



August 25, 2000

SPACE CENTER Roundup

VOL. 39, NO. 17 LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEXAS

STS-106 Crew, ground teams prepare for 'Dream Mission'



NASA JSC Photo STS106-(s)-002

The crew of STS-106, from left, Boris Morukov, Scott Altman, Rick Mastracchio, Edward Lu, Dan Burbank, Terrence Wilcutt, and Yuri Malenchenko.

With the successful launch and docking of the Russian Zvezda Service Module and Progress resupply craft achieved, the spotlight is back on NASA for the next step in development of the International Space Station. STS-106, which will be the 99th shuttle mission, is slated to bring the next visitors to the newly expanded station. The 106 crew, a team of five U.S. astronauts and two Russian cosmonauts, is now in final stages of training for its September 8 launch aboard *Atlantis*. Crewmembers say they've got one of the best missions ever.

"Having the opportunity to fly on a space shuttle mission is an awesome experience," said Commander Terry Wilcutt, "but what makes STS-106 special is the wide and challenging range of tasks we will perform. During our mission, we will fly to and dock with the space station, perform a space walk, open up a brand new module, install and check out crucial systems on board the station, unload a cargo resupply vessel, operate the shuttle robotic arm, and finally undock and fly around the station."

Wilcutt will be joined by Pilot Scott Altman (Cmdr., USN), Mission Specialists Dan Burbank (Lt. Cmdr., USCG), Ed Lu (Ph.D.), Richard Mastracchio, and Cosmonauts Yuri Malenchenko (Col., Russian Air Force) and Boris Morukov (M.D.) for the planned 11-day mission.

Assigned just over six months ago, the mission is chock full of high-profile activities for the crew, the largest mission objective being the unloading and stowage

of equipment and supplies from *Atlantis* and the Progress. According to STS-106 Launch Package Manager Sharon Castle, more than 7,200 pounds of payloads will be ferried to orbit on *Atlantis*. Another 1,300 pounds will be unpacked from the Progress module already attached to the orbiting station. Payloads include everything from food and water to exercise equipment, computers, clothing and medical gear – all for the first permanent residents of ISS.

EVA milestones

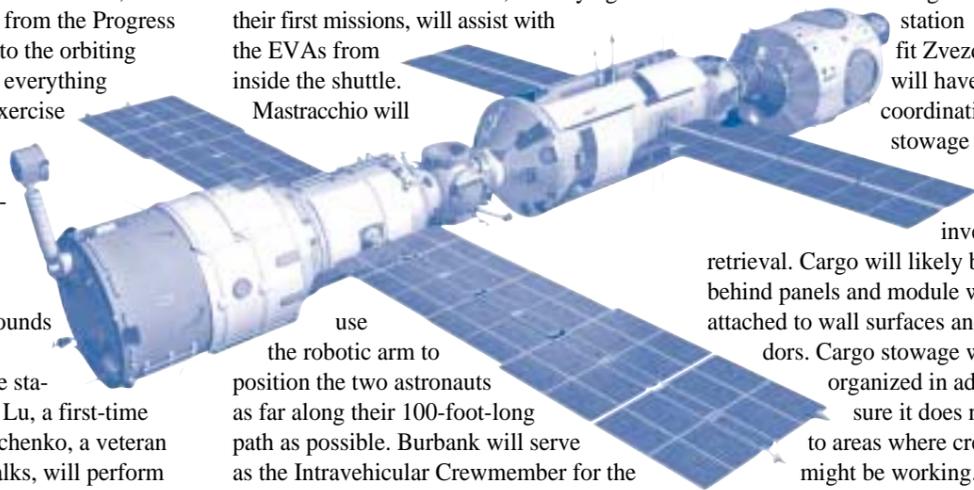
Approximately 100 pounds of equipment will be installed externally on the station. To accomplish this, Lu, a first-time space walker, and Malenchenko, a veteran of two previous space walks, will perform a space walk on the fourth day of the flight, only the second EVA involving both a U.S. astronaut and a cosmonaut outside of the shuttle.

The EVA also will be the first in which a U.S. astronaut moves about the station using the Russian tether protocol. Traditionally during EVAs, U.S. astronauts use a single tether to leash the crewmember to the spacecraft. However, because of the distance crewmembers must travel for their various tasks on the station's exterior, and obstacles along the way, use of a single long line in this case is not feasible. For this mission, and likely many more afterward, the space

walkers will maneuver by continuously attaching, disconnecting and reattaching two shorter tethers – much as a rock-climber – to traverse the length of the station.

Burbank and Mastracchio, both flying their first missions, will assist with the EVAs from inside the shuttle.

Mastracchio will



use the robotic arm to position the two astronauts as far along their 100-foot-long path as possible. Burbank will serve as the Intravehicular Crewmember for the space walk, coordinating all of the EVA activities from within *Atlantis*' cabin.

Once positioned, Lu and Malenchenko will install several devices to the station, including a magnetometer – an instrument that indicates the orientation of the spacecraft – to a boom on the station. They also will connect *Zvezda*'s various data cables and lines to the *Zarya* module.

Orbital housewarming

One of the highlights of the mission will be when the crew opens the hatch to the station's living room on flight-day five. *Zvezda*, launched less than two months

ago, will provide the early living quarters for station residents but at this point is more like a vacant apartment. The crew will spend five days unloading cargo and stowing it throughout the station to properly outfit *Zvezda*. Burbank will have the task of coordinating all the stowage of gear in the ISS and recording the inventory for future

retrieval. Cargo will likely be stowed behind panels and module walls as well as attached to wall surfaces and station corridors. Cargo stowage will be well organized in advance to make sure it does not block access to areas where crewmembers might be working.

Cleared for departure

Once *Atlantis*' crew has prepared the ISS for its first residents, the shuttle will undock from the station. At that time, Altman will take the controls and execute a flyaround of the station to enable the shuttle crew to conduct a photographic survey of the station's exterior.

After the flyaround, the shuttle will maneuver away from the station and prepare for a pre-dawn landing September 19 at the landing facility at Kennedy Space Center to complete the third shuttle mission of the year. ■

More information on the mission, including sighting opportunities, can be found at <http://spaceflight.nasa.gov/>.



Legendary Apollo-era engineer dies.

Page 2



JSC hosts Space Cowboys' Press Weekend.

Page 5



First integrated payload trainer arrives at JSC.

Page 7

Owen Maynard, key architect of Apollo spacecraft, dies at 75

Owen Eugene Maynard, an early leader of the Apollo Program and one of Canada's spaceflight pioneers, died on July 17. He was 75.

In 1960, Maynard was part of a small group of engineers, NASA's Space Task Group, in Langley Field, Virginia, assigned to a new human spaceflight program called Apollo. Working under the direction of leading human spaceflight luminaries such as Robert Gilruth, Maxaget and Caldwell Johnson, Maynard helped develop the initial designs of what would eventually become the Apollo Command and Service Modules. The following year, when President John F. Kennedy gave Apollo the goal of landing on the moon by the end of the decade, Maynard helped devise how Apollo would fly to the moon and return safely back to Earth.

Unlike Mercury and Gemini, the selection of a spacecraft for Apollo followed a process involving external studies, requests for proposals, and technical evaluations. In practice, however, the Space Task Group had its own design for Apollo. Maynard was part of the technical review board that confirmed the group's design.

About one year after Kennedy's call to land on the moon, NASA had decided on sending astronauts to the moon and bringing them back to Earth by a method known as lunar orbit rendezvous or LOR. Maynard was among the first members of the Space Task Group to see the wisdom of using LOR as a means of landing on the moon at a time when other methods were favored. NASA eventually selected LOR as the mode for the lunar landing in 1962.

The decision to use LOR defined the Apollo spacecraft as three separate entities: the Command Module, Service Module, and Lunar Excursion Module (later changed to Lunar Module). The latter vehicle became central to Maynard's career at NASA when, in 1963, he rose to the post of chief of LM Engineering in the Apollo Spacecraft Program Office at the Manned Spacecraft Center in Houston. Maynard and his group worked closely with engineers from Grumman, contractor for the LM.

The LM, as a craft that would perform solely in the vacuum of space and the light gravity of the lunar surface, presented new opportunities and challenges for engineers. The landing gear presented problems since



Owen Maynard discusses various exhibits during Prince Philip's visit to JSC in 1966.

NASA JSC Photo S66-24136

no one knew exactly the composition and density of the lunar surface. Maynard worked on the assumption that the moon's surface bore similarities to that of Arizona and helped design the landing gear accordingly.

"We didn't know what the lunar surface was like," Maynard said in a

1999 interview for the JSC Oral History Project. "The scientists were telling us that the lunar surface was like a fairy castle structure, electrostatically suspended particles that when you landed on it, you'd just sink many meters into the moon's surface, like very light snow, for hundreds of meters, maybe. And the leading scientists that had spent their money looking [through] telescopes and radio telescopes and everything else, when they tried to formulate what that would be like from normal scientific data, they concluded that it's what is called soils mechanics – something that you couldn't actually land in. So here Kennedy had challenged us to

go land on the moon, and we didn't know whether, if we did, we would sink out of sight."

In 1964, Maynard was promoted to the position he would hold for most of the remainder of his career at NASA: chief of the Systems Engineering Division. To many people, this made him Apollo's chief engineer. His responsibilities encompassed making sure that the constituent parts of the Apollo spacecraft worked together, not only among themselves but also with the launch vehicle and ground facilities.



Owen Maynard gives notice of civil service promotion to his secretary, Carol O'Loughlin.

NASA JSC Photo S66-31108

Maynard moved out of the Systems Engineering Division in 1966 to direct the Mission Operations Division and, in June of that year, he organized the Apollo Lunar Landing Symposium during which leaders of NASA and the contractor community got their first detailed technical preview of Apollo's first lunar landing mission.

After the Apollo fire in January 1967, Maynard returned to head the Systems Engineering Division. During that year, he and his group devised the A to

G mission sequence for Apollo test missions leading up to the first lunar landing on the G mission. Maynard remained in charge of systems engineering until he left NASA in 1970 following the successful achievement of Kennedy's goal.

Maynard was born in 1924 in Sarnia, Ontario, Canada. When World War II broke out, he left school and worked as a boatbuilder and machinist before joining the Royal Canadian Air Force in 1942. He flew a

number of aircraft in Canada and overseas, although the war ended before he could see combat.

After the war, Maynard worked at Avro Canada while he earned his degree in aeronautical engineering at the University of Toronto. He held a number of jobs at Avro including working on the layout of the Avro Jetliner and the design and testing of the CF-105 Avro Arrow weapons pack and landing gear.

In 1959, the Arrow Program was cancelled, and Maynard and 30 other Canadian and British engineers from Avro joined NASA. Until he became involved in the Apollo Program in 1960, Maynard worked on the Mercury Program.

Having worked on crew escape systems at Avro, Maynard evaluated the Mercury capsule's emergency provisions. He found that an emergency abort off the pad, for instance, could cause the spacecraft to land on solid ground rather than in water. The shock attenuation system consisted of a crushable honeycomb layer between the capsule and its heat shield. Maynard found this configuration led to a high degree of "rate of rise of G," which can cause damage to the internal organs of a pilot. To counter this, he suggested using a deployable landing bag beneath the heat shield to take the shock of impact.

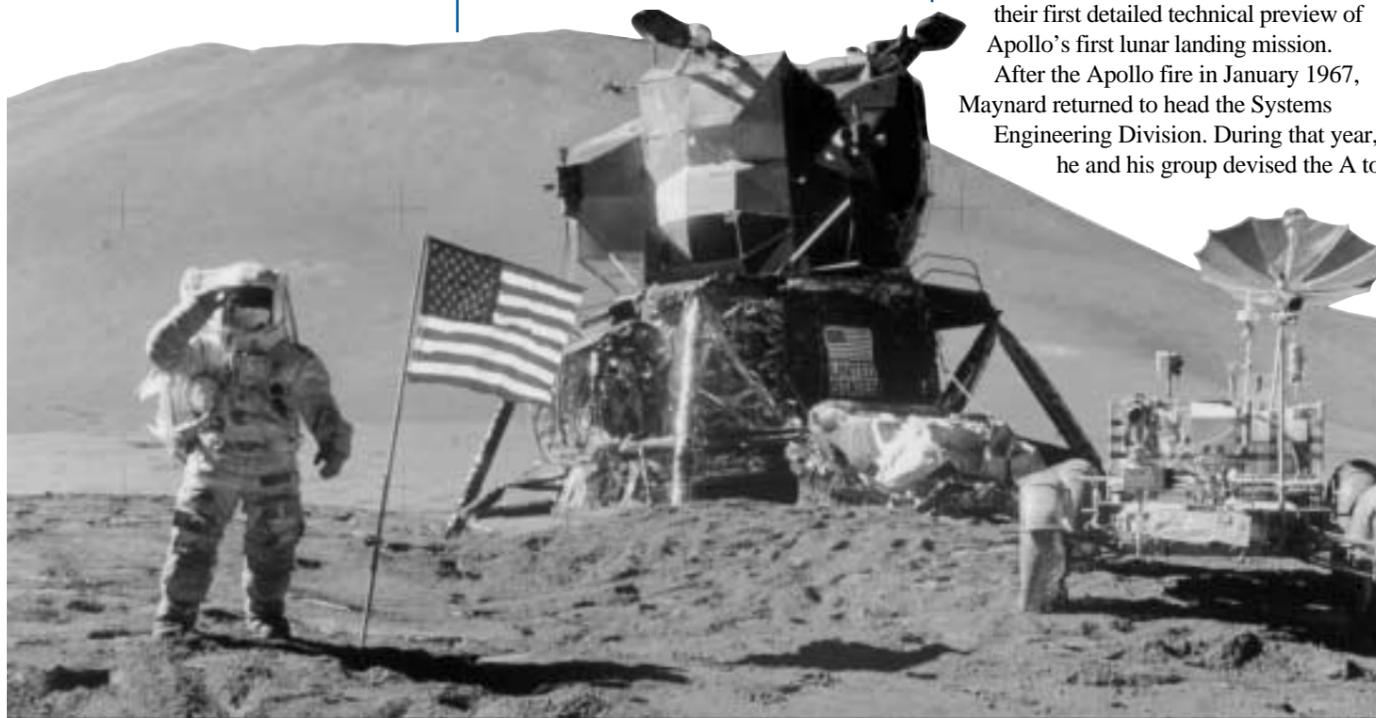
Maynard was a member of a group at NASA that won a U.S. patent in 1967 for the design of a "radial module space station." This station featured solar cells and artificial gravity.

After leaving NASA in 1970, Maynard joined Raytheon in Boston where he worked on many aerospace programs. During this time, he became an advocate for the use of satellites to collect solar power for use on Earth and the use of solar power collected on Earth for powering spacecraft. He retired from Raytheon in 1992, at which time he and his wife, Helen, returned to Canada.

Maynard received many honors including two NASA Exceptional Service Medals and an honorary doctor of engineering degree from the University of Toronto. Upon receiving his degree, Maynard repeated an observation he often made about himself and the team that built Apollo: "The extraordinary had been accomplished by quite ordinary people."

Maynard is survived by his wife; their four children, Donald, Merrill Helen, Elizabeth, and Annette Kathleen; and many grandchildren. ■

Chris Gainor and the JSC Oral History Project Office contributed to this story. Gainor, a writer in Victoria, B.C., Canada, is preparing a history of the 31 Canadian and British engineers who joined NASA in 1959 after the Canadian government cancelled the CF-105 Avro Arrow Program.



NASA Photo AS15-88-11866

New Mexico SciAds continue efforts in technology and education outreach

By **Cheerie R. Patneau**

The Science Advisors (SciAd) Program, a community-based effort begun in the Las Cruces Public Schools in New Mexico in 1990 to help school-aged children become more knowledgeable in math, science, and technology, continues to flourish.

Pleddie Baker, a NASA White Sands Test Facility employee, was instrumental in establishing the SciAd Program to improve math, science, and technology education of schoolchildren. A SciAd program was created at the Sandia National Laboratories in Albuquerque, New Mexico, but after repeated calls asking them for support in southwestern New Mexico 230 miles away, Sandia asked White Sands Test Facility to establish a similar program for Las Cruces. With help from Sandia, the Atmospheric Research Laboratory at White Sands Missile Range, and the LCPS, the SciAd Program was established in southern New Mexico.

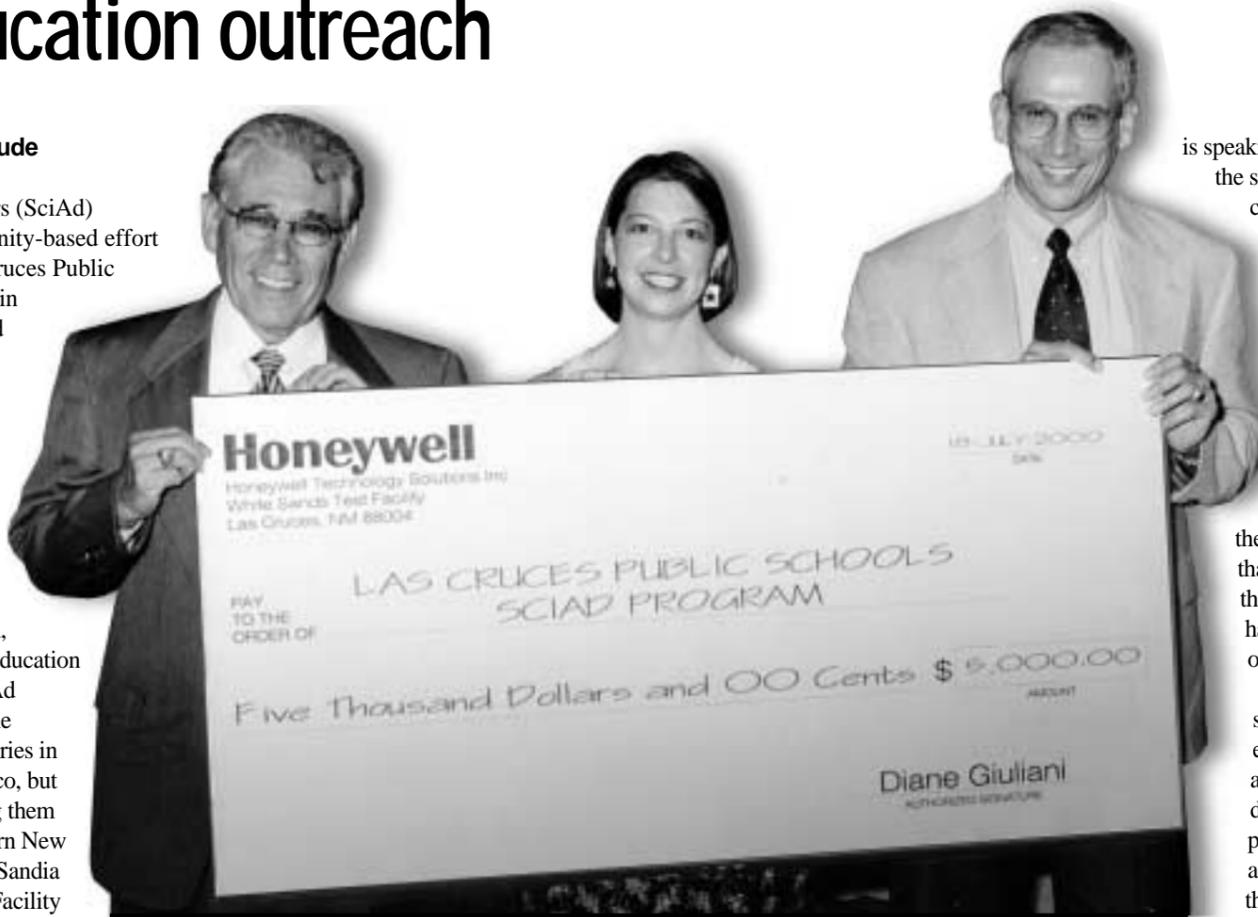
Baker indicated that there were reasons for wanting to implement the program. "Many students avoid math and science when they reach middle and high school because they fear it is too hard or they can't do it, many students graduating from high school are not prepared for a job in a technical field or prepared to pursue a technical degree, and the labor market has shifted and there are more jobs available for skilled labor now than unskilled labor."

Participation in the program has been "very positive at WSTF and in the community," Baker says, "with women and men engineers, scientists, and technicians participating and even more requests coming from teachers than we have SciAds to fill." Another indication that the program is succeeding is that "math and science aptitude test scores have increased in the LCPS district" since the program began. "This cannot be attributed solely to the SciAd Program, but responses from teachers and students certainly indicate it is a major factor."

Past Science Education Alliance president and Honeywell Technology Solutions Inc. employee Scott Hill was effective in establishing the SEA, a 501-C3 (nonprofit) corporation, which oversees the SciAd Program and promotes increased community awareness, participation, and commitment. Hill said of the program, "I'm grateful for the opportunity to have participated in SEA for the past five years. We've transformed it from a grass roots organization into an organization with structure and life and continual personal involvement."

"To that end, we were able to become incorporated as a nonprofit organization, hire a coordinator, assist in training and coordination of SciAds and each school's SciAd teacher activity representative, and work with the schools defining the needs of the teachers and schools and the roles and responsibilities of the various participants."

"Lastly, our goal was to obtain a reliable source of funding other than NASA. All of those goals have been accomplished to some degree or another.



Honeywell Technology Solutions Inc. Program Manager Bob Baker, right, presents Las Cruces Public Schools Superintendent Jesse Gonzales, left, with a check for \$5,000 to enable the SciAd Program to continue. Also attending the check presentation is LCPS SciAd Coordinator Marie Haaland.

The LCPS School Board has agreed to fund 50 percent of the budget and with the corporation sponsorship from Honeywell, this provides a base for funding activities."

From the employees who work at WSTF, ARL, Physical Science Laboratory, New Mexico State University, and other

community organizations and members, the SciAd Program has pooled more than 40 special subject SciAds and 100 school SciAd volunteers. These SciAds not only support all the elementary, middle, and high schools in Las Cruces but also several parochial schools, a home-school association in Las Cruces, and at least one school in surrounding communities such as Alamogordo, Cloudcroft, Deming, Hatch, Lordsburg, and Gadsten school districts.

One of the technical advisors is HTSI employee Dennis Smith. Smith is a project leader engineer in the Propulsion Department and has been a SciAd for the past four years. Smith has held several Science Nights for parents and teachers at Hermosa Heights Elementary School where he promotes inquiry into science. Smith shows how materials change in outer space conditions. Smith may freeze bananas with liquid nitrogen and then use them as hammers to pound in nails or place flowers under the same conditions and shatter them on a table. When exposed to liquid nitrogen, Smith explains, "gloves shatter and balloons deflate." Smith may question his young audience. "What do you think it's going to do? Why?" He picks up answers from the crowd and repeats them back, creating suspense, before he shows his audience what the materials will do.

Smith carries over to the community the safety skills that he learned as a project leader engineer, using cryogenic protective gear, goggles, and gloves to shield himself and youngsters from splashes. He also demonstrates how different materials like those found in Ping-Pong balls, rubber, or plastic balls react because of their characteristics, and that safety gear

requires different materials to be effective, depending upon the job hazard. Smith also sets up textbook experiments for teachers at Hermosa Heights Elementary School on an as-needed basis. He believes that the students should learn about safety first.

HTSI employee and SciAd Joe San Filippo, who worked in the Laboratories Department for many years and is now an engineer for propulsion test systems, volunteers for the Dugan Tarango Middle School and Central Elementary School in Lordsburg, about 120 miles west of Las Cruces. San Filippo recently attended a

SciAd Award Banquet where a NMSU student was working for a restaurant catering the banquet. The student, Javier Placencia, recognized San Filippo from his visits to his school some seven years back. Of this recognition, San Filippo said, "It's a small world.

You never know when you will influence a young person, stimulate an interest in science or engineering or help someone down a career path." Placencia was "flabbergasted that Joe also remembered me," and said that the reunion was a "focal point for me. I was glad that the SciAd Program was in Lordsburg. We don't have a lot of opportunity to learn about different concepts and ideas there. The program opened my eyes to new ideas

and was a good influence." San Filippo says he doesn't remember what he talked about that day long ago in Lordsburg, but as he talked with Placencia, he recognized that the SciAd mission had been realized. Placencia is now studying business at NMSU.

San Filippo's SciAd repertoire includes lectures on electromagnetism, spaceship design, building mechanical structures, and data visualization. WSTF HTSI coworker, Tom Reiser, created the Earth Odometer, software that helps students realize how fast the Earth is traveling in miles per hour. During a lecture, San Filippo begins the software that simply displays an ever-increasing number, the distance the Earth travels, as he

is speaking. San Filippo asks questions of the students during the spaceship design class. "Have you ever traveled on a spaceship before?" Of course, the answer is invariably no. San Filippo also asks, "What seven things would you want to bring with you on a spaceship?" Most mention things like Nintendo, while others may "argue for a CD player and forget toilet paper," he said. At the end of the presentation, he reveals that they are all indeed on a spaceship at that very moment, and the computer shows just how far they have traveled since the beginning of the class.

Hill summed up the program by saying, "The SciAd Program is an excellent example of what can be accomplished by a few active, dedicated individuals. Through the program's excellent presentations, actions were provided that reinforced the value of community participation to the schools. The continued involvement of NASA personnel and HTSI personnel, with the LCPS system, is very important to the

continual improvement of science and math education in Las Cruces.

"This ten-year activity has been exported to Houston and serves as a model for community involvement. I'm proud to have been part of the transition and feel privileged to have participated in this process with the dedicated personnel. Pleddie Baker, Nancy Chanover, SciAd program coordinator, Karen Matray, LCPS coordinator and SEA board member, and especially NMSU Physical Science Laboratory Director Kathy R. Hansen were instrumental in our success."

Baker believes the SciAd Program is outstanding. "Our primary objectives were to work with teachers and help them become comfortable teaching math and science and help them develop hands-on activities. We also wanted to show students that scientists and engineers were just regular people and that what the math, science, and technology students are learning in school are the important skills they need in real life. However, many secondary benefits have surfaced. SciAds have become role models for students and firm supporters for improvements in our education system. They have become voices throughout the community, pointing out the difficulties and obstacles teachers face every day, and the teachers' desire and commitment to improve. The SciAds' demonstrated dedication to help all children has also inspired parent and community awareness and participation.

"The employees of Honeywell Technology Solutions Inc. are unselfishly giving to make every child's life and future a better one; they are truly leaders by example."

Students, teachers, or volunteers interested in the program can contact the <http://www.wstf.nasa.gov/sciad/educate.htm> Web site for further information. ■

The author is a technical writer with L & M Technologies, Inc., a subcontractor to Honeywell Technology Solutions Inc.



Dennis Smith



Joe San Filippo

“The SciAd Program is an excellent example of what can be accomplished by a few active, dedicated individuals.”
— Scott Hill

Astronaut Candidate Class of 2000 announced



Dominic Antonelli

Seventeen men and women have been selected for the Astronaut Candidate Class of 2000. They arrived at JSC this month to begin a period of training and evaluation.

This year's class consists of seven pilot and 10 mission specialist candidates. Of the 17 class members, 14 are male and three are female.

The class members include Dominic A. Antonelli (Lt., USN); Michael R. Barratt, M.D.; Robert L. Behnken (Capt., USAF); Eric A. Boe (Maj., USAF); Stephen G. Bowen (Lt. Cmdr., USN); B. Alvin Drew (Maj., USAF); Andrew J. Feustel, Ph.D.; Kevin A. Ford (Lt. Col., USAF); Ronald J. Garan, Jr. (Maj., USAF); Michael T. Good (Maj., USAF);

Douglas G. Hurley (Maj., USMC); Timothy L. Kopra (Maj., USA); K. Megan McArthur; Karen L. Nyberg, Ph.D.; Nicole P. Stott; Terry W. Virts, Jr. (Capt., USAF); and Barry E. Wilmore (Lt. Cmdr., USN).

The astronaut candidates were selected through a highly competitive process that evaluated their education, training, experience, and unique qualifications.

Following the initial period of training and evaluation, the astronaut candidates will receive technical assignments and continue training in preparation for spaceflight assignment.

A complete list of the candidates and their biographical information can be found at: <http://www.nasa.gov/newsinfo/astro2000.pdf>.



Michael Barratt



Robert Behnken



Eric Boe



Stephen Bowen



B. Alvin Drew



Andrew Feustel



Kevin Ford



Ron Garan



Michael Good



Douglas Hurley



Timothy Kopra



K. Megan McArthur



Karen Nyberg



Nicole Stott



Terry Virts



Barry Wilmore



NASA JSC Photo 2000-05569 by Benny Benavides

Expedition One Update: *Crew departs for Russia*

Symbolizing the completion of its preflight training in the U.S., the Expedition One crew is treated to a celebratory cake from the training team in Bldg. 5. The international crew, left to right, Russian Cosmonauts Sergei Krikalev and Yuri Gidzenko and U.S. Astronaut Bill Shepherd, departed August 10 for Star City, Russia, where they will complete their mission training. The three are scheduled to launch from Baikonur in a Russian Soyuz Rocket October 30 and will be the first long-duration residents of the International Space Station.

For additional information on Expedition One visit <http://spaceflight.nasa.gov/station/crew/index.html>.

Media roundup for *Space Cowboys* press event



NASA JSC Photo 2000-05348 by Robert Markowitz

Press Weekend for the *Space Cowboys* movie presented JSC with an opportunity to share spaceflight news with the media. Shown here, JSC's Phil West shows actress Marcia Gay Harden an EVA glove while ISS Chief Scientist Kathryn Clark and a Warner Brothers representative look on.

Stars of a different kind were the focus of JSC for one brief weekend this summer. On July 22 and 23, JSC's high-fidelity mockups and unique spaceflight training facilities became the backdrop for *Space Cowboys*' Press Weekend.

As part of the event, JSC hosted more than 150 U.S. and international entertainment reporters to inform and educate them about spaceflight and NASA. The press, already treated to a special screening of the film Warner Brothers sponsored at a local theater, filled Bldg. 9 for live interviews and footage.

Shrouded in black tents placed throughout the Bldg. 9 mockups, were the movie's stars – Clint Eastwood, James Garner, Tommy Lee Jones and Donald Sutherland. Inside the tents, some of TV's most well-known entertainment media, such as *E!*, *Access Hollywood*, *Starz* and *Encore*, sought sound bites from the megastars.

The event was a unique opportunity to showcase the nation's space program to a different sector of the press corps. JSC and Headquarters' Public Affairs staff arranged several NASA speakers and exhibits in Bldg.9 ranging from TransHab and space tools to the glass cockpit and virtual reality demos. Reporters and camera crews also were shown the Mission Control Centers and the Neutral Buoyancy Lab.

Costs incurred by JSC for the media interview portion of the event, as well as the filming of the movie, were reimbursed by Warner Brothers under separate Space Act Agreements. The Warner Brothers film was produced with the cooperation and support of NASA.

Lights, camera, action!

Much of the filming was done in Los Angeles, but many sequences were filmed at JSC including the Shuttle Motion-Based Simulator and the NBL. Scenes also were filmed at KSC including the Vehicle Assembly Building, the launch pad, and the astronaut ready room. Although the film is based on a fictional story, producers strived to make it realistic and plausible, even to the space experts.

To that end, some JSC employees technically advised film producers. Writers sought the advice of NASA Flight Director Bryan Austin who reviewed the script for technical accuracy.

"It was very satisfying to watch it after having worked on it with them," said

Austin. "To see some of the sequences in there that I suggested."

Austin said he could tell the writers were familiar with aviation terminology, but offered them more appropriate shuttle phrases for some of the dialogue. He also suggested some changes when it came to shuttle capabilities, such as deleting original scenes for a landing wave off and go-around.

"They went to great lengths to recreate things, like the MCC, accurately," said Austin. "When I first watched it, I was trying to pick out all the realities but once I reminded myself this was not a



NASA JSC Photo 2000-05354 by Robert Markowitz

Space Cowboys actress Marcia Gay Harden gets prepped for an interview during Press Weekend at JSC.

documentary, I found the movie really entertaining."

Austin notes actual shuttle footage is used in the movie, such as the landing scene which is actually Eileen Collins' historic STS-93 flight last summer with the shuttle name skillfully replaced by *Daedalus*, the shuttle name in the movie.

Some of the sounds themselves are also based on actual audio from space. Astronaut Bob Cabana worked with the crew on the set in Los Angeles last summer to provide assistance with the filming of the ascent, rendezvous and grapple scenes. While there, he provided noted Film Editor Joel Cox with an inflight video from one of his missions.



NASA JSC Photo 2000-05350 by Robert Markowitz

Entertainment reporters and camera crews from around the world convened at JSC's Bldg. 9, using space mockups as a backdrop for Press Weekend.

"I interfaced with most of the main characters giving them some pointers on what it's like to be in space and what

astronauts are doing during the various mission phases and why," said Cabana. "Being on a soundstage is quite an experience. In all honesty, I really enjoyed the technical aspects of the filming – how they develop the sets, the filming, and putting all the bits and pieces together. It's really a lot of work."

Brad Ball, Warner Brothers Pictures president of Domestic Theatrical Marketing, was on hand for Press Weekend and likened movie production to shuttle missions.

"This experience has been such a good reminder of all the technical support and

the hundreds and hundreds, if not thousands of people behind it to make it happen," said Ball of his visit to JSC. "It's sort of analogous to a film, if you will. You might see six or seven people on the screen, but behind that there are many, many people who spent a lot of weekends and time

away from their families to get it done."

According to Ball and Cox, creating a realistic movie about space adds more technical challenges to creating the film, especially creating the perception of microgravity.

"We created our own weightlessness," said Cox. "That was really the trickiest stuff we did – moving them around on arms, floating them around and using a little conveyer belt for the movements."

It also took some precarious positioning of the actors. "We've hung people from ceilings. We've had people stand around holding on to walls as if that were necessary to keep yourself from floating off, and then have ball-point pens and clipboards floating by suspended on filament lines," said Jones. "We've been on little stools that have caster wheels on them that move around. It really presents no challenge to an actor; all you have to do is stand there and take these various rides, but it's a group effort for the whole company."

"I wanted to make the film as believable as possible," said Eastwood, who directed the film. "In order to do that, we needed NASA's help to get as close as we could to the circumstances surrounding a launch. It's a complicated process and it requires careful planning and teamwork on all levels. Bringing a film crew in to simulate the whole thing was probably an even bigger headache for NASA, but the agency really came through for us. I couldn't be more pleased with the results." ■

Stars reflect on JSC, space program



CLINT EASTWOOD

On working at JSC...

It was great having the help and the assistance of all the people and the input of the various astronauts. Naturally, when you run the show down here [with] a lot of insiders, people who know what it takes to make the spacecraft go up, it's always a little bit nerve-racking, because these are people who know, even though you're doing a hypothetical story. Somebody called it last night "plausible fiction" and I think that's a great way to put it.

But we sure appreciate all the help that everybody gave us out here. We couldn't have done it without them, certainly not as well.

On the shuttle simulator...

My first landing was pretty good. I'm interested in aviation so that makes it easier but when you get to the space shuttle it becomes another realm.

On the space program in general...

Just to see the people and their enthusiasm towards their work. The dedication is pretty phenomenal here.



TOMMY LEE JONES

On perception of the space program...

Everyone admires NASA, everyone thinks correctly that the astronauts are heroes but not everyone has an awareness of the scale of things. All this stuff is really big. And it's hard to imagine that until you actually see it.



DONALD SUTHERLAND

On the people at JSC...

They inspired me and they gave me my character. Joseph Brodsky, a Russian poet, in a commencement speech said, 'Try to stay passionate, leave your cool to the constellations, passion alone is a remedy against boredom.' The people here; their sense of passion, the sense of dedication, sense of self-deprivation and the rigor of their work and their community... I was filled with admiration for them.

On special experiences while at JSC...

I'm a Canadian and I had the delight of using the Canadarm and the great pride that I did it successfully.



JAMES GARNER

On JSC...

Keep doing the work they're doing. The astronauts and the support that they have was very, very interesting.

Photos by Ken Regan

Ripped from the ROUNDUP

Ripped straight from the pages of old Space News Roundups, here's what happened at JSC on this date:

1 9 6 5

After traveling 3,338,200 miles through space in seven days, 22 hours and 56 minutes, the Gemini V spacecraft and crew floated to a landing in West Atlantic waters, ending their record-breaking flight at 6:55 a.m. CST August 29.

Bearded Astronauts L. Gordon Cooper Jr. and Charles Conrad Jr. landed some 90 miles west of the prime recovery ship, the aircraft carrier USS *Lake Champlain*, after making 120 revolutions around the Earth in just under eight days. The flight was cut one revolution short because of a storm called Hurricane Betsy in the planned recovery area.

1 9 7 5

After last month's historic Apollo-Soyuz flight and two weeks of hospitalization and rest in Hawaii, the three Apollo astronauts, Tom Stafford, Vance Brand, and Deke Slayton, have come home to Houston and to JSC.

The crew's expected arrival July 26 was delayed because of a pulmonary irritation resulting from inhalation of toxic gas minutes before splashdown. Their reported chest discomfort led to admittance to Tripler Army Medical Center in Honolulu, Hawaii, where they remained in isolation for six days. Nine days of semi-isolation followed, in company of their wives and families, during which they were still monitored for any further irritation or discomfort.

The three families arrived in Washington, D.C., for post-mission press conferences. At a White House ceremony, President Ford presented the crew with NASA Distinguished Service Medals and promoted Tom Stafford to the rank of Air Force Major General.

1 9 9 0

The Hubble Space Telescope lit a fire of excitement in the scientific community this week when its cameras discovered a massive stellar nursery with almost 60 stars in a cluster formerly thought to include 27 objects.

Scientists at the HST Control Center Monday released four photos of a star cluster called R-136 in 30 Doradus — "The Swordfish" — which resides in the large Magellanic Cloud in the Southern Hemisphere.

Astronaut Collins honored with Stewart Award

The Mighty Eighth Air Force Museum recently honored NASA Astronaut and U.S.A.F. Col. Eileen Collins for her extraordinary role as an aviator and the first female shuttle commander. Ben Love, a veteran of 25 B-17 missions as part of the Eighth Air Force and a director of the museum in Savannah, presented Collins with the 1999 Brigadier General James M. Stewart Award at a ceremony in downtown Houston July 19.

"Colonel Collins was selected for her leadership on her three spaceflights and the technical problems she overcame during two of them," said Love. "You [Eileen] represent the finest elements of being an American in your work... You serve as a great role model, much like Jimmy Stewart."

Collins has logged more than 537 hours in space. She served as pilot on STS-63 (February 2-11, 1995) and STS-84 (May 15-24, 1997), and shuttle commander on STS-93 (July 22-27, 1999).

The Stewart Award, an annual award named for airman and popular screen actor Jimmy Stewart, honors an individual or a group of individuals in recognition of uncommon aviation skills, dedicated leadership and high competence of aviation-minded men and women.



NASA JSC Photo 2000-05317 by Robert Markowitz

Eighth Air Force veteran Ben Love, right, presents the 1999 Brigadier General James Stewart Award to Astronaut Eileen Collins.

"Stewart's name in itself points to the traits the nominees would seek in candidates for this award," explained Love. "I flew combat at the same time he did, from a different base, but I assure you, he did not take the easy combat missions — he was the real McCoy."

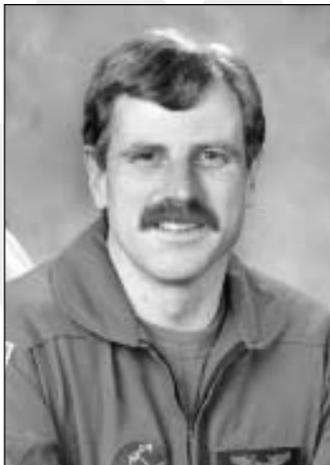
Astronaut Collins is the third recipient of the Stewart Award. Past recipients include Colonel John H. Beard, U.S.A.F., leader of the longest aerial combat mission, which lasted 35.5 hours; and General Michael E. Ryan, U.S.A.F., Chief of Staff of United States Air Force. ■

International astronauts honored for outstanding contributions to space program

Canadian Astronauts Dafydd (Dave) Rhys Williams and Julie Payette, international members of NASA's astronaut corps, were honored recently for their contributions to both the American and Canadian space programs.

The Ninety-Nines, Inc., an international organization of women pilots, honored the two Canadian Space Agency astronauts for outstanding contributions in promoting aviation and aerospace throughout the world. The award was presented in Atchison, Kansas, the birthplace of Amelia Earhart.

Williams' and Payette's names will now appear in the Forest of Friendship. The Forest, located in Atchison, is home to trees representing all 50 states and 35 countries from around the world, and



Dave Williams



Julie Payette

includes flags and plaques honoring the men and women who have contributed significantly to aviation and aerospace.

Williams joined NASA as a member of the 1995 class of astronauts, reporting to the Johnson Space Center in March of that year. In 1998, he was a crewmember

on the STS-90 Neurolab mission focusing on the effects of microgravity on the brain and nervous system and recognizing "the decade of the brain." The STS-90 mission completed 256 orbits of the Earth, traveling 6.3 million miles. He currently leads JSC's Space and Life Sciences Directorate, which encompasses medical requirements and benefits of spaceflight as well as planetary exploration missions.

Payette is a member of the 1996 astronaut class. She was a member of the STS-96 crew that carried four tons of logistics and supplies to the International Space Station in 1999 to prepare it for the first Expedition crew, scheduled to arrive later this year. She is currently a member of the Crew Test Support Team providing crew insight and support to the development and testing of space station hardware and software in Russia. ■

TICKET WINDOW

The following discount tickets are available at the Exchange Stores

General Cinema Theaters	\$5.50
Sony Loew's Theaters	\$5.50
AMC Theaters	\$5.00
Fiesta Texas	adult \$20.50, child (under 48 inches) \$17.25
Astroworld	1 day \$21.00, 2 day \$31.00
WaterWorld	\$12.00
Moody Gardens (2 events) (does not include Aquarium Pyramid)	\$10.75
Moody Gardens (Aquarium only)	\$9.25
Sea World	adult \$29.00, child (3-11 years) \$19.25
Schlitterbahn	adult \$21.50, child (3-11 years) \$18.00
Space Center Houston	adult \$11.00, child (age 4-11) \$7.25
(JSC civil service employees free.)	
Space Center Houston annual pass	\$18.75
Splash Town	1 day \$13.00, Season Pass \$37.50
Postage Stamps (book of 20)	\$6.60

Exchange Store hours

Monday-Friday
Bldg. 3 7 a.m.-4 p.m.
Bldg. 11 9 a.m.-3 p.m.

➤ All tickets are nonrefundable.
➤ Metro tokens and value cards are available.

Super September Sale

➤ 10% off all merchandise, candy and cards Sept 1-15! Stop by the stores for details.

For additional information, please call x35350.

Please bring your driver's license to pay by personal check.



NASA, European Space Agency team delivers first integrated payload trainer to JSC

The Minus Eighty Laboratory Freezer for the International Space Station (MELFI) trainer was delivered to the Payload Training Complex in Bldg. 5's Space Station Training Facility on July 7. This trainer will be used to train ISS Increment 4 and UF-1 crews currently scheduled to launch in October 2001.

The first major piece of station hardware developed for NASA by the European Space Agency and its industrial contractor, Astrium, MELFI is a -80 degree Celsius rack-based freezer system that will be used for the cooling and preservation of scientific materials aboard the ISS at +4 degrees C as well as at -26 degrees C and at -80 degrees C. It will be transported to and from the station aboard the Italian-built Multi-Purpose Logistics Modules that will be carried to orbit in the space shuttle's cargo bay.

Rick Nygren, manager of the ISS Payloads Office, thanked the ESA/Astrium team at an acceptance review and award ceremony at the Astrium facility in Toulouse, France, on June 22. "The MELFI trainer represents the first major milestone in a cooperative effort between NASA and ESA in achieving a flight-like crew training capability on the ground to train both shuttle and station astronauts and cosmonauts for long-duration research aboard the International Space Station. The MELFI trainer is significant because it is the first integrated payload trainer and it is of superior fidelity."

Crew training on the MELFI trainer will include normal operating procedures for sample insertion and removal, routine maintenance items, Orbital Replacement Units and off-nominal troubleshooting procedures. The crew will be able to command the MELFI trainer from either the front panel or from a Portable Computer System and respond to unplanned failures originating from an instructor station in the Bldg. 5 training complex. This trainer will also have the ability to train ground crews at Marshall Space Flight Center's Payload Operations and Integration Center or JSC's Telescience Support Center by providing access to MELFI's telemetry and providing ground command and control.

ESA is expected to provide all the basic ISS crew and science refrigeration capabilities including the MELFI, the crew refrigerator/freezers, and the cryogenic freezer system as part of barter agreements between ESA and NASA. ■

Gary Cartee, a crew trainer from Marshall Space Flight Center, and Astronaut Laurel Clark evaluate the MELFI trainer in preparation for Increment 4 payload crew training.



NASA JSC Photo 2000-05158 by Bill Stafford

United States, Brazil working together to expand space exploration

Outreach event highlights Brazil's role in space station

At the beginning of July, astronaut Marcos Pontes and avionics instructor Regina North were invited by the Brazilian Space Agency (AEB) and the National Institute for Space Research (INPE) to go to Brazil and support various activities to promote understanding of the International Space Station among Brazilian scientists and the general public.

Pontes, a test pilot and a Brazilian Air Force major, graduated with distinction from the Instituto Tecnológico de Aeronáutica and received the Space and Aeronautics Institute Award and the EMBRAER (Empresa Brasileira de Aeronáutica) Award in 1994 for test pilot training. In August 1998, he graduated with distinction from the Naval Postgraduate School in California and reported to the Johnson Space Center to begin astronaut candidate training.

North, a behavioral scientist with United Space Alliance in the Space Flight Training Division in the Mission Operations Directorate, has studied in Brazil, France, and the United States. She has been a member of the ISS instructors' team for the last five years. She started her career as an instructor in ISS payload training in the MOD and was later transferred to the International Training Integration Office. Currently, she is a member of the ISS Avionics Training Team.

An American born in Brazil, North is very familiar with the ISS Program, its partners and participants. She speaks five languages fluently and is currently learning Russian. She is also the cross-cultural communication instructor for United Space Alliance's Space Academy.

In Brazil, astronaut and instructor were a winning team, delivering support to AEB and INPE, lecturing in Portuguese, and explaining the ISS and the human space exploration program to several thousand people in fewer than 10 days.

Their presentations began at INPE's School of Space in São José dos Campos. INPE is the organization tasked by AEB to manage the ISS contract between NASA and AEB and is responsible for



Regina França of the Brazilian Space Agency, NASA Astronaut Marcos Pontes, and Regina North of United Space Alliance at the National Institute for Space Research in São Paulo, Brazil.

developing equipment to be provided to NASA for assembly of the ISS.

Currently in its second year of operation, INPE's School of Space provides high school students from around the country an intensive overview of national and international space activities.

The weeklong program, the first of its kind in South America, consists of lectures and seminars by scientists, engineers and policymakers working on the space program today. Students are selected according to their grades and their interest in pursuing studies in space engineering, science, and research. Students learn about building satellites and launchers, testing and integration, tracking and telemetry, remote sensing, meteorology, astronomy, the Brazilian space program, and the ISS.

Following their presentations at the School of Space, Pontes and North left São Paulo to participate in a prestigious National Scientific Congress sponsored by the Brazilian Society for the Progress of Science (SBPC) and hosted by the University of Brasilia in Brazil's capital



Regina North explains the uses of flight equipment displayed in the Brazilian Space Agency/ National Institute for Space Research booth at the University of Brasilia during the National Scientific Congress sponsored by the Brazilian Society for the Progress of Science.

city. The theme of this year's Congress was the 500th anniversary of Brazil and the new challenges, options, and alternatives for the development of Brazil in the next century.

As part of this program to focus on the increased participation of Brazil in the space arena, Pontes, North, and Eduardo Dornelles from AEB presented a four-day course titled "Brazil and Space Exploration." Dornelles presented the history of the Brazilian space program, the international agreements, and the Brazilian participation in the space station. North presented an overview of the ISS and its components, and Pontes presented the everyday life of an astronaut and how to become an astronaut.

To complement this course, AEB and INPE installed an elaborate booth in the SBPC conference pavilion. At the AEB/INPE booth, elegantly mounted on blue, yellow, and green (primary colors of the Brazilian flag) carpeting, were displayed panels depicting the history of the Brazilian space program and models of Brazilian-built satellites, rockets, and the ISS. As a team, Regina França from AEB, North and Pontes demonstrated the use of NASA/Public Affairs Office-provided flight equipment (launch/reentry helmet, glove used for extravehicular activity, space food, and intravehicular activity uniform) and answered questions from thousands of visitors.

Dr. Luis Gylvan, president of AEB; Dr. Raimundo Mussi, AEB director for ISS Development; and other AEB/INPE Brazilian authorities visited, worked at the booth and attended the course. AEB and INPE were very thankful for JSC's support of the event.

This joint effort was a clear example of the ISS Program exercising its major goal of bringing nations together to promote international cooperation and expanding the understanding of space exploration around the world. "It was a great success," says North. "It showed an International Space Station that is growing, healthy and strong; demonstrated a solid international cooperation for space exploration; and confirmed NASA's commitment to maintaining its leadership with the support and involvement of Brazil, the only country in the Southern Hemisphere to participate in the ISS venture." ■

DATES & DATA**August 30**

Astronomy seminar: The JSC Astronomy Seminar Club meets at noon August 30 and September 6 in Bldg. 31, Rm. 248A. For more information contact Al Jackson at x35037.

Spaceteam Toastmasters meet: The Spaceteam Toastmasters meet at 11:30 a.m. August 30 and September 6 at United Space Alliance, 600 Gemini. For details contact Patricia Blackwell at (281) 280-6863.

August 31

Communicators meet: The Clear Lake Communicators, a Toastmasters International club, meet August 31 and September 7 and 14 at 11:30 at Wyle Laboratories, 1100 Hercules, Suite 305. For more information contact Allen Prescott at (281) 282-3281 or Richard Lehman at (281) 280-6557.

Radio Club meets: The JSC Amateur Radio Club meets at 6:30 p.m. at Piccadilly, 2465 Bay Area Blvd. For more information contact Larry Dietrich at x39198.

September 1

Chess Club meets: The Space City Chess Club meets from 5 p.m. - 9 p.m. at the Clear Lake Park Recreation Bldg. All skill levels are welcome. For details please call James Mulberry at x39287 or James Termini at x32639.

September 5

Quality Society meets: The Bay Area Section of the American Society for Quality meets at 6 p.m. at the Ramada King's Inn on NASA Road 1. For more information contact Ann Dorris at x38620.

September 7

Warning System Test: The site-wide Employee Warning System performs its monthly audio test at noon. For additional information contact Bob Gaffney at x34249.

September 8

Astronomers meet: The JSC Astronomical Society meets at 7:30 p.m. at the Center for Advanced Space Studies, 3600 Bay Area Blvd. For details contact Chuck Shaw at x35416.

OUT & ABOUT ★

NASA JSC Photo 2000e20692 by James Blair
JSC's new Child Care Center nears completion. Shown here, Shannon Clem (left) and Ronald Zepeda of Houston Safety Surfaces paint the surface of the swing set. The center, located near the Gilruth Center, opened August 16.

September 12

Aero Club meets: The Bay Area Aero Club meets at 7 p.m. at the Houston Gulf Airport clubhouse at 2750 FM 1266 in League City. For details contact Larry Hendrickson at x32050.

NPMA meets: The National Property Management Association meets at 11:30 a.m. at the Gilruth Center. For additional information contact Ray Whitaker at (281) 212-6030.

September 13

IAAP meets: The Clear Lake/NASA Chapter of the International Association of Administrative Professionals (formerly Professional Secretaries International) meets at 5:30 p.m. at Bay Oaks Country Club. Cost is \$16. For details and reservations, call Tami Barbour at (281) 488-0055, x238.

September 14

Airplane club meets: The Radio Control Airplane Club meets at 7 p.m. at the Clear Lake Park building. For more information contact Bill Langdoc at x35970.

NASA BRIEFS**HUBBLE DISCOVERS MISSING PIECES OF COMET LINEAR**

To the surprise and delight of astronomers, NASA's Hubble Space Telescope has discovered a small armada of "mini-comets" left behind by what some astronomers had assumed was a total disintegration of the explosive comet LINEAR.

Hubble's powerful vision has settled the fate of the mysteriously vanished solid nucleus of the comet, which seemed to disappear after it moved around the Sun.

On July 27, ground-based observers lost sight of the bright core of the comet and suggested that the nucleus disintegrated into a pile of dust. Astronomers at the Space Telescope Science Institute in Baltimore, MD, quickly reprogrammed Hubble to search for the missing nucleus. Johns Hopkins University astronomer Hal Weaver said he was stunned when the Hubble image popped up on his computer screen. "My first thought was Hubble Space Telescope does it again! We caught the fish! This is amazing, very exciting, very neat."

Though comets have been known to break apart before, this is the first time astronomers have a close-up view of the dismantling of a comet's nucleus due to the Sun's heat. Since the 1950s, researchers assumed comet nuclei were loose clusters of ice and dust, called cometesimals, held together by gravity. Solar heat causes the ices to sublimate and violently release gas as explosions and garden hose-style jets. The pressure of the solar radiation blows away particles like debris caught in a gale.

Some astronomers think that the fragments now being seen in LINEAR may be the primordial building blocks of the original nucleus, the so-called cometesimals, which theory predicts should be several tens of feet across. The breakup of a comet tells scientists how it was put together in the first place. The cometesimals were built up from micron-sized grains of dust as it collected in the early solar system, roughly 4.6 billion years ago.

On Weaver's screen were at least a half dozen "mini-comets" with tails, resembling the shower of glowing fireballs from fireworks. They were clustered in the lance-head tip of an elongated stream of dust and an isolated brighter piece in front of the cluster may be the parent nucleus for the smaller fragments. Hubble's exceptional resolution and sensitivity allowed it to reveal the nuclei as separated bodies at a level of detail never before seen in a disintegrating comet.

Some astronomers believe this was Comet LINEAR's first visit to the inner solar system, after traveling for nearly the distance of one light-year (six trillion miles) from the vast comet storehouse called the Oort cloud.

PACIFIC DECADAL OSCILLATION PACKS A ONE-TWO PUNCH

The Pacific Ocean, the largest and deepest of the world's seven oceans, suffers periodic mood swings that have a dramatic impact on our weather. These mood swings are a climate phenomenon known as Pacific Decadal Oscillation, or PDO. It's an El Niño-like shift in the ocean's temperature that scientists once thought cycled every 15 to 20 years.

However, there's new NASA research that now shows there may be a second, much longer, PDO pattern that lasts about 70 years.

Yi Chao, Ph.D., an oceanographer at NASA's Jet Propulsion Laboratory, and colleagues Michael Ghil, Ph.D., and James McWilliams, Ph.D., of the University of California, Los Angeles, have found evidence of the PDO's two-part structure in a study of the past 92-year record of sea-surface temperatures in the North and South Pacific. The results of their study appear in the August 1, 2000, issue of Geophysical Research Letters.

More information about the Pacific Decadal Oscillation is available on the Internet at:

<http://topex-www.jpl.nasa.gov/discover/PDO.html>

and

<http://tao.atmos.washington.edu/pdo/>

GILRUTH CENTER NEWS**Sign up policy:**

All classes and athletic activities are on a first-come, first-served basis. Sign up in person at the Gilruth Center and show a yellow Gilruth or weight room badge. Classes tend to fill up two weeks in advance. Payment must be made in full, by cash or by check, at the time of registration. No registration will be taken by telephone. For more information, call x33345.

Gilruth badges:

Required for use of the Gilruth Center. Employees, spouses, eligible dependents, NASA retirees and spouses may apply for photo identification badges from 7:30 a.m.-9 p.m. Monday-Friday and 9 a.m.-2 p.m. Saturdays. Cost is \$12. Dependents must be between 16 and 23 years old.

Open from 6:30 a.m.-10 p.m. Monday-Thursday, 6:30 a.m.-9 p.m. Friday, and 9 a.m.-2 p.m. Saturday. Contact the Gilruth Center at (281) 483-3345. <http://www4.jsc.nasa.gov/ah/exceaa/Gilruth/Gilruth.htm>

Nutrition intervention program: This is a free seven-week program designed to provide an understanding of the role diet and nutrition play in health. The program includes a series of lectures and private consultations with a dietitian. You will learn how to use dietary vitamins, minerals and herbal nutraceuticals for optimizing health. Classes are held on Wednesdays from 4 p.m. to 5 p.m. For details call Tammie Labiche, registered dietitian, at (281) 483-2980.

Defensive driving: One-day course is offered once a month at the Gilruth Center. Pre-registration required. Cost is \$25. Call for next available class.

Stamp club: Meets every second and fourth Monday at 7 p.m. in Rm. 216.

Weight safety: Required course for employees wishing to use the Gilruth weight room. Pre-registration is required. Cost is \$5. Annual weight room use fee is \$105. The cost for additional family members is \$58.

Exercise: Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is \$24 for eight weeks.

Step/bench aerobics: Low-impact cardiovascular workout. Classes meet from 5:25-6:25 p.m. Tuesdays and Thursdays. Cost is \$40 for eight weeks.

Yoga stretching: Stretching class of low-impact exercises designed for people of all ages and abilities in a Westernized format. Meets Thursdays 5-6 p.m. Cost is \$40 for eight weeks. Call Darrell Matula, instructor, at x38520 for more information.

Ballroom dancing: Classes meet Thursdays from 6:30-7:30 p.m. for beginner, 8:30-9:30 p.m. for intermediate and 7:30-8:30 p.m. for advanced. Cost is \$60 per couple.

Country and western dancing: Beginner class meets 7-8:30 p.m. Mondays. Advanced class (must know basic steps to all dances) meets 8:30-10 p.m. Mondays. Cost is \$20 per couple.

Fitness program: Health-related fitness program includes a medical screening examination and a 12-week individually prescribed exercise program. For more information call Larry Wier at x30301.

Aikido: Martial arts class for men and women meets 5-6 p.m. Tuesdays and Wednesdays. No special equipment or knowledge is needed to participate. Aikido teaches balance and control to defend against an opponent without using strength or force. Beginning and advanced classes start each month. Cost is \$35 per month.

SPACE CENTER Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Johnson Space Center, Houston, Texas, and is published by the Public Affairs Office for all space center employees. The Roundup office is in Bldg. 2, Rm. 181. The mail code is AP3. The main telephone number is x38648, and the fax is x32000. Electronic mail messages may be directed to:

Editor William Jeffs william.p.jeffs@jsc.nasa.gov
Assistant Editor Nicole Cloutier nicole.cloutier1@jsc.nasa.gov

**PRSR STD
U.S. POSTAGE
PAID**

WEBSTER, TX
Permit No. G27