Techniques;" Mark G. Rossi, electronics: "Low-Speed Ramp Activated VCC Failure Mode Module;" John J. Roehling, facilities and services: "Acrylic-Plexi Sneeze Guards;" and Dr. Wayne E. Simon, engineering mechanics, "Subliminal 3-D Vision."

Also, Melvin W. Kueth, technical operations/space systems division: "Low Loss Radio Frequency Multi-Channel Rotary Joint;" Dale C. Rudolph, engineering mechanics: "Rotary Actuator, Mechanical, Stored Energy;" Law-



Shown with a model of the external fuel tank for the space shuttle, Donald A. Thomas (second from left) has been honored for his "significant inventive" contributions to the tank production program. Kenneth P. Timmons (second from right), former vice president and general manager of the Michoud division where the external tank is manufactured, presented a cash award to Thomas. Others participating in the recent ceremony were Richard P. Merschel (right), manager, mechanical materials engineering; and Clark W. Johnson (left), unit head, composites laboratory. Thomas' adhesive system, heat shield ablator, and spray system solvent have played important roles in productivity and profitability on the external tank program.

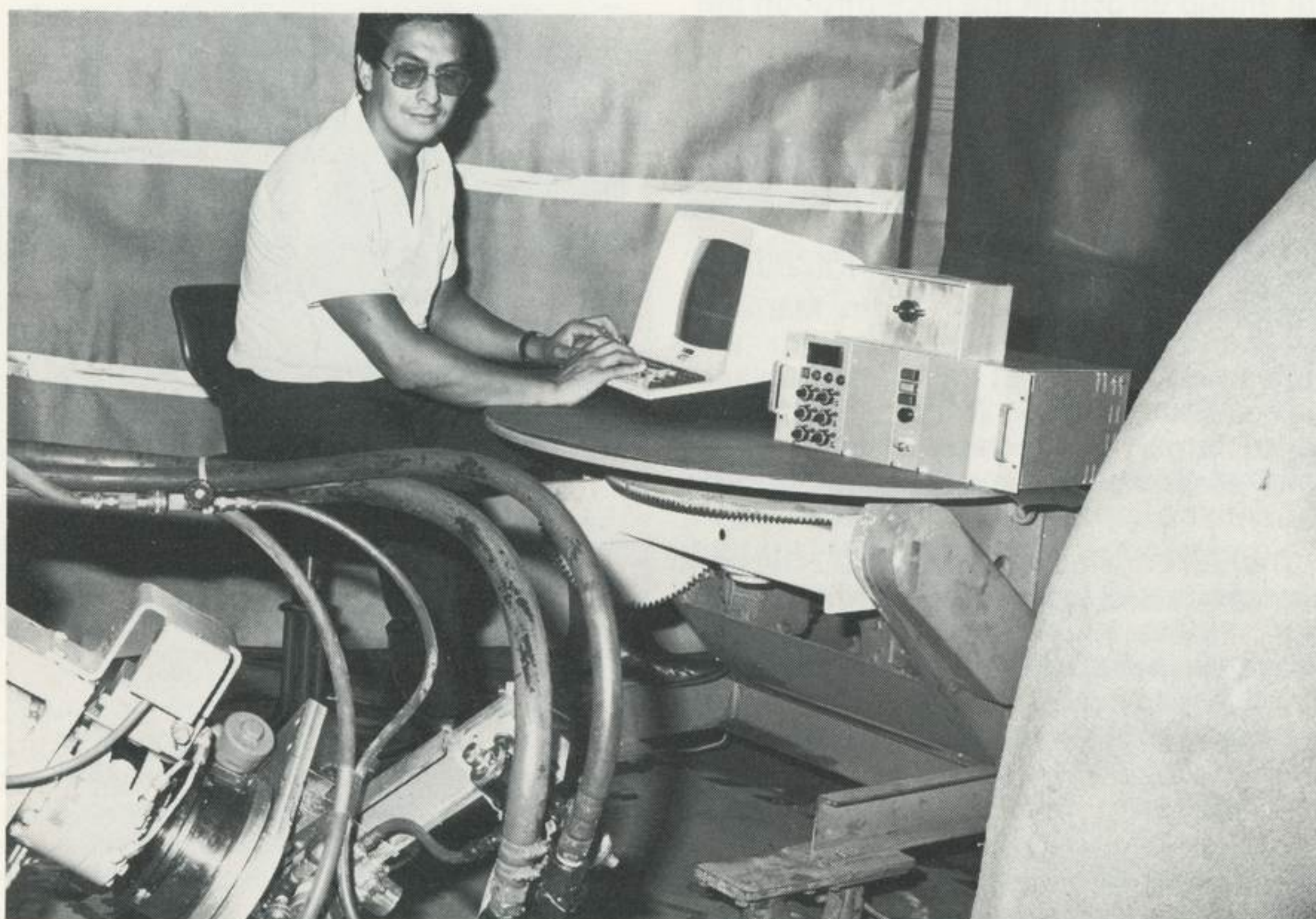
rence R. Redd, engineering mechanics: "Multiple Engine Aeroassisted OTV (Orbit Transfer Vehicle);" John R. Lager and William R. Llewellyn, engineering mechanics: "Thermally Tightened Space Truss Structures;" Neil J. Butterfield, engineering mechanics: "Large Diameter Separation Joint;" Dr. Benton C. Clark III and Todd E. Crumbaker, electronics: "High-Brilliance Lensless Projection of Test Patterns;" William D. Nygren, engineering mechanics: "Low Torque Anti-Backdrive Device (ABD);" Curtis E. Farrell, systems engineering/space systems division: "Quantitative Risk Analysis Methodology;" and Matthew M. Wallo, engineering/Michoud: "Ethylene Acrylic/Epoxy Ablative Material."

## Highway dept., Company take aim on traffic mishaps

Denver Aerospace and the Colorado Highway Department have improved signage and lights to help reduce the potential for vehicular accidents on Highway 75 leading into the company's main plant at Waterton.

T.M. Crawford, director of personnel safety and security, noted the highway department has put up improved curve warning signs with flashing yellow lights along with the chevron-type curve warning signs. The company also has put up warning signs with flashing yellow lights as well as traffic cones on the highway divider between incoming and outgoing lanes.

"We will continue to work with the highway department and two consulting firms to determine other measures to reduce accidents," Crawford said. "However, the most important part of accident prevention rests with employees—driving carefully and observing posted speed limits."



Carlos Ramirez controls the "business end" of one of Michoud's two Cincinnati Millicron HT-3 robots. His intelligence safety system, for which he recently won a cash award, can analyze and make decisions to maximize safety of robotic applications.

### MARTIN MARIETTA NEWS Published by Public Relations MARTIN MARIETTA AEROSPACE

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

Technical Operations:	Floyd R. Teiffel Jr. 6872
Production Operations:	Steven L. Cohen 3369
Business Development:	E. W. Andrews 4619
Space & Electronics Systems Division:	Robert I. Curts 3639
Space Launch Systems Division:	John H. Pond 9165
Business Management:	Daphne R. Gillison 3155
Personnel/Recreation:	Leroy Hollins 6750 Lori A. Sharp 6605
Michoud Division:	Evan D. McCollum 3788
Vandenberg Operations:	Richard L. Kline 2202
Canaveral Operations:	Robert V. Gordon 9108

DENVER AEROSPACE  
P.O. Box 179—Denver, CO 80201

September 14, 1984

## Education with Industry marks 22nd year

Three U.S. Air Force officers—Maj Mario S. Cafiero and Capts Charles F. Zacchero and Thomas A. Anderson—have begun their service's 10-month Education with Industry (EWI) program, marking the 22nd year such students have been assigned to Denver Aerospace.

EWI is a graduate-level program administered by U.S. Air Force Institute of Technology (Air University) at Wright-Patterson AFB, OH. Essentially a management internship, emphasis is an on-site industrial educational experience, aimed at improving the officers' managerial qualities and technical competence. The program provides the student-officer a greater understanding of production, procurement, and management concerns shared by industry and its customer. Historically, upon completing the programs EWI graduates have been assigned primarily to systems or logistics commands where interface with the aerospace industry occurs frequently.

The student-officers actively participate in work assignments at Denver Aerospace and are treated as though they are, indeed, Martin Marietta employees.

Cafiero comes to the program with 13 years of military service from Andrews Air Force Base (AFB), MD, where he was special mission select navigator for the 89th Military Airlift Wing. That assignment entailed navigating C-135 and C-137 aircraft on worldwide special air missions supporting the President and



Vice President of the United States, cabinet and congressional leaders as well as other prominent civilian and military leaders. He holds an master of science (MS) degree in systems management from the University of Southern California and a bachelor of science (BS) in aero technology from Arizona State University.



Zacchero most recently was a missile combat crew commander at Little Rock AFB, AK, where he commanded a four-member Titan II missile combat crew and managed a multi-million dollar intercontinental

ballistic missile (ICBM) complex. A six-year veteran, he has an MS in industrial management from the University of Arkansas and a bachelor of arts (BA) in political science from the University of Pittsburgh.

Anderson, also a six-year veteran, was contract performance evaluation officer for the Ballistic Missile Office (BMO) at Norton AFB, CA. There he managed contractor performance for Peacekeeper, small ICBM and Minuteman contracts valued at more than \$1.3 billion. His master of business administration is from Southern Illinois University; his BA in business administration and economics is from Doane College, Crete, NE.



Margaret A. Clark-Mather demonstrates a prototype modularized work environment, installed recently in Engineering Bldg room 222. The picture shows one person's office within the total configuration. About eight individuals—most of whom are involved in engineering service order (ESO) and independent research and development (IR&D) workstation hardware/software evaluation activities within the larger computer software development environment (CSDE) project—will give feedback on the new office stations. Those new office arrangements will be used to make optimum use of the modularized design, layout, and space for the software department's homeshop, research, training, and laboratory personnel in the Software Center of Excellence at Littleton Systems Center (LSC).



Robert J. Molloy (center), space defense initiative director, recently was presented a special American Institute of Aeronautics and Astronautics (AIAA) Space Shuttle Flag Award. He was selected the Rocky Mountain section distinguished recipient for "outstanding continued service to the profession" through AIAA participation. Other Denver Aerospace flag award recipients were: John W. Robinson (left), vice chairman of the Rocky Mountain section; Dale A Fester (right), section awards chairman and national AIAA director for propulsion and energy; Norman R. Augustine, company president; Dan C. Bochsler; Jackie O. Bunting; J. Donald Doub; Ralph N. Eberhardt; Paul S. Fedec; Grover W. Hall; and J. Michael Murphy.

## Library's new acquisitions include recent AIAA conferences

The research library, located in second floor module 226 of the Engineering Bldg, ext 6363, has added to its reference and circulating collections.

New materials this month include: *PASCAL Programs for Business*, *Handbook of Practical Gear Design*, *Beam Weapons*, *Software Engineering*, *Glass Engineering Handbook*, and the *1984 Almanac of American Politics*.

Recent American Institute of Aeronautics and Astronautics (AIAA) conference proceedings available on microfiche include: Dynamics Specialist Conference, May 1984; the 25th Structures, Structural Dynamics and Materials Conference, May 1984; AIAA/NASA Space Systems Technology Conference, June 1984; and the 17th Fluid Dynamics, Plasma Dynamics and Lasers Conference, June 1984.

# \$17 million autonomous land vehicle contract signed

Denver Aerospace will develop and integrate technologies for a military robot vehicle capable of completely independent—or autonomous—operation.

The contract was awarded in late August by the U.S. Army Engineer Topographic Laboratories at Fort Belvoir, VA, and will be funded by the Defense Advanced Research Projects Agency (DARPA).

The five-year, \$17 million contract calls for developing and integrating computer systems into a eight-wheeled autonomous land vehicle to demonstrate the application of advanced computer architectures, artificial intelligence, and robotic technologies.

As presently conceived, the autonomous land vehicle will be completely self-contained and will be operated independently of any human intervention by an artificial intelligence system in its computer data base. Various sensors on the vehicle—television cameras, laser radar—will feed data to the vehicle's computer system, giving it a picture of what is in front of it and enabling the vehicle to determine and react to its environment. Based on what the vehicle "sees," it will be able to change its course to avoid obstacles, or even plan a different route to its objective.



Concept by Dennis Clark, Denver Aerospace graphics department

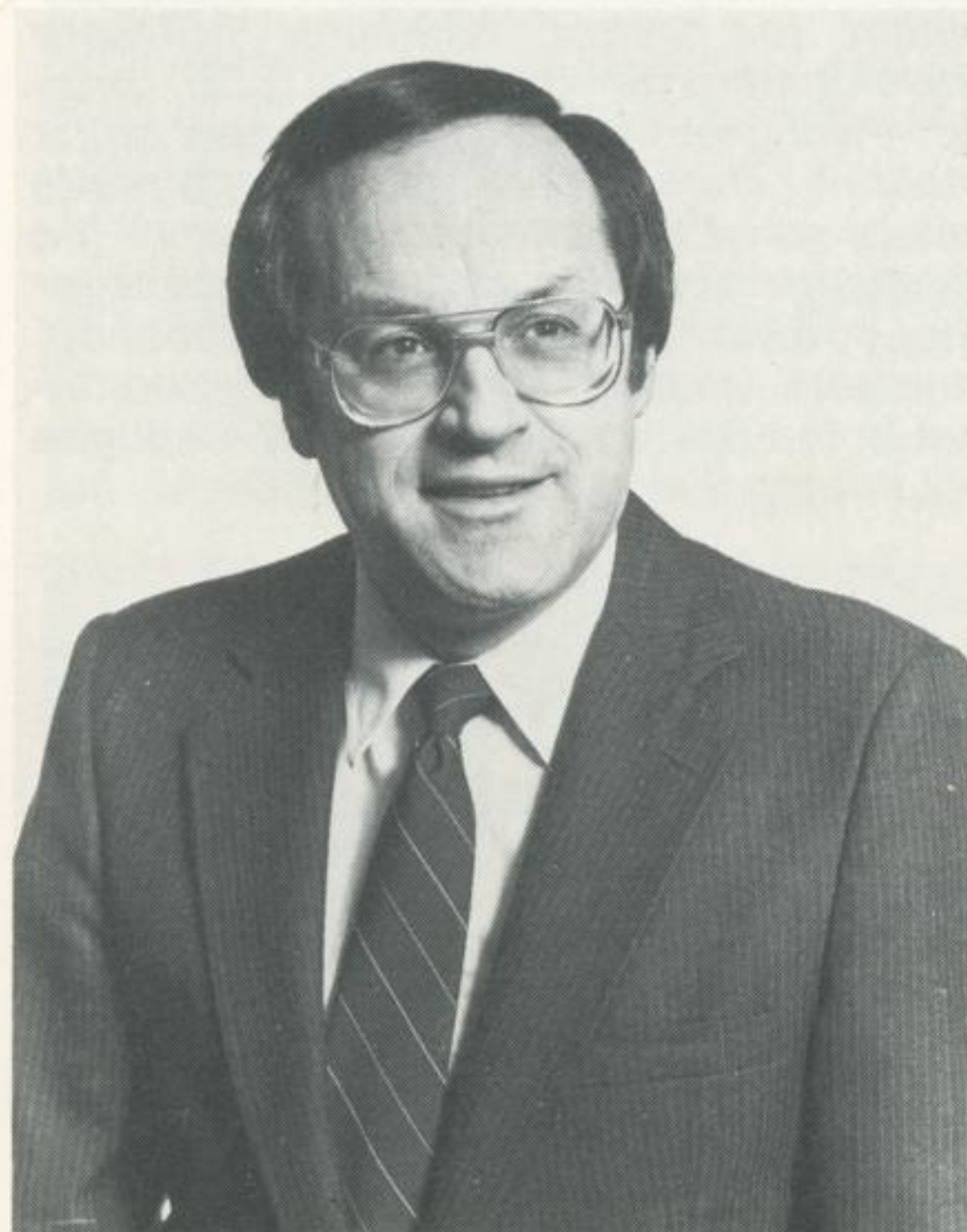
"Development of the autonomous land vehicle is only one step toward proving the technologies for autonomous robotic land vehicles, aircraft and spacecraft," said Roger T. Schappell, principal investigator and program manager. "The vehicle will be used as a test bed for advanced artificial intelligence, computer vision, advanced computer architectures, and robotic technologies—most of which still are in early stages of development."

The contract calls for demonstration of technology developments each year. By 1985, the vehicle must be able to travel 20 kilometers over a preset paved road. In 1986, the vehicle also will be able to recognize obstacles in its path and avoid

them. During 1987, the vehicle will demonstrate off-road capability over irregular terrain. By 1988, it must be able to recognize landmarks and perform more sophisticated navigation. At contract expiration, it is expected the vehicle also will be able to replan around impassable objects, for example, replan a route to its objective if faced with a washed-out bridge.

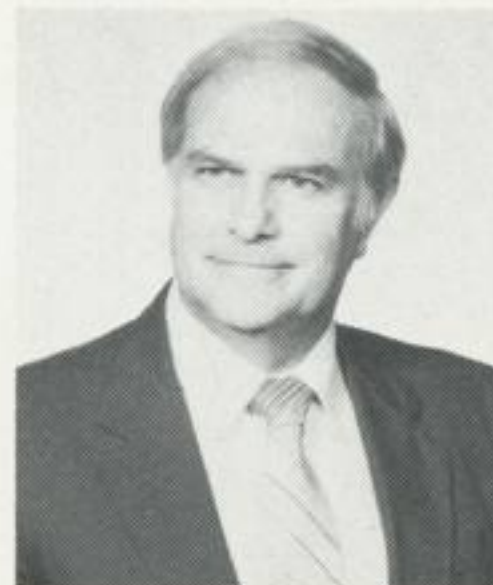
DARPA considers the vehicle a national test bed for the developing technologies, and has outlined a multitude of military and nonmilitary uses for an autonomous land vehicle. Such a vehicle, for example, would be able to penetrate and perform tasks in areas hazardous to humans.

Martin Marietta Aerospace has been involved in the development of artificial intelligence systems and advanced robotics for 18 years, and currently is involved in 34 programs dealing with those developing technologies.



James W. McAnally, vice president of defense systems, has been named 1984 Denver Aerospace United Way campaign drive chairman. This marks the first time company upper management has become so heavily involved in the annual United Way campaign, and is intended to heighten the program's visibility and, therefore, increase employee involvement and participation. Leroy Hollins, recreation and personnel services administrator, will continue as in past years to coordinate the campaign drive, which will kick off Oct. 8 and end Nov. 9. He will be assisted by Fitzroy Newsum of public relations.

Aerospace,  
military  
audiences briefed  
on mission success



John P. Gartin's audience included more than 50 persons from eight major aerospace firms and military installations in the Colorado Springs/Denver areas during a recent speaking engagement.

Gartin, Denver Aerospace Peacekeeper quality assurance chief and member of the American Society of Quality Control (ASQC), delivered an overview of the mission success role within Martin Marietta Corporation. The presentation included an approved Peacekeeper receipt-to-launch film that showed the assembly and checkout process for the missile.

The occasion was a joint ASQC/Society of Logistics Engineers (SOLE) chapters meeting at Peterson Field at the Springs.

Want  
to make  
your  
vote count?

FIRST  
you must register.

MARTIN MARIETTA

## Recreation

(Editor's note—Martin Marietta Denver Aerospace's Recreation Department, exts 6750 and 6605, is located in Engineering Bldg, module 124. Flyers on sports and other extracurricular activities, discounted sports, entertainment and travel tickets, and special sales are available from that office and from the department's information racks throughout the company.)

**Alpine**—The Rocky Mountain Alpine Club is offering a one-day course Sept. 22 for Red Cross certification in one- and two-man cardiopulmonary resuscitation (CPR), mouth-to-mouth resuscitation, obstructed air passages, and CPR for children. Cost per participant is \$6.50 (Mike Paul, ext 8305). Also, the group's fall picnic and general membership meeting will be at the South Turkey Creek picnic area Sept. 29 (Barb Converse, ext 4748).

**Flying**—Pilot Mike Ryer will discuss aerobatic flight and show a video on the sport at the 5 p.m. meeting of the Titan Flyers, Tuesday, Sept. 18, in the company's recreation area clubhouse (Dan Romceovich, ext 7768).

**Parapsychology**—The Parapsychology Club's monthly meeting will undertake basic experiments to investigate the individual's personal psychic potential. The session will begin at 5:15 p.m., Thursday, Sept. 20 in room 200-A at Denver Systems Center (DSC). Names of non-badged employees must be submitted to Gloria Katz, ext 5609, by Wednesday, Sept. 19.

**Riding**—The Ridgerider's Saddle Club plans a local trail ride, beginning at 10 a.m., Saturday, Sept. 15 from the Titan test area, as well as a "bull roast" in the company's recreation picnic area, beginning at 1 p.m., Sunday, Sept. 16 (Frank Roe, ext 7393).

**Running**—Jeff Findle of the Waterton Shepherders Running Club, ext 9576, is the contact for those interested in the five-mile Corporate Team Race to be held in Denver's City Park, Sept. 30.

**Skiing**—Rain or shine the Martin Marietta Satellite Ski Club's fall picnic will begin at 5 p.m., Sept. 28 in the company's recreation area—and it's free of charge to all new 1984-85 season members (Ski Phone, ext 3477).

**Volleyball**—Entry deadline for fall volleyball leagues is Friday, Sept. 21. All Martin Marietta employees and their immediate family members—18 years or older—Data Systems, and Armed Service personnel are eligible to participate on a first-come, first-served basis (Recreation, ext 6750).



Robert G. Morra (left), vice president of technical operations, presents a \$5000 Denver Aerospace check to Allan Huth, Colorado Association of Commerce and Industry (CACI), in behalf of the Colorado Advanced Technology Institute. The donation is part of the company's continuing awards and grants program.

## Gold C values from A to Z

Automobile gasping for a tuneup? Favorite skirt open for a new zipper? Gold C value books have discount coupons for those and literally hundreds of other needs, fast food, and entertainment.

Those discount coupon books are available at \$7 each from any Ridgeriders Saddle Club member. Contacts include Bruce Torbeck at Greenwood, ext 1685; Olivia Martin at Westpoint, ext 7890; Phil Lukens at Denver Systems Center (DSC), ext 9564; Mary Smith at Space Support Bldg (SSB) and Space Support North (SSN), ext 8410; Joe Carroll at Littleton System Center (LSC), ext 0553; and Irene Woodzell, Engineering Bldg, ext 5804.

## Tom Bailey wins Shepherder's 2 1/2-miler in Canyon

Tom Bailey finished the recent 2 1/2-mile event of the Waterton Shepherders Running Club's biweekly canyon run in 14 minutes and 56 seconds for the best time, but ended up 35th in the race through the handicapping.

He was followed by Tom Barnish and Darrell Deering, both of whom clocked 15:16 and came in first and 15th, respectively, through handicapping.

The Shepherders' running competitions are usually held every other Thursday and are of varying distances. Contacts are John Huleatt, ext 7705; Terry Heggy, ext 7556; and Jeff Findle, ext 9576.

## Ninmer on 3rd place national amateur baseball team

A recent new hire at Martin Marietta pitched and played first base for the Denver-area team that tied for third place in the Stan Musial World Series, the American Amateur Baseball Congress' national championships, at Battle Creek, MI, over the Labor Day holiday.

Charles W. Ninmer, who joined Denver Aerospace's technical applications and flight software design department last February, is the son of James W. Ninmer. The father has been with Martin Marietta 14 years and is a senior staff engineer in ground electronics production systems (GEPS).

Ninmer's team qualified for the 50-year-old amateur tournament by winning the regional title at Denver over other teams from Colorado as well as Oklahoma, Texas and New Mexico, by earlier placing second in state competition.

## Cooper holes in one on fourth at Englewood

Wilton L. Cooper of the Martin Marietta Research and Test League, recently made a hole-in-one on the par three, 140-yard shot fourth hole at Englewood Municipal Golf Course.

Cooper began playing golf in high school about 15 years ago and noted his hole-in-one "was the first I've ever seen, let alone made." The bad news, he added, was that he made it playing against his boss. He added he ended up with a 47 for the nine holes—and was beaten ultimately by his boss.