

Artificial Intelligence
Space Station
Space Shuttle
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July 18, 1987

Number 14



Pasquale Gambatese, a senior test engineer on the space station program, demonstrates the Atmospheric Revitalization Group

Expert System in Martin Marietta's Core Module Integration Simulator, Huntsville, Alabama. See page five for story.

Space Launch Systems wins pact

Martin Marietta Space Launch Systems will conduct a year-long design study of an advanced launch system under a \$5 million Air Force contract.

The contract was one of seven awarded July 10 in a cooperative Department of Defense (DoD)/National Aeronautics and Space Administration (NASA) initiative aimed at revitalizing the U.S. space transportation technology and capacity base, the Air Force said.

"These contracts represent another significant step in recovering our nation's space launch capability," said Air Force Secretary Edward C. "Pete" Aldridge, Jr. "More important than that, however, they initiate an expansion of that capability to assure affordable access to space for future DoD and NASA requirements."

The contracts will enable the Air Force and NASA to undertake the intensive, focused technology program and competitive concept definition necessary to support the development of a full operational advanced launch system. The Air Force says its primary goal with the program is to reduce significantly the cost of getting to space.

James W. McCown, vice president, Advanced Programs, Space Launch Systems, said his company was "very pleased to win this contract because it represents the next-generation launch vehicle."

"It's a major endeavor to us, and represents a continuation of our major product area here in Denver, which has been the Titan," McCown said.

The company plans to submit designs for an interim system, which would use existing technology and be operational in 1993 or 1994, and a longer-term system, which would use more advanced technology and be launched by 1998. The designs will include the entire scope of space launch operations, including manufacturing, processing and launch facilities.

Martin Marietta has been investigating various launch systems under contract to NASA as part of a Space Transportation Architecture Study (STAS) that began in September 1985. STAS is a joint DoD/NASA evaluation of national space transportation and technology requirements through the year 2010. ■



P.J. Bennett, manager of performance measurement systems (PMS) for Martin Marietta Astronautics Group, seated, demonstrates a simplified version of the PMS designed for smaller contracts with earned value requirements. Watching the demo are, standing left to right, Col. John B. McCabe, commander of the Air Force Plant Representatives Office, and Alan P. Babbitt, assistant deputy chief of staff/comptroller, headquarters Air Force Systems Command.

Company receives AF certification

Martin Marietta Astronautics Group has received the Air Force's "Certificate of Triservice Acceptance," signifying that the group's performance measurement system (PMS) meets criteria set by the Department of Defense (DoD) for production contracts.

The PMS is used to manage costs and schedules. It consists of a set of management disciplines outlined in a manual.

Alan P. Babbitt, assistant deputy chief of staff/comptroller, headquarters Air Force Systems Command (AFSC), presented the certificate to Peter B. Teets, president, Astronautics Group, during a ceremony on July 1. Babbitt also toured the factory and saw a demonstration of a simplified version of the PMS designed for smaller contracts with earned value requirements.

P.J. Bennett, manager of performance measurement systems for the Astronautics Group, said the company demonstrated that it had a PMS that met DoD criteria on the Titan IV program. If a certified system is not continuously implemented, a company may not be able to receive progress payments on DoD contracts or remain on the approved bidders list, he said.

According to Bennett, the Air Force reviewed the PMS for a year after work began on the Titan IV contract, and the company was able to demonstrate successful implementation of the system with minimal corrective action.

The company received a similar certificate for research and development contracts in March 1982. ■

Mars meeting set for CU July 18-22

Five Martin Marietta employees will be among 175 persons presenting papers during "The Case for Mars III" conference, to be held July 18-22 at the University of Colorado (CU).

Dr. Benton Clark, Dr. Harold Filbert, Bill Willcockson, Henry Rackley, and Dale Pettit prepared papers for the conference. Martin Marietta is also sponsoring a reception at the conference.

The first two days of the conference will emphasize education and public awareness, while the last three days will be devoted to technical presentations and workshops on scientific, technical and social issues and strategies for exploration of Mars.

James Fletcher, National Aeronautics and Space Administration (NASA) administrator, will be the featured keynote speaker for

the technical program, which also includes extensive participation from scientists representing NASA, universities, the Air Force, and aerospace companies.

The conference is sponsored by the Jet Propulsion Laboratory; Los Alamos National Laboratory; NASA's Ames Research Center, Marshall Space Flight Center, and Johnson Space Center; The Planetary Society; and the American Astronautical Society.

Conference registration begins at 9 a.m. July 18 at the Glenn Miller Lounge, University Memorial Center, on the CU campus. The regular registration fee is \$60, or \$25 for students and educators. No registration is required for those attending public sessions on July 18 and July 19. Call 492-5437 for further information. ■





Attending a seminar on process simplification are, standing, left to right, Jack Macy, Santo Bertuzzi and Jim Ritz. Seated are Gene Horak and Buck Reynolds.

PROJECT CHALLENGE

(Editor's Note: the following update by Santo Bertuzzi introduces the "Process Simplification" section of Project Challenge.)

One of the keys to the success of competitive companies lies in analyzing and simplifying the processes by which they do their work. With that in mind, Project Challenge is taking a number of actions aimed at simplifying all Martin Marietta's work processes.

During the course of the past few months, you have read about the initiatives we are undertaking to automate the way we work. These include computer-aided engineering, computer-aided design, and computer-aided manufacturing; manufacturing resource planning; and up-graded integrated scheduling system and the cost/schedule control systems criteria. But in order to achieve true cost savings, we also need a clearly defined, simplified understanding of how we do our work.

One of the steps we have taken to analyze and simplify work processes is to visit many companies who have gone through this process themselves, including Raytheon, Hamilton Standard, and Hewlett-Packard. We looked at how they have simplified their work processes, and what problems they have had doing that.

We also have brought Hewlett-Packard on board to assist us in implementing Project Challenge. Primarily, Hewlett-Packard will train us in process analysis and simplification.

An initial management overview session on process simplification was held on June 15,

and a second session was held on July 1. In addition, classes were held on June 30 and July 1 to train team leaders, coaches and instructors who will be responsible for analyzing and facilitating the changes in work processes.

We have chosen several processes at the area where work is done as pilots for simplification under Ken Shipe. The processes and their managers include: return to vendor, Jenny Tyler; printed circuit board line, Gary Romano; functional test, Jim Burr; Titan major weld, Gene Horak; receiving inspection, Bob Schaller; production control order release, Robert Sassman.

In addition, we have looked at practices and procedures to see where they can be simplified, and have found a number of things that keep us from being effective. Heading pilot projects for practices and procedures is Dave Brodie.

The pilot standard procedures chosen as candidates for revision, and their managers, are: engineering change procedure, Robert Glover; liaison calls, Debbie Floyd; non-conformance reporting, Ken Shearer; parts, materials, processes, Ron Kirlin; and systems engineering process, Chuck Roberts.

After the pilot projects are complete, process simplification will start being implemented companywide. This will give all employees a way to participate in improving the way they do their work and helping us become more competitive. ■

Last Titan II taken from silo

An era in U.S. military history has ended with the removal of the last Martin Marietta-manufactured Titan II ICBM from its silo.

The last of 52 missiles deactivated over a six-year period was removed from its silo at the 308th Strategic Missile Wing at Little Rock Air Force Base on June 23. It was shipped to Norton Air Force, California, for storage.

Removal of the last Titan II signaled the first time in nearly 25 years that the missile has not been a part of the U.S. strategic force.

Captain James T. Smith, chief of public affairs for the 308th, praised the Titan II system, which he said was developed to last 10 years, but actually lasted 25.

"Titan II has been a very integral part of America's deterrence system since 1963," Smith said. "It's been a tremendous system. A lot of people down here spent their whole career on Titan II, and are retiring with the system."

Smith said the Titan II has been an economical system, especially since the deactivated ICBMs are now being converted to space launch vehicles. Martin Marietta Astronautics Group is under contract to convert eight of the missiles, with an option for five more.

Deactivation of the Titan IIs began in October 1981. The missiles were removed from silos in Kansas and Arizona earlier. ■

Company offers new dental plan

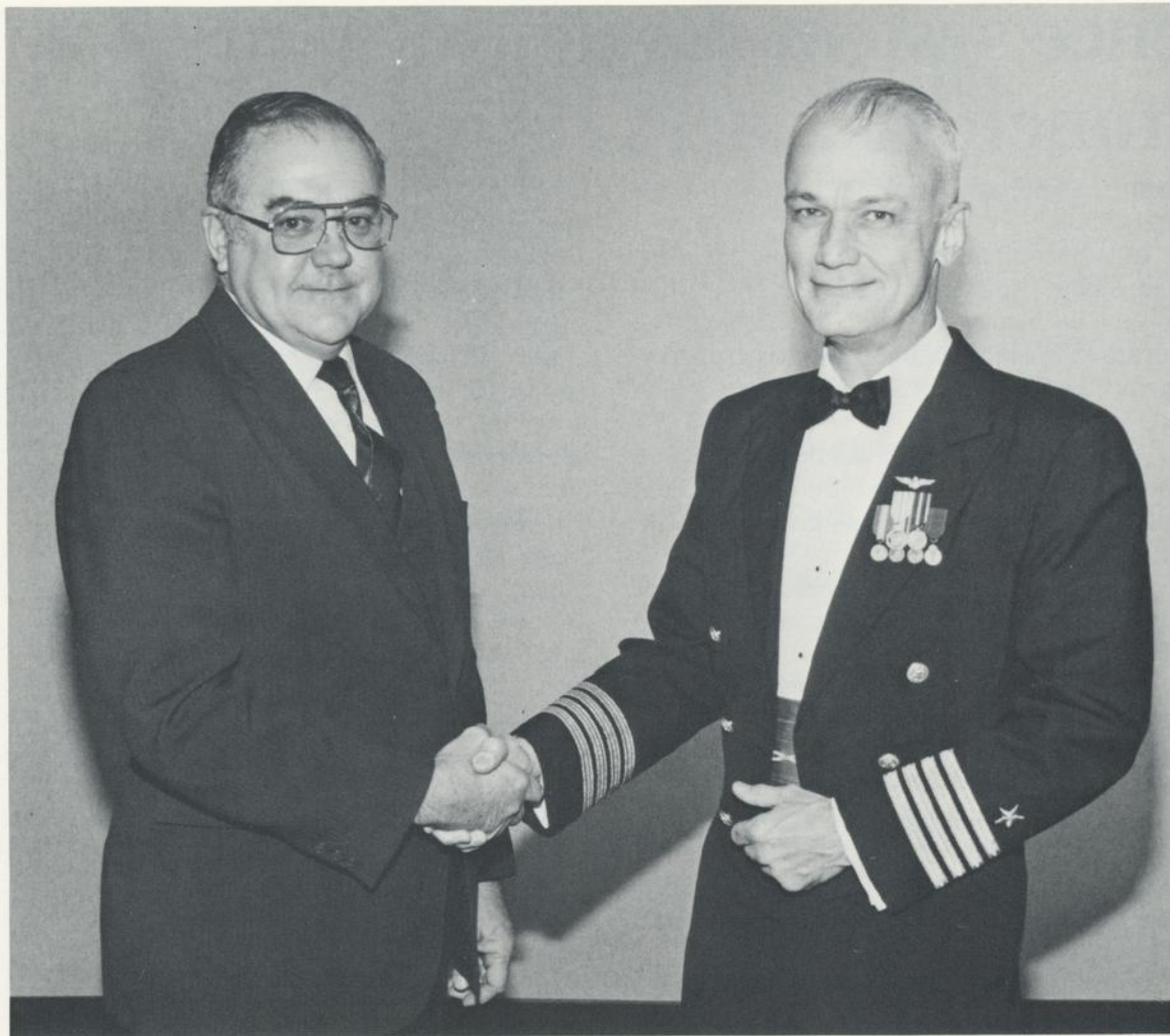
Employees may choose a new dental plan beginning August 1 as an alternative to the existing plan, the Employee Benefits office reports.

Carolyn Aldorfer, chief, Employee Benefits, said the company will begin providing a prepaid dental plan, administered by Safeguard, in addition to the existing plan, administered by Connecticut General Insurance Company.

Under a prepaid dental approach, an employee chooses a participating dentist upon enrollment. An employee generally incurs fewer out-of-pocket expenses with a prepaid plan, but may be more limited in choice of provider or type of care, Aldorfer said.

Enrollment material has been mailed to each employees' home, and includes a list of participating dentists and a comparison of major differences between the Connecticut General plan and the Safeguard plan.

To be covered under the new plan, an employee must complete the enrollment card, choose a primary dentist, and return the form to the Employee Benefits office (Room 125, Eng. Bldg., or MS 1343) no later than Friday, July 24. Employees who do not reply will remain in the existing Connecticut General plan. ■



Astronaut McCandless receives meritorious service medal

Capt. Bruce McCandless, NASA astronaut, right, receives congratulations for the Spirit of St. Louis Medal from Martin Marietta employee John Robinson. McCandless was selected by the American Society of Mechanical Engineers (ASME) in recognition of exceptional achievement as mission specialist on the fourth flight of the space shuttle Challenger, particularly his accomplishment of mission objectives using the manned maneuvering unit. Robinson is chairman of the Spirit of St. Louis Medal Board of ASME.

Procedures defined for matching gifts

Martin Marietta's educational and cultural gift matching program provides an additional incentive for employees to make regular financial contributions to educational institutions or cultural organizations. Employee gifts to educational institutions are matched two-for-one; to cultural organizations, one-for-one.

Any full-time employee with a minimum of one year's continuous service can participate in the program.

Colleges and universities, including junior or community colleges, may receive gifts through the program if they are approved by the appropriate regional accrediting organizations, and recognized by the Internal Revenue Service as organizations to which deductible contributions may be made.

Cultural organizations eligible under the matching gift program are museums, operas, drama companies, dance companies, symphonies, and certain arts and culture centers.

Donations to educational institutions must be a personal gift (not merely pledged) and must be made directly to an eligible college or university in the form of cash or securities having a quoted market value. Gifts to be matched must be a minimum of \$25 and not exceed an annual combined maximum of

\$15,000 per employee, per year. The gifts will be matched \$2 for \$1 up to the combined maximum stated.

The organizations must operate for the benefit of the general public, be located in the United States or its territories, and be tax-exempt under section 501 (c) of the U.S. Internal Revenue Code.

Gifts to cultural organizations will be matched on a dollar-for-dollar basis, with a \$25 minimum and \$1,000 maximum per employee during the calendar year.

For more information about the educational and cultural matching gift program, contact Betty Wooster at Ext. 7-6550. ■

Moore valedictorian at Columbia College

Rebecca L. Moore, finance, Defense Systems, with a perfect 4.0 grade point average, was the valedictorian at the June 1987 graduation at Columbia College in Aurora, Colo., an extension of Columbia College in Missouri.

Moore received her bachelor of science degree in business administration. She took advantage of Martin Marietta's tuition reimbursement program, Columbia College's accelerated semesters, and earned her undergraduate degree in less than three years. ■

Air Force option exercised on IFSS

Martin Marietta Strategic Systems will produce 24 Peacekeeper instrumentation and flight safety system (IFSS) shipsets under a \$53.5 million contract option exercised by the Air Force this month.

The shipsets will be delivered between December 1990 and November 1991.

The option is the first to be exercised in a \$253.8 million add-on to the IFSS production contract awarded in August 1986. A second option can be exercised in July 1988.

Carried in the flight test missiles, the IFSS transmits information on the performance of the missiles during flight. It permits safe destruction of a missile should a serious malfunction occur. ■

Space Systems wins contract

Martin Marietta Space Systems has been awarded an Army contract to develop acquisition, tracking, and pointing designs for a hypervelocity pellet weapon, which is being evaluated as part of the Strategic Defense Initiative (SDI) program.

Under the \$5.1-million contract, the company also will develop technologies and test critical subsystems to enable the weapon to acquire, track, and point at a target. The weapon will be designed to accelerate pellets to destroy a target by the force of the impact.

The 15-month contract was awarded by the U.S. Army Strategic Defense Command in Huntsville, Ala. It includes a \$6.3-million, 17-month option for acquisition, tracking, and pointing hardware and software testing.

The program, headed by Dr. David A. Nichols, is part of the multifaceted studies being conducted in the advanced SDI product area. Robert B. Bolles heads advanced SDI programs. ■

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Artificial intelligence system developed to predict space station malfunctions, alert crew

Astronauts aboard the National Aeronautics and Space Administration's (NASA) space station may use a system that can predict malfunctions in the station's oxygen supply up to two days before they happen—and then tell the crew how to fix the problems.

The system, a software program, called the Atmospheric Revitalization Group Expert System (ARGES), is a type of artificial intelligence technology that lets machines use the same processes as humans do in making decisions.

ARGES can predict more than 15 different major malfunctions in the part of the oxygen supply, or air-revitalization system, that removes carbon dioxide from the air aboard the space station.

When ARGES suspects that a problem is going to occur, it sounds an alarm to alert the crew. Then it flashes a series of color displays on an astronaut's computer screen, showing what type of malfunction will occur, where the problem is, and when the malfunction is expected to happen. ARGES will also tell the crew how to fix the problem.

ARGES was designed and developed by Martin Marietta in Denver, and was successfully tested in the company's Core Module Integration Simulator (CMIS), a full-scale, working model of a space station module, at NASA's Marshall Space Flight Center in Huntsville, Ala.

ARGES is a prototype of an artificial intelligence system for the entire environmental control and life support system of the space station, which is scheduled to be operating in

orbit 250 miles above the Earth by the mid-1990's.

In other missions, such as Space Shuttle and Skylab, spacecraft had to carry enough oxygen on board to last the full mission. But because the space station will be a permanent facility and its missions will last longer, oxygen will be recycled.

Also, the space station will be NASA's first mission to use advanced automation and robotics technology, such as artificial intelligence.

ARGES would allow astronauts to adjust their work schedules and set aside time in advance to fix problems.

"The astronauts could deal with problems at their convenience and get out of the fire-fighting mode," says Tom Cook, lead engineer for space station artificial intelligence and expert systems applications in Denver. "The goal is to have a system like ARGES manage the entire air-revitalization system, and even other parts of the environmental control and life support system."

In the air-revitalization system, the carbon dioxide removal component is a solid amine water desorbed assembly (SAWD), developed by the Hamilton Standard division of United Technologies Corp., a member of the Martin Marietta space station team. It is about the size of a 21-inch television set. Amine (solid diethylene triamine) is a chemical that readily and efficiently absorbs carbon dioxide.

In the system, air is pumped from a space station module into an amine filter, where the carbon dioxide is removed, and the air is

returned to the module. Then steam is pumped through the filter to force the carbon dioxide into a reduction unit where oxygen can be reclaimed and returned to the station's air supply.

The ARGES software program has expert knowledge of the carbon dioxide removal assembly system. For example, based on information it receives from sensors throughout the system, ARGES may detect a slight weakness in a valve. Then, by using the same "rules of thumb" reasoning that a human expert would use, ARGES would predict the time the valve will fail. ARGES also would have "knowledge" of the crew's schedule, and could suggest a convenient time for repairing the valve.

The space station is such a big project that NASA has divided it into five work areas called work packages. These are managed by four NASA centers and NASA headquarters in Washington, D.C. Martin Marietta heads a team of companies working on Work Package 1, which is managed by NASA's Marshall Space Flight Center.

Work Package 1 includes design, development, test, and evaluation of the space station's U.S. laboratory, habitation and logistics modules; environmental control and life support systems; thermal control systems; internal audio, video, and lighting systems; power and data distribution systems; and certain application software. It also includes fabrication of airlocks and nodes connecting the modules.

Martin Marietta will submit its space station proposal next week. ■

Employee ideas merit rewards

Five Production Operations employees have received cost savings awards through the company's suggestion program, Success Through Suggestions.

Employees who earned monetary awards for their ideas are as follows:

*Betty Darlene Coleman, for suggesting improvements in the method of making electrical connectors to support various programs;

*Richard Morgan, for two ideas, one a modification of a tool used during bladder proof pressure tests to support Titan, and the other a suggestion to salvage and modify spare propellant flow meters to support the integrated launch support contract for Titan;

*David Rizzuto, for a suggestion to modify the SSB airlock change room;

*Anthony Capozzola, for suggesting a holding fixture in the first floor factory machine shop that reduced the potential for errors;

*Ray Czarnek, for a suggestion on how to salvage parts scrapped during fabrication of a Titan III.



Receiving cost savings awards through the company's Success Through Suggestions program are, seated left to right, Betty Darlene Coleman, Richard Morgan, David Rizzuto, Anthony Capozzola and Ray Czarnek. Standing, left to right, are the winners' managers, Chuck Vashus, John Howard, Jim Harrington, Stan Albrecht, Lou Janke, Lloyd Trujillo, Ray Schwindt and Jim Eastham.

Health Awareness Week set for Aug.

A variety of educational literature and health-related tests, as well as a racewalk clinic, will be available to employees during the 3rd Annual Health Awareness Week, scheduled for August 10-14.

The week is hosted by the Employee Rela-

tions and Services department, with participations from United Way agencies that include the American Red Cross, American Cancer Society, the Arthritis Foundation,

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Corporate Games results

Here are the Martin Marietta results from the seventh annual Denver Corporate Games, in which company athletes took second place. Athletes from the Astronautics Group, Information & Communications Systems, and Data Systems competed in track and field, a 5-K road race, swimming, golf, bowling, tennis, volleyball, cycling, and racquetball. Martin Marietta scored a total of 290 points in Division A for companies with 2,500 or more employees.

Team points were scored by the following Martin Marietta team members:

Track:

100-Meter Dash, Men—3rd Place, Stacy Ming (11:12); 100-Meter Dash, Women—4th Place, Krista Kenning (13:73); 1500-Meter Run, Masters, Men—3rd Place, Dan Trujillo (4:37:60); 1500-Meter Run, Women—5th Place Bobbie McCown (6:10:18); 1500-Meter Run, Men—3rd Place, Bill Irvine (4:30:45); 200-Meter Dash, Women—3rd Place, Marlene Gunther (30:56); 200-Meter Dash, Men—2nd Place, Todd Myers, (24:20).

1600-Meter Relay, Men—2nd Place, James Dillinger, Mike Petit, Joe Robb, Stacy Ming (3:34:55); 5K Road Race, Men—18-24 Years, 4th Place, Dave Fester (20:33); 25-29 Years, 2nd Place, Keith Golding (16:46); 30-34 Years, 1st Place, Doug Haas (17:30); 50+ Years, 1st Place, Joe Martin (20:36); 5K Road Race, Women—25-29 Years, 4th Place, Diane Eckhoff (22:15) 30-34 Years, 3rd Place, Sally Cuffin (20:55); 35-39 years, 3rd Place, Sushma Bockhorst (27:28).

Bicycle Time Trials:

Men—3rd Place, Tim Williams (10:03:54); Women—1st Place, Clare Bena (11:50:58).

Bicycle Criterium:

Women—1st Place, Erlinda Kiefel; Men—2nd Place, Tilo Reber; Masters—3rd Place, Gary Cuffin.

Tennis:

Women's Singles—4th Place, Lisa Payne; Men's Doubles—3rd Place, Ernie Berliner, Dave Jackson; Women's Doubles—3rd Place, Carolyn Aldorfer, Cindy Nagy.

Raquetball:

Men—1st Place, Mark Helton; Women—4th Place, Emma Jackson.

Coed Volleyball:

2nd Place—John Shupe (coach), Bob Brown, Jeff Shook, Cathy Gorman, Lauri Heinz, Barb Bowman, Darcy Winterling, Gail Downer, Roxanne Powell, Eric Morningstar, and Pete Silvaggio.

Swimming:

1st Place Overall—Terry Heggy (coach) 100-Meter Master Relay—1st Place, Beth Kalstein, Tom Acree, Diane Mertz, and Grady Romine (59:85); Men's 50-Meter Freestyle—2nd Place, Derek Hansen (26:95); Women's 50-Meter Freestyle—3rd Place, Krista Barker (35:28); Men's 50-Meter Breast—1st Place, Doug Yager (32:51); Women's 50-Meter Breast—4th Place, Phyllis Halvorson (49:06).

Men's 50-Meter Back—3rd Place, Gerard Carter (32:71); Men's 50-Meter Butterfly—1st Place, Dennis Casey (29:38), Men's 100-Meter Freestyle—1st Place, Bob McKenry (59:24); Women's 100-Meter Freestyle—3rd Place, Teresa Ford (1:26:11); 200-Meter Coed Medley Relay—4th Place, Lori Sanstedt, Doug Yager, Dennis Casey, and Phyllis Halvorson (2:25:93); 200-Meter Coed Freestyle Relay—2nd Place, Teresa Ford, Derek Hanson, Krista Barker, and Bob McHenry (2:08:58).

Golf:

2nd Place Overall, Cathy Leigh (88 score)

Bowling:

1st Place, Floyd Teiffel, Earl Layton, Tom Renz, Marilyn Grafner, and Dixie Wilmot. ■

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and the Colorado Optometric Center.

The American Diabetes Association will offer a two-minute diabetes screening and the Arapahoe Community College Fitness Center will conduct percentage of body fat composition testing.

Martin Marietta safety personnel will provide safety literature related to the worksite, home and automobile. Nutritionists from Food Services will be available to answer specific nutrition questions. Information will also be available regarding the company's Employee Assistance Program.

Employees interested in learning about racewalking, an effective non-injurious form of aerobic exercise suited for all ages, can participate in a free racewalk clinic on Tuesday, August 11, at 5 p.m. in the recreation area. The clinic will be conducted by Visha Sedlak, an international racewalk competitor.

Detailed schedules of Health Awareness Week Activities will be available in the recreation racks after July 27. Health awareness activities are scheduled in the Engineering Bldg., August 10; SSB, August 11; DSC, August 12, for all employees in Academy Park and Linpro; Terrace Towers, August 13, for employees at the Towers and Greenwood; and LSC, August 14, for employees at LSC, South Lincoln, and South Park. ■

Employees reminded of new seat belt law

The Plant Protection department reminds employees to observe the new Colorado seat belt law.

Under the law, which went into effect on July 1, automobile drivers and any front-seat passengers are required to wear seat belts and shoulder harnesses if the vehicle is equipped with them. Semi-truck drivers and passengers also must comply with the law.

All drivers, including those operating company-owned vehicles, are strongly urged to comply with the new law, said A.J. Sulzer, chief, Plant Protection. ■

Employee services/recreation

Rocky Mountain Alpine Club—Day Hike/Climb-Gray's Peak and Torrey's Peak, Sunday, July 19. Hike to the top of twin 14,000-foot peaks. This trip requires no technical climbing equipment or ability, but adequate footwear and clothing are important. **Day Hike-Audobon Peak, Saturday July 25.** Hike to the top of Audobon Peak in the Rocky Mountain National Park. **Day Hike/Climb-Long's Peak, Saturday, August 1.** One-day trail hike up Long's Peak. There will be some scrambling required, and climbers will gain over 3,000 feet of elevation on the way to the top, so bring warm clothing, a lunch, and

plenty of water. Call Frank Farrell, Ext. 1-1115.

Macintosh Users—WaterMUG (the Waterton Macintosh Users' Group) will have a Friday Afternoon Club (FAC) and software swap on Friday, July 24. For more information, call Eric at Ext. 7-6815 (or 979-3558 at home).

CWA—The Career Women's Association has organized a series of training meetings. The next meetings will be held at 5 p.m. in the presentation room of the Space Support Building on July 28 and August 6. Call Eileen Tucker, 798-8286 (home).

ArtSaver discount coupons available

Coupons that will enable employees to get discounts at 17 cultural events or organizations throughout the state are available from the Recreation Department.

The ArtSaver discount coupon sheets contain discounts for or free admission to theatre, music, dance and opera performances, as well as to various museums along the Front Range. The coupons are being distributed to employees of companies like Martin Marietta who are members of the Colorado Business Committee for the Arts.

Employees can obtain ArtSaver coupons from the recreation racks after July 22. ■