New era of worldwide space exploration begins

By James Hartsfield

When Endeavour lifts off next month, it will lift more than just a new space station; more than the promise of unprecedented space research; more even than the cornerstone of the largest spacecraft ever built—it will have aboard the start of a new era of worldwide space exploration.

As the first of about three dozen shuttle missions to assemble the International Space Station, the STS-88 crew will initiate a construction site in Earth orbit, where a state-of-the-art laboratory complex will take shape during the coming years as components from across the globe are joined together.

"The International Space Station...is a stepping-stone to the future, and the future of space exploration is all of us working together," Endeavour Commander Bob Cabana said.

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Assistant to the President for Science and Technology pledges support for NASA

President Clinton’s assistant for science and technology visited JSC recently, and returned to Washington pledging to support the International Space Station program and its objectives.

Dr. Neal F. Lane visited JSC on September 22, toured facilities and received briefings on activities here related to the Human Exploration and Development of Space.

Tommy Holloway, manager of the Space Shuttle Program, and United Space Alliance’s President and CEO Russ Turner briefed Lane on shuttle operations, while Randy Brinkley, manager of the International Space Station program, provided an overview of station progress and plans. Dr. Nigel Packham, crew commander, Lunar/Mars Life Support Test Project, discussed closed loop life support system development efforts, and Dr. Doug Blanchard provided a tour of the Lunar Lab in Bldg. 31. John Muratore, X-38 project manager, provided an overview of the X-38, the crew return vehicle for the ISS.

According to Lori Garver, head of NASA Headquarters’ policy and plans office, Lane pledged to support the ISS program and its objectives.

Dr. Bonnie Dunbar (left), JSC’s assistant director for University Research and Affairs, and JSC Director George Abbey (right) brief Dr. Neal F. Lane, assistant to the President for science and technology, on the current status of the International Space Station.
This month marks the 25th anniversary of the launch of Skylab and the first crew to live aboard America’s first space station, Skylab.

The Skylab Orbital Workshop was launched with no crew on May 14, 1973. Subsequent crewed missions were launched later that year on May 25, July 28 and November 16. Mission objectives were to show that space station operations were medically feasible, define design requirements, and demonstrate science performance during long-duration flight.

The launch of the workshop was marred by the loss of its pilot which occurred due to a technical issue. One of the main solar panels was also lost and the other panned down. It reached orbit with inadequate electrical power and dangerously high temperatures inside. These problems, which threatened total loss of the mission, were overcome by the work of the space engineering teams at JSC, Marshall Space Flight Center and their contractors.

The first crew was launched about ten days later than planned, but with a full set of equipment with which to erect a structure for the heat shield and to fix up the unpowered solar panel. Their success showed the value of extravehicular activities for repair of orbiting spacecraft.

Skylab, an acronym for the phrase Conceived to Usher in a New Era of Research for Mankind, spanned more than a year’s time, during which more than 11 million miles were flown. The space station was the first space facility responsible for Tracking and Data Relay Satellite System ground control activities.

STS-88 will include a long string of firsts. For the first time, the shuttle crew will not have a direct line of sight toward a module they capture with the arm. Currie’s view of the Zarya during the robotic arm operations will be obstructed by the Unity module and she will rely on TV views and a new, Canadian-developed “space vision system” for cues. The Zarya module, at 43,000 pounds, will be the most massive structure ever moved using the shuttle’s mechanical arm.

“We’re going to have elements that aren’t even built in the same country...mated together for the first time over 200 miles up,” Currie said. “It has been a very detailed and complex task to manufacture parts... to that strict of a tolerance and to devise ways to test them on the ground to ensure their compatibility.”

The station’s five years of assembly in orbit will encompass hundreds of hours of space walks, and its success will depend on the practice and planning performed on the ground, explained Jerry Ross, who already has accumulated 23 hours of space-walking experience on previous shuttle missions.

“One way to describe what it’s like, flight after flight, is if you can imagine waking up on Christmas morning and Santa Claus has delivered a whole bunch of ‘to be assembled’ things to your kids, and you get the packages there and just try to figure out ‘tab A in slot B’ and all that stuff,” Ross said.

Another first will be that Mission Control must coordinate with a Russian company, the Khrunichev Space and Rocket Center which built Zarya, that was not involved during Shuttle-Mir missions.

“The team is ready. The crew is ready. The launch marked its stable attitude and disappointing, but we have put them to good use and we are better prepared than we would have been were we ready to go,” Castle said.
Safety & Total Health Day: Measuring success

By Mary Peterson

September 23. The day was hot, maybe a bit uncomfortably so, but it was little noticed as one JSC employee made his way to a booth he had not seen on any previous Safety & Total Health Day.

The booth he sought did not have trinkets or giveaways and, for that matter, only a couple of people milled around, mostly looking at a dog of questionable pedigree but with the unmistakable quality of being somebody’s “important” friend. It was the JSC Wildlife & Service Dogs booth, said, “I think the structure was good, and it gave us a more mature program than we have had in the past.”

“People seemed to feel more comfortable participating in S&TH Day, and they have accepted it as an event that has a distinct purpose.” Davis said further that many in his group had expressed an interest in serving on committees and having an even deeper involvement in the future.

The 1999 S&TH Day offered many employees their first look at the center’s most ambitious safety and health incentive program to date: the OSHA Voluntary Protection Program. Managers and group leaders led the overture in their individual groups, and program leaders set forth by JSC Director George Abbey — close call reporting, a review of reported incidents, and the introduction of the Voluntary Protection Program — Davis said, “I think the structure was good, and it gave us a more mature program than we have had in the past.”

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The 1999 S&TH Day offered many employees their first look at the center’s most ambitious safety and health incentive program to date: the OSHA Voluntary Protection Program. Managers and group leaders led the overture in their individual groups, and this effort was supplemented by a VPP booth sponsored by the JSC Safety Action Team where questions were answered and information distributed.

“Comments were positive and encouraging,” according to Deborah Mika, a senior safety engineer and VPP coordinator for Hernandez Engineering.

“Many said they had just had a presentation or how to manage a safety issue, still others used at least part of the day for some self-improvement. Larry Wirz, director of Health-Related Fitness at the Gilruth Center, said, “We had an equally enthusiastic, if not as large, crowd of fun run participants as last year. And, although it was hot, we warned everyone to take it easy, so, thankfully, we had no run participants as last year. And, although it was hot, we warned everyone to take it easy, so, thankfully, we had no injuries, just fun.” The aerobics class, new this year, also was a highlight for several people. It will be back.

Finally, there was no better example of Safety & Total Health Day answering a personal need than that demonstrated by the selfless blood donors to help friends and family of JSC. One, a tiny 3-year-old girl undergoing cancer treatment and another, a United Space Alliance employee who had undergone cardiovascular surgery, were among the beneficiaries of the record 595 pints of blood donated at the S&TH Day blood drive. Of that total, 107 replacement units went to the child and 32 went to the USA employee.

By any measure, S&TH Day was a success. It is tangible evidence that JSC does care about its employees and their welfare. Abbey, in his statement at Teague Auditorium, reaffirmed this when he said, “You are important to us, and your wellness means a lot to us. You represent our most important resource.”

Assisting the Crash Dummies on Safety and Total Health Day are (left to right) Elvis, Nurse Vera, JSC Director George Abbey, Seymore Safety, and JSC Deputy Director Jim Wetherbee.
Launching a new star

Unity node ready to launch

By James Hartsfield

Launching aboard Endavour in December, the six-sided Unity connecting module, the first U.S.-built station component, will lay a foundation for all future U.S. International Space Station modules in orbit, just as it has already done on the ground.

"The biggest challenge we’ve had is in being the first," explained Bill Bastedo, who has overseen much of Unity’s construction as the launch package manager for the last two and half years at JSC. "We’ve had to handle all the processes first. In many cases, we’ve had to invent the processes needed to build it and the processes to deal with those who’ll launch and operate it. We also made all the mistakes you would expect when you’re doing things for the first time."

Construction of Unity began in the fall of 1994 at a manufacturing facility at the Marshall Space Flight Center. In June 1997, it was shipped from Marshall to Keneddy Space Center for final assembly and launch preparations. Simultaneously, two conical mating adapters that are attached to Unity for launch were built in Huntington Beach, Calif. Unity has six berthing ports, one on each side, to which future modules will attach. With the two mating adapters attached, it weighs about 25,350 pounds and measures 36 feet in length and 15 feet in diameter.

In 1996, it was tough just to coordinate our team meetings—we had people spread out in four time zones: at Kennedy, Marshall, Houston and Huntington Beach," Bastedo said. "And we had four different cultures and sets of work control systems to integrate." Bastedo and about 10 other engineers in the station program’s mission integration and vehicle office work on the launch package team for Unity. Although it is a passive passageway, Unity is a complex hub of the station through which resources such as fluids, environmental control and life support systems, electrical and data systems are routed. More than 50,000 mechanical items, 216 lines to carry fluids and gases and 121 internal and external electrical cables using six miles of wire had to be detailed in the module. The detailed and complex hardware installation required more than 1,800 drawings.

Bastedo said the work on Unity has often gone far above and beyond the call of duty, and everyone at JSC, Boeing and elsewhere has exceeded each challenge. "We have had to track literally hundreds of interfaces that Unity must make," Bastedo said. "It makes hundreds of connections on orbit and that translates into many test requirements and specifications. It is no accident that every time we leak check it, it is better than the specifications—a factor of 20—an outstanding achievement when you have 172 sealing areas. The engineering planning, the workmanship and the overall quality of the hardware have been outstanding."

Among those instrumental in the technical success have been Randy Gallaway, former element manager for Unity, and Brian Mitchell, the current element manager, both JSC employees in residence at MSFC. Bastedo said. Also, Beth Ceratto’s efforts to integrate efforts of the design team and the launch processing team have been vital. Other key contributors have included Karen Engeland, a primary liaison between the team and mission operations personnel; Kim Ulrich, who was a key to successfully integrating Unity; and Paul Marshall, the developer of the basic philosophy.

"You have to do more than just hear the dialogue and joint decision-making necessary to allow the kind of technical interchange and joint decision-making required," Geyer said. The team at JSC has had to break down barriers of not just language, but also culture and engineering philosophies.

"You have to do more than just hear an interpreter to speak the language well," Geyer explained. "We started off with really no processes agreed to among us and now we have hundreds, hundreds that we use for not just the Zarya but also other components. We have made a lot of progress."

Geyer said the Boeing team that has been on-site at Khrunichev in Moscow has been instrumental in maintaining the lines of communication concerning day-to-day activities in development of the module. Others who played a major role at JSC included Mike Berdich, who was responsible for overseeing the installation on Zarya of a Power and Data Grapple fixture, which will allow the station’s Canadian-built robotic arm to attach to the module. "All of the subsystem teams that we have worked with have been there from the beginning, and the excellence of their work has played a large part in the success of Zarya," Geyer added.

Zarya node: A testament of U.S. and Russian teamwork

By James Hartsfield

The Zarya control module, the first component of the International Space Station to launch, has reflected the nature of the International Space Station program as a whole throughout its development, said JSC Russian Elements Manager Mark Geyer.

"This is the first really major piece of hardware built jointly by Russia and the U.S., and in that aspect it is a microcosm of the station itself."

Geyer said. "It started our processes of how we work with Russia... how we perform tests together, how we build hardware together, even how we write software together..."

Zarya will be boosted to orbit by a Russian Proton Rocket from the Baikonur Cosmodrome, Kazakhstan, on Nov. 20. Built by Russia but owned by the U.S., construction of the 42,600-pound module began in late 1994 at the Khrunichev State Research and Production Space Center in Moscow. Zarya was built under a subcontract to The Boeing Co.

Instruments in observing the construction of the module from JSC since its inception has been Doug Drewry, the station program’s launch package manager for Zarya. Along with

Drewry, Jack Geyer and Ginger Barnes, Zarya also has been a key person in the module’s development, providing engineering support to resolve technical issues throughout the process. With them, a Boeing team of about 50 people, led early on by Ginger Barnes and now by Mike Wood, has provided oversight of the module’s construction, including a resident Boeing office at Khrunichev.

Working on the Zarya development has meant spending many nights away from home and family, said Geyer, with the average number of trips to and from Russia during the last four years standing at between 15-20 for almost everyone.

"The biggest challenge in development of Zarya has been building the level of trust and mutual understanding between U.S. and Russian counterparts that is necessary."

"Sunrise" and is symbolic of the dawn of a new era of the new international cooperation in space, Geyer added.

"You have to do more than just hear an interpreter to speak the language well," Geyer explained. "We started off with really no processes agreed to among us and now we have hundreds, hundreds that we use for not just the Zarya but also other components. We have made a lot of progress."
Station flight controllers finish generic training

Four teams of International Space Station flight controllers completed their generic training in September and began conducting the first STS-88 flight-specific training—so-called. The team completed a year of intensive preparation that began with basic voice protocol simulations in the fall of 1997 and advanced to complex exercises using new Space Station Training Facility-provided simulators.

During their generic training, the teams simulated the most critical elements from the launch package 2A and 3A timelines, including extravehicular activities and system activation. Each flight control team worked through a series of 12 mission scenarios, which included various aspects of standalone ISS operations and integrated STS/ISS assembly missions.

“Progress to date has been astounding,” said ISS Flight Director Sally Davis. “Most of the people on these teams were not flight controllers on the Space Shuttle Program before, so this assignment is their first experience working in the space station team. They have come so far and have made so much progress that they really do function like a flight control team.”

Each team has its own assigned station flight director. In addition to Davis, Mark Kirsach, Mark Ferring and Jeff Hanley were named to these positions. Since late 1996, Kirsach is the lead station flight director for 2A, while Ferring heads 2A.1, Davis leads 3A and Hanley directs 4A.

For the early assembly missions, an experienced shuttle flight director will be the lead for shuttle operations and for the overall increment. Each flight will also have the lead for the station who will work issues associated with the space station.

The station teams will begin operations in the Mission Control Center Houston (MCC-H) with the launch of the FGB. Continuous around the clock staffing will be provided during the docked phase of 2A. After the shuttle undocks, the teams in Houston will rotate, providing full Flight SDI will respond to questions from Moscow and monitor high-level telemetry of the spacecraft. If any anomalous events occur, the SDI will call the flight director who will call in other team members as necessary. Twenty-four-hour support will be provided if required.

Continuous flight control team support will begin in Houston with the 4A mission currently scheduled for August 1999. With 4A, key components of the U.S. power system—the solar arrays, batteries, and distribution elements—will be delivered.

The training facilities and control center have followed parallel courses of development. Last fall, the first pieces of the station control center were delivered to Bldg. 30 and the first versions of the ISS simulation were delivered to TFF. In the spring, the second iterations of these facilities were delivered, and the flight station control teams and flight crews began conducting generic simulations in earnest. Recently, the final flight releases became available and have been used for STS-88 flight-specific training.

The blue Flight Control Room in Bldg. 30 is used primarily for station operations. Although shuttle operations will be based in the white FCR and station operations in the blue FCR, they are interchangeable. Since station training will be conducted in the assembly missions start, plans are under way to develop a third FCR.

Many new systems had to be developed and installed in the control center to conduct station operations, principally those used to process telemetry and station commands. These systems are being verified with the successful completion of an end test between the control center and the flight hardware at KSC in August. Currently, the interface assembly between the MCC and the MCC-Moscow (MCC-M) is being tested. This interface allows U.S. communications assets to be used by the MCC-M and Russian communications assets to be used by the MCC-H.

Getting down to the nuts and bolts: Putting the station together

In December, members of the STS-88 crew will attach Unity to Russia’s Zarya control module. Prior to the shuttle’s rendezvous with Zarya, astronauts will use the shuttle’s Remote Manipulator System to lift Unity out of the payload bay. The shuttle will then dock with Zarya, using the RMS to latch Unity to Zarya. Once the components are attached, astronauts will conduct three space walks to connect power and data transmission cables among Zarya, Unity and two Pressurized Mating Adapters.

And so begins construction of the International Space Station, a project that will turn Earth orbit into a daily construction site for the next five years. Astronauts will perform more space walks in those years than have been conducted since space flight began. Approximately 160 EVAs, totaling about 1,700 crew hours, or about 850 EVA hours, are planned for station assembly—about as many EVA hours as have been conducted in the history of human space flight to date.

During the first seven shuttle assembly missions, there is no capability for space walks to be conducted from the station without the space shuttle present. The Russian Service Module provides a capability for station-based Russian space walks using only Russian spacecraft, but the U.S. capability will not be available until the Joint Airlock Module is attached to the station during the seventh space shuttle assembly mission, STS-101.

After the Joint Airlock Module is operational, the philosophy of space walk training for increment crewmembers will shift due to the increasing complexity of the station and the ability of the station crew to perform space walks. Because the station’s growing size and complexity will make it next to impossible to train station crew members for every EVA task they may be called upon to perform during a mission, training will increasingly aim toward providing crew members with a general suite of EVA skills.

As space walks increase, the ISS will have to be equipped for the new generation of space robotics. The space shuttle’s robotic arm will operate both as “space cranes” to maneuver large modules and components and as a “cherry picker” to move on tracks along the length of the station’s truss, putting much of the station within grasp of the arm.

The space station’s truss eventually will be extended, adding many special fixtures placed strategically around the station and then detach its other end and pivoting it. In addition, the station arm eventually will be able to ride on a Mobile Remote Servicer Base System that will move on tracks along the length of the station’s truss, putting much of the station within grasp of the arm.

The SSRMS is a larger and more advanced version of the shuttle’s RMS. The SSRMS will have the new capability to move among segments with much greater precision, like an inchworm, locking its free end on one of many special fixtures placed strategically around the station and then detaching its other end and pivoting it. In addition, the station arm eventually will be able to ride on a Mobile Remote Servicer Base System that will move on tracks along the length of the station’s truss, putting much of the station within grasp of the arm.

The SRRMS is scheduled to launch in December 1999. The Mobile Remote Servicer Base System will launch in August 2000.

Canada is also providing the Special Purpose Dextre Manipulator, or Canadarm, and a hand-like robot that can handle some of the delicate tasks that astronauts typically perform, such as tightening and loosening bolts. The Canadarm is scheduled to be launched and attached to the robotic arm in May 2002.

The Canadarm will be the major challenges in assembling the station? Probably not. Putting the larger pieces together, according to Harbaugh, is easier than that since the overall mating of large structures will be validated on the ground, the major problems that may arise will concern issues such as bringing the smaller items together and seeing that they are properly secured. But the time has come to begin that assembly process.

“We have reviewed the three space walks planned for STS-88, and that training process is very mature and the crew is ready to go,” said Harbaugh. “It’s time to get to work.”

Astronauts perform a training session in the Neutral Buoyancy Laboratory of the Sonny Carter Training Facility. "We have demonstrated through shuttle-Mir that we can train people and walk them through tasks so that they have an appreciation for what will have to be performed on orbit without ever having practiced that specific task beforehand on the ground," said Gregory Harbaugh, head of the EVA Office. "This philosophy differs significantly from our previous approach to EVA training."
NASA New England Outreach Center honors JSC

JSC received the NASA New England Outreach Center’s Commitment to Excellence Award at the seventh annual NASA Technology and Business Conference held in Burlington, Vt. Kenneth Martindale, JSC small and disadvantaged business specialist, accepted the award. JSC was recognized for its continued commitment to Northeast business firms in its contracting opportunities. Firms in the Northeast receive approximately $500 million in direct awards from NASA, with over 25 percent being awarded by JSC. Subcontract awards to the Northeast at least equal that value.

The Commitment to Excellence Award for a NASA field center commends outstanding corporate performance in efforts that further small and disadvantaged business interests. The award is presented for support of NASA’s New England Outreach Center and NASA’s small and disadvantaged businesses. JSC contributes to the advancement of diversity of contracting opportunities with its annual “Inspection,” highlighting its technologies and facilities.

Prime example of community partnering wins top honors

The General Services Administration presented its Achievement Award for Real Property Innovation during a recent ceremony held at GSA Headquarters in Washington, D.C. JSC’s entry, “Partnering for Land Use – Agriculture Science Center Laboratory,” was selected as the winner in the Best Policy category. JSC employees Melody Nation, realty officer, and Don Holick, master planner, received the award.

An independent four-member panel comprised of real estate and management experts from industry and government selected JSC’s winning entry from among 41 entrants in two categories. By now, the sight of majestic longhorns grazing on JSC land just behind Rocket Park is very familiar. But without the determined efforts of Nation and Holick, this vision would never have become a reality.

No doubt the request from JSC Director George Abbey was a challenge – find a way to use a controlled area of JSC property for a hands-on agricultural education facility, an idea born from his desire to meet government, agency and center strategic goals and from discussions held with the superintendent of the Clear Creek Independent School District.

JSC Director George Abbey (right) presents the Marilyn J. Bockting Award for Secretarial Excellence to Karen McMahon. Space Shuttle Program Manager Tommy Holloway (left) attended the presentation.

Sue Bobo accepts the Marilyn J. Bockting Award from JSC Director George Abbey (right). Chin Lin, chief of the Thermos, Engineering Support Branch, attended the presentation.

JSC plans to spend a total of $2.22 billion in fiscal year 1989, a 26 percent increase from the previous year, including a 67 percent increase in planned space station spending. Funding for Space Station Freedom comprises about 14 percent of JSC’s total planned costs in 1989 as compared to the 10 percent of the center’s spending it comprised in fiscal year 1988.

Space station conference set for February

NASA will cosponsor a conference on International Space Station utilization scheduled for February 1-4, 1999, in Albuquerque, N.M. More than 20 sessions will cover all of the major research areas to be explored on the ISS including biotechnology, biomechanics, gravitational biology, materials science, fluids and combustion research, space science, earth sciences and engineering research. Sessions on commercial research and service activities and technical presentations on ISS capabilities will also be included. The complete list of planned papers, as well as registration and logistics information, may be found on the web at http://www-cnsf.unm.edu/issps.
By John Ira Petty

When Raphael “Ralph” Anthony Grau speaks with his mother, they might use English, Spanish—or both of the above with some Italian, French and Portuguese thrown in. Sometimes they forget to switch back to just plain English when they speak to others, which has confused some small-town conversation partners.

Grau is EEE Parts Lead in the International Space Station Program. EEE stands for electrical, electronic and electromechanical parts, “basically switches, relays, microcircuits,” he said. “Every computer chip, every signal processing chip has to get my blessing for space station. The parts count has got to be in the hundreds of thousands.”

Grau’s multicultural, multinational background is in many ways what the Americans are about. It certainly reflects the diversity of the JSC workforce.

Grau’s first name is Spanish, the middle name Italian, and last name German. “My dad was born in Cuba; his parents were from Spain. My mom and dad were born before that the family was German. My mom was born in Brazil; her grandparents were Italian.”

The language abilities have come handy. For example, he regularly volunteers to do interviews with media representatives from Spanish-speaking countries. He also worked at the JSC booth at the State Fair of Texas for the Technology Transfer Office. Smiling, enthusiastic and outgoing, he handles those duties well.

At age 34, Grau has been at the NASA complex since May 1990. He worked for Ford Aerospace for three months, then got those duties well.

The International Partners Office at NASA Headquarters. Headquarters is the office maintains close coordination with international partners on a daily basis, the ISS. The Nodes are outfitted with U.S.-sourced components for which NASA retains responsibility and oversight.

Other projects that the office manages involve all station partners and participants. The partners recently reached an agreement on cost sharing, an effort that took years to achieve. To reach this accord, the partners had to develop a mechanism to share the expenses associated with operating on-orbit station components.

“Determining the fair share of each country’s piece of the station was a complex exercise because contributions vary across nations,” said Stencil. “We had to estimate what we think it will cost to operate the station, and then we had to decide what is common to everybody and, lastly, we had to reach a fair percentage for each partner and participant.”

In addition to working with international partners on a daily basis, the office maintains close coordination with NASA Headquarters. Headquarters is tasked with being the final arbiter in negotiating inter-government agreements and memorandums of understanding, but the International Partners Office sets the requirements for those agreements.

The International Partners Office works with its HQ counterpart, the Space Flight Division of the Office of External Relations, on a daily basis. Interaction among the offices includes providing support in response to Congressional inquiries concerning the International Space Station.

With all of the early partner/participant contributions on schedule for delivery, the office is now turning its attention to working issues associated with launching the station.

“Once the challenge now is to anticipate potential threats to development activities that may become problematic,” said Stencil. “There are countries that challenge requirements or ask for more money to deal with new requirements. There are no guarantees with any development program, but think we are starting to turn the corner to launching the station.”

I wanted to get into the project management side,” he said. “My job isn’t so technical, as long as things don’t break. But if they do break, I’ve got to understand why.”

His job basically is to shake out the bugs before equipment gets on orbit. For Grau, there is life outside the space program. Until about three years ago he was active in water skiing, snow skiing, personal watercraft, dirt bikes and more. Then he ruptured a disc in his back. Surgery was successful, but hobbies changed. Now he builds his own computers and home theater systems.

He also enjoys inside-the-loop night life. He lives in the Greenway Plaza area, “a really vibrant part of town.” Being out and about relieves the stress. “We’re in a very stressful program. You need to manage stress before it eats you alive.”

With the stress comes satisfaction. Grau says he believes there’s a renewal of interest in space, “especially as we start pushing more commercial factors. We think we really need to be agents of change and facilitate private industry getting into space—setting up the infrastructures and the knowhow to do it safely.”

Space has become multinational. The Phase I Shuttle-Mir program is an example of the benefits. “It’s contributions to the space program were substantial.

“We don’t normally think of gaining perspective,” Grau said. “It helps so much—just taking a step sideways and looking at it with a different set of eyes and a different set of rules.

“Space isn’t a single country’s endeavor anymore. It has to be multinational, because of economics and technical factors. We all have our strengths we bring to the table.”

Besides, Grau said, “Some of our differences are so artificial.”

“Determining the fair share of each country’s piece of the station was a complex exercise because contributions vary across nations.”

“We had to estimate what we think it will cost to operate the station, and then we had to decide what is common to everybody and, lastly, we had to reach a fair percentage for each partner and participant.”
Human Resources reports the following personnel changes as of October 3, 1998:

**Key Management Assignments**
Erl Thompson was named associate director, Information Systems Directorate.
Wayne Thomas was named manager, Space Station Acquisitions Management Office, Business Management Directorate.
Ginger Daniel was named manager, Institutional Business Management Office, Business Management Directorate.
Craig Dismore was selected as deputy chief, ESA and Space Shuttle Systems Branch, Engineering Directorate.

**Additions to the Workforce**
Terry Papijai joins the Flight Operations Branch in the Flight Crew Operations Directorate as a research pilot.
Nicole Stott joins the Shuttle Training Support Branch in the Flight Crew Operations Directorate as a senior flight simulator engineer.
John Yaniev joins the Flight Operations Branch in the Flight Crew Operations Directorate as an aviation program specialist.
David Kovth joins the Flight Planning Branch in the Mission Operations Directorate as a flight controller.
Bryan Svejko joins the Cargo Integration and Operations Branch in the Mission Operations Directorate as a flight controller.
Frank Cho, John Garr, Holly Ridings, and Bridget Ziegelauer join the Environmental Systems Branch in the Mission Operations Directorate as flight controllers.
Kristina Kennedy and Michael Wright join the EVA and Robotics Systems Branch in the Mission Operations Directorate as flight controllers.
Michel Ruiz joins the Electrical Systems Branch in the Mission Operations Directorate as a flight controller.

**NPMA meets:** The National Property Management Association will meet at 5:30 p.m. Nov. 10 at Robinette and Doyle Caterers, 216 Kirby in Seabrook. Dinner costs $14. For details, call Sina Hawsey at x36582.

**November 10**
Aero club meets: The Bay Area Aero Club will meet at 7 p.m. Nov. 10 at the Houston Gulf Airport clubrooms at 2750 FM 1266 in League City. For more information, call Larry Hendrickson at x2050.
NPMA meets: The National Property Management Association will meet at 5 p.m. Nov. 10 at Robinette and Doyle Caterers, 216 Kirby in Seabrook. Dinner costs $14. For details, call Sina Hawsey at x36582.

**November 11**
IAAP meets: The Clear Lake/NASA Chapter of the International Association of Administrative Professionals (previously Professional Secretaries International) will meet at 5:30 p.m. Nov. 11 at Bay Oaks Country Club. Cost is $16. For details, call Elaine Kemp at x30556.

**November 12**
MAES meets: The Society of Mexican-American Engineers and Scientists will meet at 11:30 a.m. Nov. 12 in Bldg. 16, Rm. 111. For details, call George Salazar at x30163.
Airplane club meets: The MSC Radio Control Airplane Club will hold its annual auction at 7:30 p.m. Nov. 12 at the Clear Lake Park pavilion. For more information, call Bill Langdoc at x35970.

**November 13**
Astronomers meet: The JSC Astronomical Society will meet at 7:30 p.m. Nov. 13 at the Center for Advanced Space Studies, 3600 Bay Area Blvd. For more information, call Chuck Shaw at x35416.
NS4 meets: The Clear Lake Area chapter of the National Space Society will meet at 6:30 p.m. Nov. 13 at the Radisson Hotel - Hobby Airport (9101 Gulf Fwy.) in the Deer Park room. The event is open free to the public.

**November 17**
NPMA meets: The National Property Management Association will meet at 11:30 a.m. Nov. 17 at the Glenthor Center. Cost is $14. For details, call Mike Puryear (280-2058) or Sina Hawsey (483-6582).

**November 18**
Astronomy seminar: The JSC Astronomy Seminar will meet at noon Nov. 18 and 25 and Dec. 2 in Bldg. 31, Rm. 129. For more information, call Al Jackson at x20587.
Space Shuttle Testmasters meet: The Space Shuttle Testmasters will meet at 7 a.m. Nov. 18 and 25 and Dec. 2 at the House of Prayer Lutheran Church. For details, call George Salazar at x30162.
Communicators meet: The Clear Lake Communicators, a Toastmasters club, will meet at 11:30 a.m. Nov. 25 and Dec. 2 at Lockwood Martin, 555 Fordge River Rd. For more information, call Alorton Precost at 282-3281 or Mark Crawford at 282-4306.
Space Shuttle Testmasters meet: The Space Shuttle Testmasters will meet at 11:30 a.m. Nov. 18 and 25 and Dec. 2 at United Space Alliance, 600 Gemini. For details, call Patricia Blackwell at (281) 282-4302 or Brian Collins at x35190.
Scuba club meets: The Lunafins will meet at 7:30 p.m. Nov. 19 at Pot Pie Pizzeria at Watergate Marina. For details, call Mike Manering at x32618.

**November 19**
Directors meet: The Space Family Education board of directors will meet at 11:30 a.m. Nov. 19 in Bldg. 45, Rm. 712D. For more information on this open meeting, call Gretchen Thomas at x37864.

**December 3**
Radio Club meets: The JSC Amateur Radio Club will meet at 6:30 p.m. Dec. 3 at the Piccadilly, 2465 Bay Area Blvd. For more information, call Larry Distruh at x39198.

**End of Year**
NASA’s Mars Global Surveyor has captured some spectacular new views of Olympus Mons, the largest volcano in the solar system, and a system of giant channels on the red planet known as Kasei Valles. The new images are available on the Internet at http://www.jpl.nasa.gov and at http://mgs.jpl.nasa.gov/ and at http://www.nasa.gov.