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Expedition 1 crew to bring station to life

With the launch of the first Expedition crew this month, the International Space Station will be transformed from a place to visit to a place to live.

In November, a U.S.-Russian crew of three will begin living aboard the ISS, starting a permanent human presence aboard the orbiting outpost. The crew includes ISS Commander Bill Shepherd, a U.S. astronaut; Soyuz Commander Yuri Gidzenko, a Russian cosmonaut; and Flight Engineer Sergei Krikalev, also a Russian cosmonaut.

When the crewmembers arrive, the station will consist of three modules: the Russian Service Module Zvezda, which will serve as living quarters and on-board control center for the early station; the U.S.-funded and Russian-built Zarya, a module that provides supplementary power and propulsion functions; and the U.S.-built Unity, a connecting module that provides the attachment points for future U.S. segments.

The crew's mission will be a flight test of the new station as they assist with critical assembly activities. The crew will be launched October 30 on a Russian Soyuz spacecraft from the Baikonur Cosmodrome in Kazakhstan.

Gidzenko will serve as the Soyuz commander for the two-day trip from Baikonur to the station.

"After two days, in orbit 32, we'll begin the process of docking," said Gidzenko. "We'll still have a distance [to] approach, then we approach the station, then we have the docking itself. As a rule this is all done automatically, on an automated mode; the flight engineer, the commander and the astronauts or cosmonauts who are monitoring the process, and if something does occur with the automatic docking, well then the crew gets involved and does it manually. Specifically I have two levers that would allow me to control the vehicle to do the approach and docking manually. Then, following the docking, we check the seal, equalizing pressure between the transport vehicle and the ISS. We open [the] hatches. Then we start working on the station."

The first residents will take the station on a shakedown cruise through space

during their four-month stay. They will turn on and test all the parts, preparing the outpost for the arrival of the Destiny laboratory in early 2001.

"The very first thing we're [going to] do is turn the lights on," said Shepherd. "It's kind of like getting into your house. We have a backup computer panel that we're [going to] fire up and make sure that we can

"On shuttle, everything is fairly carefully orchestrated because we don't have a lot of time during the mission, so the planning is very precise about what you're doing almost every minute," said Shepherd. "We won't have that on station. We'll get up every morning, look at the message traffic from the ground, try and figure out what the last-minute changes

can be pretty negative if you don't work out. Between that, doing some Earth observations and we've got a couple science experiments on board. We have a space walk planned, and we have shuttles coming and going all the time, Progress vehicles to load and unload, and we'll stay busy."

The first Expedition crew will welcome a number of space shuttle visitors during its time on board the ISS. Each shuttle flight will deliver different station components.

"The most important flight, I believe, in our scheduled mission is [the] 5A flight, which [will] deliver [the] Lab for us," said Krikalev. "It will mean additional modules for us to live in because 3A and 4A will install equipment outside of the station, and it wouldn't be habitation area for us, but 5A will deliver [the] Lab and its new module, which is going to be [the] central part of [the] U.S. side of the station. It also has new computer systems, new hardware for future scientific equipment, and life support equipment also. So it would be another big and interesting task for us to activate all of this, check it in different modes, reconfigure all computer systems on board to the station to make [the] computers able to talk to each other and exchange information and, actually, I believe [the] biggest task for us will be through all flight, will be computer configuration, and testing hardware and software in different modes."

The Expedition 1 crew will have plenty to do when shuttle crewmembers visit and attach new pieces of hardware to the ISS during several space walks.

"Because a lot of EVAs depend on specific position of the station, we need to be sure that attitude control will be proper, and configuration of jets which hold attitude will be proper because if crew is working somewhere close to jets, we need to be sure that jets wouldn't fire on the shuttle, on the arm, on the crewmembers," said Krikalev. "In many cases, at least 4A would be a good example, after [the] installation of solar arrays, we need to reconfigure system to get power from the solar array, and actually activate [the] computer system, which controls

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When the Soyuz hatch opens and Shepherd, Krikalev and Gidzenko board the International Space Station, it will become a home for cosmonauts and astronauts for 15 or more years. It will be a routine step for our crew; but it will mark a moment when we are permanently changing the course of human space flight. Human space flight will truly become an international operation as we become one group working together to accomplish a common goal.

I want to acknowledge the accomplishments of the Shuttle-Mir Phase One Program, as we mark this new beginning of permanent occupation of the International Space Station. What we learned in those nine Shuttle flights to Mir is now embodied in the teams hard at work in Phase 2 construction of ISS.

I want to acknowledge the connection that every one of us working on this Program feels, as the crew takes their posts. There is a huge team who will be there with the crew each step of the way.

We've arrived at base camp, we have a lot of climbing to do still – the summit is in sight.

–Tommy Holloway, NASA International Space Station Program Manager

talk to the computer. Then we're [going to] go around the house and turn the utilities on, and we're [going to] want to get at the fresh water [to] be able to heat it and make food; turn the toilet on – it's got some assembly that goes with it – configure some radios. And if we get all that done the first day, we'll count it as a success."

Daily activities for the first crew aboard the ISS will be somewhat structured, but not to the extent that they are aboard the space shuttle. Crewmembers will use a program called the Onboard Short Term Plan Viewer to help plan their daily schedules.

have been to the day's plans. We'll have a short conference with Mission Control to discuss this with the flight directors; then we'll get into the day's work. Part of that will be assembly and checkout of various pieces of [the] station, maybe some tests on some gear that has been installed previously that we want to look at. It is a very serious requirement on board to get some exercise every day. Everybody has two hours each day to run on the treadmill and do some other stuff because it's very important to stay healthy because when you're weightless the effects on your body

Expedition 1 Crew



William M. (Bill) Shepherd

William (Bill) Shepherd, 47, Capt., USN, will serve as the International Space Station commander. Selected as an astronaut by NASA in 1984, Shepherd considers Babylon, N.Y., his hometown and will be making his fourth space flight. Shepherd served as deputy manager for the International Space Station Program from 1993 to 1996, before his assignment to command the first Expedition crew. His space shuttle flights include mission STS-27 in December 1988; STS-41 in October 1990; and STS-52 in October 1992. He has logged more than 440 hours in space.



Yuri Pavlovich Gidzenko

Yuri Pavlovich Gidzenko, 35, Lt. Col., Air Force Russia, will serve as the Soyuz commander. Gidzenko began his training as a Russian cosmonaut in 1989. He was born in the village of Elanets, Elanetsky district, Nikolayev region, Russia, and will be making his second space flight. Gidzenko commanded the Euromir-95 mission aboard the Mir Space Station from September 1995 to February 1996. He has logged more than 180 days in space.



Sergei K. Krikalev

Sergei Konstantinovich Krikalev, 38, will serve as the Flight Engineer. Selected as a Russian cosmonaut in 1985, Krikalev was born in Leningrad (renamed St. Petersburg), Russia, and he will be making his fourth space flight. He first flew as flight engineer on the second joint Soviet-French science mission aboard the Mir Space Station from November 1988 to April 1989. He next flew as flight engineer on the ninth Mir mission from May 1991 to March 1992. In February 1994, Krikalev became the first cosmonaut to fly on the space shuttle on mission STS-60, the first joint U.S.-Russian shuttle flight. In December 1998, he served on STS-88, the first International Space Station assembly mission. He has logged more than one year and three months in space, including seven space walks.

In case of emergency...

Expedition crews well trained in medical procedures

Need to have that sore tooth extracted while flying aboard the International Space Station? Having respiratory problems and need to have an emergency tracheotomy performed? Is that heart in need of some quick cardiopulmonary resuscitation? Need to have that wound sutured? Not a problem.

Two of the three Expedition crewmembers for each mission are designated as Crew Medical Officers or CMOs and are trained to do basic dental procedures, perform CPR, do emergency tracheotomies, intubate a patient and more. They have been trained to use a number of medical devices for normal medical analysis as well as emergency medical procedures.

Included in the Expedition 1 crew's cargo are three bags of medical equipment and supplies: the Ambulatory Medical Pack, the Advanced Life Support Pack and the Crew Contamination Protection Kit.

The Ambulatory Medical Pack contains oral medications, topical ointments and creams as well as saline solution and eye drops, bandages and gauze, sterile gloves, thermometers, eye shields, splints, and cough lozenges. There are also surgical supplies including a disposable skin stapler, a staple remover, sterile gloves and sterile surgical instruments – everything the crew may need to perform simple surgery.



Laura Lea Barnes, training support coordinator with Wyle Laboratories, exhibits the three bags of medical equipment and supplies that the Expedition 1 crew will have on board the International Space Station.

"We train the CMOs how to do simple suturing," said Laura Lea Barnes, training support coordinator with Wyle Laboratories. "We train them to suture on pig's feet like you would get at the grocery store. Crewmembers have several options to close a wound. They can use sutures (needle and thread), staples, a surgical skin adhesive like super glue or strips of surgical tape."

The AMP also contains a Portable Clinical Blood Analyzer subpack. Every 60 days, crewmembers do a blood analysis. The dental subpack is also in the AMP. "We teach our crewmembers how to take care of their teeth," said Barnes. "They can do temporary fillings, re-cement a crown and extract teeth."

Thankfully, they also know how to anesthetize the site before removing the tooth. Each received a one-hour course in general dentistry at the JSC Clinic.

Crewmembers perform a physical exam every 30 days, and everything they need to complete it can be found in the Physical Exam Subpack – an otoscope, an ophthalmoscope, and a reflex hammer.

The Advanced Life Support Pack contains packets with everything needed to establish an airway (including a laryngoscope and suction device) as well as emergency medications. The Crew Contamination Protection Kit provides a way for the crew to clean up chemical spills and protect themselves.

The crewmembers will be provided with a medical checklist that includes all of the instructions for procedures they may need to perform – from loading syringes to extracting teeth. It is written in English and Russian. ■

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EXPEDITION 1

cooling and power supply. So in many cases, we will do this job in parallel: crew will work outside and we will work inside making all internal connections."

The Expedition 1 crew began training on October 14, 1996, in Russia. Shepherd, Gidzenko and Krikalev have traveled back and forth between the U.S. and Russia over the past four years, spending 44 weeks as an entire crew training in the U.S. and nearly double that time in Russia.

Most of the crew's training in the U.S. took place at JSC; some training took place at Marshall Space Flight Center and at

Kennedy Space Center. Most of the training in Russia took place at the Gagarin Cosmonaut Training Center in Star City, with some training at Energia in Korolev, some Russian payload training in Germany and survival training at the Black Sea and Ruza.

The Soyuz spacecraft the first crew rides to orbit will remain docked with the station. It will be changed out with a fresh spacecraft every six months. Thus, part of the crew's training regimen has included time at Russia's Black Sea, learning how to deal with the possibility of a water landing in a Russian Soyuz spacecraft.

Training of the first Expedition crew has called for both U.S. and Russian training instructors to learn about different approaches to teaching space flight crews.

"The ISS Program has been a great benefit to all training instructors from both countries as each has learned different approaches to teaching," said Debbie Trainor, NASA increment training integrator for Expedition 1.

The Expedition 1 crewmembers will return aboard the space shuttle on assembly flight 5A.1. They will be relieved by a new crew of three that will be launched on the shuttle on flight 5A.1. ■

Expedition 1 Science

In addition to assisting shuttle visitors and checking out station hardware and software, the Expedition 1 crew will conduct five U.S. experiments and five Station Detailed Test Objectives covering microgravity research, education, Earth observation, Department of Defense and human life science. Experiments and research goals are:

- ◆ **Protein Crystal Growth** – *Enhanced Gaseous Nitrogen*: Identification of molecular structures that may lead to the development of new drugs, shorten development time and improve our understanding of disease states.
- ◆ **Education** – *Seed Growth Kit*: Educational experiment to demonstrate to schoolchildren the germination and growth of seeds in space.
- ◆ **Earth Knowledge Acquired by Middle Schools**: Educational experiment to take high-resolution electronic images of the Earth, downlink them to schools and discuss the images with children. Students will develop research projects and specify Earth photography targets for use in their projects.
- ◆ **Crew Earth Observations**: To photograph Earth features of geological, meteorological or other interest.
- ◆ **Middeck Active Control Experiment II**: Launched on 2A.2B and stowed in the Node, MACE II will validate modeling and control designs for adaptive neural net control and multi-body dynamics and control in microgravity.

◆ **Spatial Differences in Carbon Dioxide Concentration**: Determine carbon dioxide concentrations in various locations of the ISS and under different environmental conditions.

◆ **Interim Resistive Exercise Device Operational Use and Impact to ISS Environment**: View IRED operation during regularly scheduled sessions, verify exercise in the Node is not raising carbon dioxide and temperature levels and collect real-time crew input regarding IRED operations during a scheduled exercise period.

◆ **Treadmill Vibration Isolation System Feasibility of Using Different Subject Load Device Settings**: Evaluate heart rates and comfort levels during nominal aerobic treadmill ISS exercise countermeasure operations.

◆ **TVIS Stability While Running/Walking During Scheduled Aerobic Exercise**: Assess whether the treadmill is providing the expected stability with respect to the impact of loads during exercise.

◆ **TVIS Subject Load Device Effect on Locomotion and Heart Rate**: Determine how crewmembers respond to various speeds and loads, document the motions of the knee and rear foot complex, and document the crewmember's heart rate responses.

"The U.S. experiments for the first crew were selected based on their science priority and ability to fit within the resource constraints of ISS assembly," said Ven Feng, NASA increment payload manager. "They represent an important first step in realizing the research potential of the International Space Station and demonstrating that we can utilize the station while we're building it." ■

Collins receives French Legion of Honor

Astronaut Eileen Collins was recently bestowed the French Legion of Honor for her unique contributions to humankind through her significant role during STS-93.

In a ceremony in Bldg. 9 September 21, François Bujon de l'Estang, Ambassador of France to the United States, presented Collins with the medal and commended her for fostering a cooperative relationship between France and NASA, as well as her "spirit of cooperation" with French astronauts.

"French Authorities are giving you, and through you, all the men and women who work hard to further the cooperation between our nations translate into a common endeavor in space, further proof of the esteem of the French people by conferring upon you the Legion of Honor with rank of Officer," said Bujon de l'Estang.

Col. Collins was lauded, not only for her role as the first female to command a space shuttle mission, but also for her ability to lead the crew, which included Pilot Jeffrey Ashby and Mission Specialists Steven Hawley, Ph.D., Catherine Coleman, Ph.D., and European Space Agency Astronaut Michel Tognini from France.

"Heroism does not only belong to the lone adventurers," said Bujon de l'Estang. "but to a united crew, perfectly coordinated and trusting each others' knowledge and experience. Cooperation and trust are the key elements to the success."



NASA JSC Photo 2000-06298 by Benny Benavides
Astronaut Eileen Collins, far left, with husband Pat Youngs and daughter Bridgette, are all smiles with François Bujon de l'Estang, Ambassador of France to the United States. Bujon de l'Estang presented Collins with the French Legion of Honor during a September ceremony.

The Ambassador included in his remarks an overview of the role France has played in the space program and its involvement with the growing International Space Station before presenting the Legion of Honor insignia to Collins.

"Presentation of this award, to me, does not signify the end of a task or a project, but a personal challenge to me as I begin new tasks and projects," said Collins. "I want to thank you for

challenging me and my colleagues to stay highly motivated, to seek better, more cooperative and more productive ways to do things in the future."

Collins made a point of commending her crew, as well as the flight directors and training team who were in attendance, for their contributions to the mission's success. ■

White Sands Missile Range inducts first NASA employee into Hall of Fame

White Sands Missile Range, New Mexico, inducted its first NASA employee into its Hall of Fame on September 21.

Alex Paczynski became the first NASA employee inducted into the White Sands Hall of Fame. Paczynski was cited for his work at White Sands Missile Range in establishing and maintaining the range's NASA space shuttle training and landing strip.

Paczynski was introduced to White Sands in 1956 when he worked for the Douglas Aircraft Company as the test director on the Nike Hercules missile program. During a four-year period at White Sands, Paczynski oversaw more than 100 missile firings for Douglas.

In 1964, Paczynski returned to New Mexico when he joined the NASA White Sands Test Facility on the west boundary of the missile range.

In the 1970s, when NASA started looking for a site to train space shuttle pilots, Paczynski took it upon himself to propose the missile range's Northrup Strip as a training site. He convinced NASA training program personnel that the strip would be ideal for their needs. They liked it, and he then went about convincing other NASA managers, White Sands Missile Range and Holloman Air Force Base.

Paczynski was persuasive. According to Christopher Kraft, former director of the Johnson Space Center, "The landing strip has been used extensively by the Shuttle Training Aircraft, a modified



Brigadier General Steven Flohr, commander of the White Sands Missile Range, inducts Alex Paczynski, right, into the White Sands Hall of Fame.

Gulfstream transport. In fact, every shuttle commander and pilot has practiced their landing approach at the range provided by this facility."

Paczynski earned the job as program manager for Northrup Strip. Next he convinced NASA and military officials that the strip could, with just a few upgrades, handle real shuttle landings. According to Major General Niles Fulwyler, former commander of White Sands Missile Range, "It was Al who first envisioned the possibility of making Northrup Strip an alternate landing site

for the space shuttle. He was confronted with many obstacles, both political and physical, but by his total dedication and perseverance, ultimately his vision came true."

By the time the first shuttle mission flew, Northrup Strip was ready. Then, on March 30, 1982, after its third flight, the Space Shuttle *Columbia* landed at Northrup Strip. The U.S. Congress changed the name of Northrup Strip to the White Sands Space Harbor after the landing.

Paczynski continued to manage the Space Harbor until he retired from government service in 1995. According to Fulwyler, it was because of Paczynski's vision that NASA and White Sands Missile Range have such a first-class training and landing facility for the Space Shuttle Program.

Paczynski was born in Niagara Falls, New York, in 1931. He attended high school there. He earned a bachelor of science degree in electrical engineering from the University of Cincinnati in 1955. Later he earned a master of science degree in mechanical engineering from New Mexico State University in Las Cruces, New Mexico.

Hall of Fame induction is the highest honor White Sands can pay one of its own for outstanding service. Only 29 people have been inducted including Dr. Wernher von Braun, the famous German and American rocket scientist.

Paczynski and his wife, Audrey, live in Las Cruces, New Mexico. ■

Krishen receives Third Millennium Medal

Dr. Kumar Krishen, chief technologist in JSC's Technology Transfer and Commercialization Office, received the Institute of Electrical and Electronics Engineers' Third Millennium Medal during a special IEEE Galveston Bay Section Awards Evening September 21 at the Nassau Bay Hilton.

Frank Benz, director of engineering for NASA/JSC, and Ken Reightler, vice president, space operations, for Lockheed Martin in Houston, presented the award.



NASA JSC Photo 2000e23534 by Robert Markowitz
Dr. Kumar Krishen

"It is a great honor for me and my employer NASA/JSC to receive this once-in-a-millennium award," said Krishen. "It only shows that NASA provides you with opportunities to excel by technically challenging you to the maximum."

Dr. Krishen has advanced original concepts concerning remote sensing, health systems, science payloads, sensor systems, communications and tracking systems, mission support technologies, and automation and robotics technologies. His research and engineering efforts have led to several experiments on Skylab, Seasat, and the space shuttle and to the publication of more than 120 technical papers, presentations and reports – 45 of which have been published in books, technical journals or society proceedings.

Dr. Krishen has advanced technology substantially through his involvement on agency, interagency and international panels and committees. He is the post-doctoral advisor to the NASA National Research Council Program and doctoral advisor to the NASA Graduate Program and the NASA Summer Faculty Program. Through these programs, he has guided more than 12 fellows in engineering and science-related programs.

Dr. Krishen is a fellow of the Society for Design and Process Science and serves on the editorial boards of the *Journal of Integrated Design and Process Science*, the *International Journal of Advanced Manufacturing Systems* and the *Indian Journal of Radio and Space Physics*.

The criteria to receive the medal include outstanding contributions to a section, community, chapter, area of technology or outstanding contribution to their board. The Galveston Bay Section received seven medals from the list of nominees submitted last year, marking the highest recognition GBS members have received for their contributions to the advancement of electrical, electronics, photonics, and computer engineering. ■

Skylab astronaut reflects on America's first space station

Skylab was America's first experimental space station. Designed for long-duration missions, Skylab Program objectives were twofold: to prove that humans could live and work in space for extended periods and to expand our knowledge of solar astronomy well beyond Earth-based observations.



Joe Kerwin



Currently a senior vice president with Wyle Laboratories, Life Sciences, Systems and Services in Houston, Dr. Joseph Kerwin was a member of the Skylab 2 crew. Dr. Kerwin and fellow crewmembers Charles P. (Pete) Conrad Jr. and Paul Weitz spent more than 28 days aboard Skylab from May 25 to June 22, 1973. The crew conducted solar astronomy and Earth resources experiments, medical studies and five student experiments. The crew completed 404 orbits and 392 experiment hours and conducted three space walks totaling six hours and 20 minutes.

Skylab was America's first experimental space station. Designed for long-duration missions, Skylab Program objectives were twofold: to prove that humans could live and work in space for extended periods and to expand our knowledge of solar astronomy well beyond Earth-based observations. Successful in all respects despite early mechanical difficulties, three three-person crews occupied the Skylab workshop for a total of 171 days, 13 hours. It was the site of nearly 300 scientific and technical experiments: medical experiments on humans' adaptability to zero gravity, solar observations, and detailed Earth resources experiments. The empty Skylab spacecraft returned to Earth July 11, 1979, scattering debris over the Indian Ocean and the sparsely settled region of Western Australia.

Wyle supports NASA and Department of Defense aero-medical research, engineering and testing by providing in-flight medical experiments, health monitoring, airborne electronics maintenance, computer networking and other related services.

The following is an excerpt from an interview conducted by Kevin Rusnak earlier this year as part of JSC's Oral History Project.



Joe Kerwin strapped into sleep restraint in crew quarters of the Orbital Workshop. Kerwin is wearing the special cap which contains biomedical instrumentation for the Sleep Monitoring Experiment.

KERWIN: On launch day, now May 25th, we showed up at the launch pad and there was practically nobody there. This was the least well-attended Apollo launch in history, because everybody had to go home and put the kids back in school, you know. So it was a very peaceful morning.

That was a great engineering triumph. I don't know if the paperwork ever got done on this stuff, but it was quickly, carefully, collegially done. Everything we tried up there turned out to work. We had a very exciting first day, kind of a long first day. It was an eight hour or so rendezvous. Good rendezvous, nothing in particular to talk about.

RUSNAK: So you get up the next morning. What tasks do you have to look forward to then?

KERWIN: Checking pressure in the Skylab. Opening the hatches that are on the command module side and on the Skylab side. Getting into the multiple docking adapter, checking things out

there, and then a very careful procedure for sampling the air in the workshop through the hatch. They were afraid that this excess temperature had leached out some potentially damaging chemicals from the walls of the workshop, and they had carefully and quickly got together some Draeger tubes. They're glass tubes with reagent in them, through which you suck a certain amount of air and it'll measure for a specific reagent. We sampled that air through the relief valve in the workshop hatch, found that there were no measurable levels of – I can't remember what the chemical was anymore. So then opened that hatch and Weitz, as the system expert, went down first, and then Conrad followed, and then I was the last one to go down. The other main job that day was to get that parasol pushed out through the sunny-side airlock and deployed....

And then the job for the next three days or so was activation, bringing all the systems up and taking all the launch pins and other things out, just methodically

checking it. It took longer than we thought, because getting used to moving your body and doing those tasks in weightlessness takes a couple of repetitions to do. No real problems, just slow. Then we started in doing medical experiments.

We couldn't do much by way of Earth resources experiments, because we were seriously underpowered. Power was still a big problem.

[When the vehicle went supersonic, some windstream under the leading edge of the heat shield ripped around to one of the solar panels and carried it off with it at the shoulder. That panel was lost. When it got to the other panel, it ripped around it instead and preserved that panel, but riveted it almost completely shut. A piece of aluminum with a rivet at one end literally wrapped it to this solar panel cover and held it down. When the Skylab reached orbit and Mission Control commanded the solar panel covers to open, they got no response from one and they got a little trickle of power from the solar panel on the other side. The thing had opened, as it turned out, about a foot and then jammed. Then the temperatures inside began to climb.]

They were very, very careful with us, making sure that we didn't turn on too many lights at one time. We were not allowed to use the food or drink heaters down in the galley. We ate our food at room temperature. That was okay. There were certain experiment combinations that had to be prohibited....

So the first two weeks, we were still in the dark. We still hadn't solved all the problems, so there was still tension. We

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SKYLAB

were doing the exercise thing. We had a half-day off around day eight or nine, and we gave the ground a little television show. Weitz had a taped copy of "Thus spake Zarathustra." It was the theme for 2001, Strauss. We played that real loud, and we set up the TV camera, and we came down into the workshop for the docking the day after and we did our acrobatics thing. See,



Pete Conrad undergoes a dental examination by the Medical Officer, Joseph Kerwin in the Skylab Medical Facility. In the absence of an examination chair, Conrad simply rotated his body to an upside down position to facilitate the procedure.

we had learned how to do it in the first week, and the ground thought that was neat. So it relaxed everybody.

EVA

But we were still a troubled mission until we got to the point of, I think it was about June 10, when we got ready to go out the door. Rusty [Russell L.] Schweickart had led the backup crew, again in the Marshall water tank, knowing what the problem was, to devise an EVA where we could go out, work our way around to that side of the workshop. There were no handholds, no footholds, no visual aids, no lights, because there was never any planned maintenance on Skylab. Too dangerous. There was, fortunately, planned EVA. It was to retrieve film and exchange film in the ATM. So we had the suits, we had the umbilicals, and we brought up some tools that we thought we'd need.

They planned an EVA that had us erect a 25-foot pole, put the cable cutter on the end of it, and the jaws, which are about three inches long, had to close around that aluminum scrap that we'd

seen, and bite halfway into it but not all the way. That was step one.

Now we had a handrail. Pete could go along the handrail while I stabilized the near end of it, with another rope attached to his sleeve. When he got as far out as he could, taking care to avoid sharp edges, please, he would hook that rope into the solar panel cover as far down as possible, so as to give it some leverage from the hinge. Because what we had to do was not only cut the scrap, but then break up that hinge which had frozen, and start the thing up. He was to go down, put the rope on, then I would tie the other end of the rope up to a handy stanchion, as close to the surface as possible, and then the two of us would get under the rope and stand up and hope for the best. That was the Rusty Schweickart solution. We said, "Well, okay, Rusty, we'll give it a go."

And out we went with all the equipment. I even had a dental saw from the medical kit taped to the chest of my suit, just in case, if all else failed, we thought maybe we could go down there with the dental saw and try to get that thing off. Didn't have to use it. Did have a couple extra tethers, six-foot equipment tethers, with hooks on both ends. This proved to be crucial to the mission. Because we went out there. Getting around to the area was no problem. Erecting the 25-foot-long pole with the ropes and all that was no problem.

We were a good 20 feet away and couldn't get any closer to the aluminum strap – getting the jaws onto the strap at a 20-foot distance with a pole with no foot restraints just was proving impossible. I had the pole in my hand and I would move it toward the jaws, trying to gauge whether I was exactly far enough there, and as I did that, my body would start turning. Newton's third law. Conrad was trying to grab my legs with one arm and a strut with another arm, but that's not a stable enough platform. We went nuts for one whole day-side pass and failed, just didn't do it.

Solution

It comes night-side, we're sitting around thinking about it. We found an eyebolt, a circular bolt which just looks like the end of a Yale lock, on the surface of the workshop near one of the antennas, right in a line. Don't know what it's there for, but what if we strapped

myself to that eyebolt? So we got the spare tether, and there's a hook on the front of the suit. Hooked it through there, ran it through the eye bolt, back up through the suit, tightened it up, and now I have a three-point suspension. Now I can stand. I'll place my feet on the surface of the workshop and almost straighten my knees all the way out, and suddenly I'm as stable as a rock. It was like standing in your garden at home. It was wonderful. Man, two minutes later, the job was done.

The rest of it unfolded as I said. We crawled under the rope that Pete had laid out. That was probably the most dangerous part of the space walk, was Pete going down there amid all that debris, but he got away with it. We stood up, and suddenly it released on us. We both [floated] into outer space. But our EVA system was an umbilical, a nice stout umbilical with an 1/8-inch steel cable in the middle of it, so we didn't have any worries about that. We went out to the end of our umbilicals, and then hand-over-handed ourselves back till we got something to hang onto. Turned around, and the prettiest sight I've ever seen in my life was that solar panel cover fully deployed, ninety degrees, and you could see the panels starting to come out as they warmed up in the sun. And we knew we had done the job. So that was great.

We finished the EVA. It was rather a short EVA. We actually went down to the sun end of the ATM, to sort of have a pre-look at the film-retrieval route and see whether that was all okay. I will mention that I was allowed to do that, because I had trained for it. You go up to

fly-around, take some nice pictures, it looks beautiful. We're rehearsing the reentry stuff. People have not been up there 28 days before, and we weren't quite sure what kind of shape we were going to be in. So we did a two-stage de-orbit from Skylab. Skylab was at 235 nautical miles, and they decided to do a service module burn to lower us to about 120 miles, and then another burn to do the final de-orbit....

Normal, routine landing. We landed so close to the carrier, they almost had to move to avoid our landing on the flight deck. This was the first mission at which the command module would be picked up by a shipboard crane, and actually settled down onto a place on the flight deck, and then we would get out. All the previous missions, they had sent a chopper out with rafts, and you got on a raft and then up into the chopper. They figured they would go easy on us, since we'd been up there for a month.

RUSNAK: Do you think there are any lessons that ISS could learn or could have learned from the Skylab Program?

KERWIN: Well, it's learned a lot that are by now so deeply ingrained into it that it would be almost hard to point them out, but the habitability, the diet and exercise, the workday structure, a lot of those things.

As a matter of fact, one thing I find that's good about this long gap between Skylab and space station is that it's kept me usefully employed for 25 years. [Laughter] People still come and ask for data. "How did you guys do that? How did you manage this? Give us a little

seminar, get some people together, and tell us about managing science on the Skylab. How did you manage to do that so efficiently? What did you do wrong, that we shouldn't repeat?" We had a lot of things that we did wrong that should not be done that way again.

So I figure that once the International Space Station has been in operation for about two years, Skylab will be as interesting as

Columbus' voyage. [Laughter] All those lessons will have been learned over again and new ones will be being learned. But now we're still popular, so it's kind of fun.

RUSNAK: It's good to know that your mission back then is still proving valuable today.

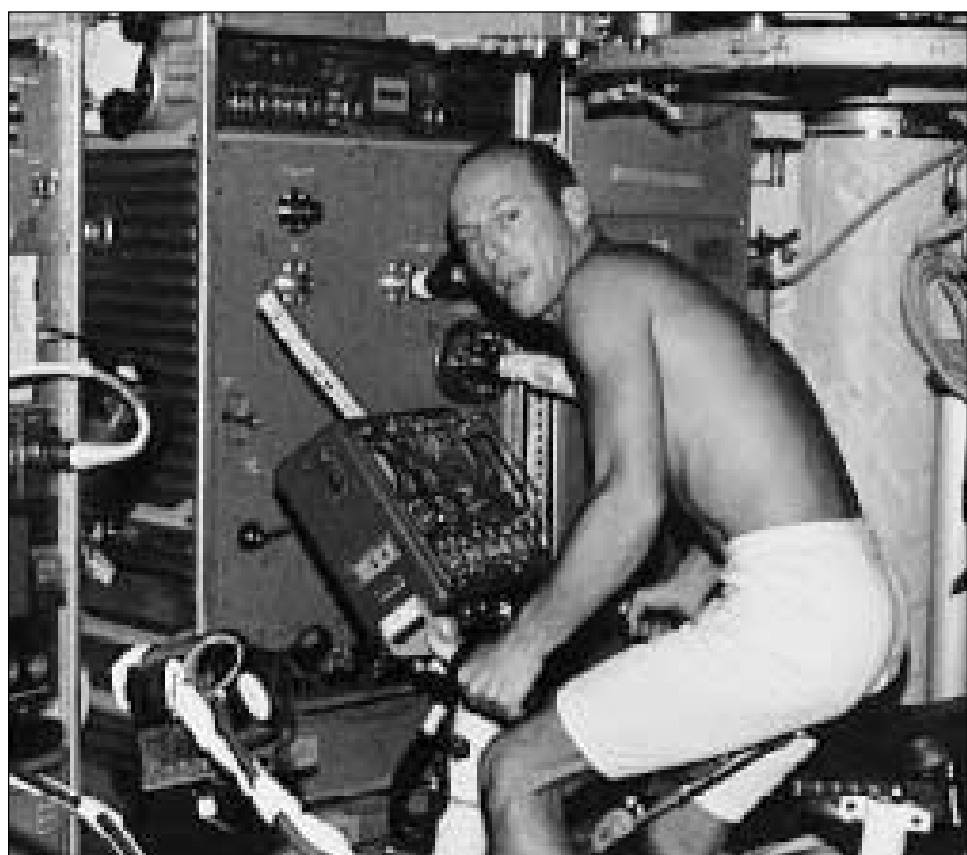
KERWIN: Yes. It was a good mission, a beautiful medical data set. Still, I think, the best, most complete medical data set on nine people that exists for weightlessness. Again, I can't wait for space station to do a much, much better job of that and to refine the exercise prescriptions and the diet prescriptions and the other countermeasures that will allow us to go for six months and a year safely, overcome physical, psychological, and environmental problems, and go to Mars. ■



Joe Kerwin, Skylab 2 science pilot, serves as test subject for the Lower Body Negative Pressure Experiment. Paul Weitz, Skylab 2 pilot, assists Kerwin with the blood pressure cuff.

the sunny end of the ATM. It's the middle of the day now, so this thing is pointed at the sun, and the Earth is now below you. You get up and stand in foot restraints up there, and you are king of the hill. I mean, here you are, standing up, looking down, and here's the world spread out, horizon to horizon. There's nothing like looking at the world through the helmet of a spacesuit. It's much better than the hatch. You just feel like you're in the middle of this big Cinerama movie. That was a heck of an experience. Described the color and condition of the parasol, and took a general look around and then went back in. It was over in less than three hours, but that was the best day of the flight....

So, day 28, we get up early in the morning, finish the deactivation, get in the command module, and depart. Do a



Pete Conrad, Skylab 2 commander, exercises on the bicycle ergometer in the crew quarters.

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

First details of a lightweight Gemini suit proposed for use in Gemini VII flight were announced this week at the Manned Spacecraft Center. The suit, currently undergoing qualification tests, has not yet been approved for use by Gemini VII pilots. It weighs 16 pounds, including an aviator's crash helmet which is worn under the soft helmet. The Gemini suit currently in use weighs 23.5 pounds.

The suit can be completely taken off during flight. It can also be worn in the partially doffed mode, in which the gloves and boots are removed and the helmet is unzipped at the neck and rolled back to form a headrest behind the neck.

1 9 7 5

NASA has signed an agreement with the Federal Aviation Administration of the U.S. Department of Transportation to act as a "third party" for the purpose of receiving, processing and analyzing reports of unsafe conditions or practices filed under FAA's Aviation Safety Reporting Program, Acting FAA Administrator James Dow announced.

The new reporting system will modify the program announced earlier this year requiring reports to be filed with the FAA.

Dow said, "The third party arrangement should assure everyone that the FAA's only objective in this program is to provide the safest possible aviation system by identifying and correcting unsafe conditions before they lead to accidents." The agreement contains specific procedures to provide protection of the identity of persons involved in reports submitted to NASA, except in those cases involving alleged criminal conduct or accidents.

1 9 9 5

NASA's Hubble Telescope has discovered several orbiting clumps of icy rubble that could be the remnants of recently shattered moonlets orbiting near the outer edge of Saturn's ring system.

Astronomers say this could represent the discovery of a new class of ephemeral transitional object in the solar system which provides new clues to the origin and evolution of Saturn's spectacular rings.

JSC to celebrate National Pharmacy Week

National Pharmacy Week is October 22-28. The American Pharmaceutical Association first created the observance of National Pharmacy Week in 1925. The objective is to promote the value of pharmacy services and the role that a pharmacist plays in health care. The Pharmacotherapeutics Laboratory, located in Bldg. 37, will participate in the nationwide campaign entitled "Educate Before You Medicate" by hosting an Open House of the pharmacotherapeutics laboratory from 9 a.m. to 3 p.m. on Wednesday, October 25.

The Pharmacotherapeutics Laboratory, known as the Pharmacology Laboratory until recently, was established at JSC in 1990 and operates under the direction Dr. Lakshmi Putcha, the senior clinical pharmacologist. The laboratory works in close collaboration with the medical operations team to support medical requirements for the space shuttle, International Space Station and space exploration programs. The activities of the laboratory include pharmacokinetic and pharmacodynamic research, therapeutic drug monitoring, specialized therapeutic monitoring for space flight-related pathophysiology, novel dosage forms development and pharmaceutical stability assessment. Some of the ongoing research in the lab includes saliva diagnostics, intranasal promethazine dosage form development and validation methods for noninvasive clinical and therapeutic monitoring.

The recent addition of Dr. Tina Bayuse, a clinical pharmacist, to the laboratory staff has added a new dimension to the lab's activities. She is involved in supporting clinical pharmacy services associated with space missions. Some of these responsibilities include the development of an international drug equivalency database for the International Space Station, space shuttle medication monographs and drug information on



NASA JSC Photo 2000-5086

Dr. Tina Bayuse, a recent addition to the laboratory staff, works on Shuttle Orbiter Medical System medication monographs.

demand for flight surgeons and other personnel supporting missions.

Celebration of National Pharmacy Week at JSC gives visitors an opportunity to see the facilities and clinical pharmacy services available at the pharmacotherapeutics lab. A display in the lobby of Bldg. 37 will present various aspects of pharmacotherapeutics at JSC. Tours of the laboratory will be given throughout the day and offer an opportunity for attendees to see the equipment in the lab as well as meet the lab personnel and learn about the research in pharmacotherapeutics. The clinical pharmacist will be on hand to discuss the pharmacy services available and future plans for a help desk and brown-bag services. To facilitate plans for additional activities in the lab, a survey will be available for visitors to complete in order to ascertain

the pharmacotherapeutic needs of the JSC population.

Visitors can see the references that are in the process of being built as part of the Drug Information Service Desk. A poster presentation on pain management on Earth as well as in space will be a must-see during the Open House. As part of that poster presentation, the electronic drug effectiveness monitor (STARx) that was developed by the lab will be on display.

There will be many things to see and learn during National Pharmacy Week and, of course, during the Open House, so stop by and get a balloon or a button and educate before you medicate!

The Pharmacotherapeutics Laboratory Open House is a wonderful opportunity to see the many faces of pharmacy and pharmacology activities and facilities at JSC. It is open to everyone. ■

JSC users encouraged to get 'Informed'

Go to the JSC internal homepage, click on "JSC Forms" and you'll discover a whole new world of electronic forms products.

Tammy Hoke, IMPASS electronic forms program supervisor, is excited about the new changes. "We are rejuvenating the electronic forms program."

The JSC forms, previously available as Delrina FormFlow products, have been migrated to a new product called Shana Informed Filler. The Informed Filler forms are now available through the Web from the Forms Search page. Click the "SEARCH" button to search for the forms.

"The Shana Informed software package is the agencywide interoperable standard for intelligent electronic forms. JSC is adopting that standard," said Hoke. "Informed Filler is a software program from Shana Corporation that enables us to fill out forms electronically and to collect and manage information."

Almost all forms will be converted to the new software. Many of the Word forms will eventually be converted as well where it makes good sense to do so, but some forms will stay in Word because of the process requirements. Some examples of why a form would stay in Word would be inclusion of the forms into documents, use outside of the JSC community where Shana software is not available, or word processing intensive forms.

"We looked at six different electronic forms products," said Hoke. "What we found was that Shana, which was already

<http://www4.jsc.nasa.gov/>

established as the agency standard, met our requirements, one of which was ensuring interoperability with the rest of the agency. The NASA Electronic Forms Distribution Center at Ames and Headquarters had previously adopted Shana Informed for their electronic forms. All we had to do was focus on



converting the JSC forms."

This product also has what is called a distribution center mechanism. When a user accesses a form via the Web, that form retains a link back to its initial source on the server. When users open a form that has been downloaded to their local template directory, the template interrogates the server as to whether or not the form has been updated. If it has, a notice is sent to the user that the form has been updated. In addition, notices regarding forms that are going to be changed can be sent to the user. "We have

never had these capabilities before, and with ISO regulations that stipulate that controlled processes be maintained to ensure that users are using current forms, these are critical elements for us to put in place," says Hoke.

The new forms software application has to be downloaded and placed on the user's desktop. It will retain links to the server to notify users of any updates. Anyone who has

access to the JSC network can locate these forms and install the software. The application is available on the JSC internal homepage. Click on the "Forms" link to search for forms, register for training and download software. Detailed instructions for using the software are also available from the download page.

The implementation strategy is to convert all FormFlow forms first, get them deployed, have the user community complete online training in the use of the new software, and give the users an opportunity to familiarize themselves with the product. The next step will be to automate forms

processes using tools like the forms software, e-mail, digital signatures, database systems and building workflow.

To assist users in this effort, JSC Forms Manager Aubra Boyd will be contacting each directorate to appoint forms coordinators for their areas. These coordinators will serve as the points of contact for each organization across JSC. ■

For more information, contact Hoke at x34014, Boyd at x36285 or Jaime Powell, programmer/analyst, at x30586.

ROUNDUP
Froch, Yardley cover new space technology in STS development

Combined Federal Campaign begins

JSC officially kicked off the annual Combined Federal Campaign on October 11, establishing a goal of \$550,000 for 2000.

The theme for the Texas Gulf Coast CFC, of which JSC's efforts are a part, is "Rise to the Challenge." The JSC campaign will run through November 10.

The CFC was established by executive order in 1961 to provide a single charitable fund-raising campaign within the federal community. Except for relief drives and emergency disaster appeals, the CFC is the only authorized on-the-job charitable fund-raising campaign for federal civilian, military, and postal service employees. The CFC gives JSC employees the opportunity to contribute to local, national, and international health and welfare charities. The Office of Personnel Management establishes the regulations governing the CFC including the charities that participate in the campaign.

There are more than 1,500 charitable organizations in the Houston CFC. These charitable agencies are listed in a brochure which is available online through the HRO Homepage and with each coordinator. Employees may direct their contributions to the charitable organization(s) of their choice by listing the agency code on their pledge forms along with the dollar amount they wish to give to that charity.

JSC employees may participate through payroll deduction by specifying an amount to be withheld every payday that will continue throughout the year. Deductions for pledges made during this campaign will begin in January 2001. Payroll deduction is a convenient way to give.

Last year, JSC employees and retirees gave a record amount of more than \$554,000 of the \$2.6 million contributed by federal employees throughout the Houston area. This year, the CFC goal is \$2.75 million.

JSC CFC Coordinator Candy Hunt said there are some interesting incentives this year for employees who pledge one hour's pay or more. Those who pledge one hour's pay per month will receive a CFC lapel pin. Those who pledge two hours' pay will receive a lapel pin and a calculator. Those who pledge \$600 or more per year will receive a lapel pin, a calculator, and a personalized certificate of appreciation signed by a prominent Texan.

In addition, those employees contributing one hour's pay per month or more will be eligible for the drawing for five three-month reserved parking spaces. The drawing will be held at the conclusion of the campaign. ■

For additional information, contact your organization coordinator or Hunt at x31836.

Space Center Houston opens doors to educators

Just weeks after JSC opened its doors to the community for Open House, Space Center Houston opened its doors to share an inside look at its attractions and educational programs to more than 500 K-12 teachers from across Texas.

The fifth annual Open House for Educators, held September 21, was designed to give teachers an opportunity to experience SCH's attractions, exhibits and educational resources.

"Every year we invite teachers to come out to see what's new at Space Center Houston and to find out about all of our different programs," said Laurie Murphy, Space Center Houston educational programs specialist. "Not only do we have programs for students, we also have a lot of professional development programs for teachers.

"NASA's Educator Resource Center is also located here at Space Center Houston, which offers free NASA materials to assist teachers with their classroom lessons. One of our goals is to help the teachers integrate those materials into their curriculum."

Open throughout the evening of Open House, the ERC drew a steady stream of interested teachers. Part of NASA's comprehensive education program, the ERC contributes to national educational goals by helping teachers expand and enhance their students' scientific and technological competence. Educators have immediate access to a wealth of information based on NASA's programs, technologies and discoveries.

Representatives from JSC's Education and Student Programs Branch handed out educational resources including brochures on NASA's student involvement programs, aerospace education services and distance learning opportunities as well as JSC educational Web site bookmarks and fact sheets on NASA careers.



Lori Wheaton of Indyne passes out educational materials during Open House for Educators at Space Center Houston.

Teachers from as far away as Dallas attended the Open House to learn how to incorporate the theme of space exploration into their classroom lessons.

Michelle Gifford, a fifth grade teacher at Deepwater Elementary School, works space-related themes into classroom lessons that span the entire curriculum from science and math to social science and reading. She says that working space-related themes into every subject makes learning fun. "We're always trying to find ways to make learning fun. If we find a fun way to teach different subjects, then the students are going to want to learn without realizing that it's learning that they're doing."

Gifford said that she attended the Open House to gather materials for a new class on space exploration. "We're starting a unit

on space and exploring the galaxies. I'm hoping to get a lot of information to take back and implement into the curriculum."

Vicki Williams, a fifth grade science teacher at Mae Smythe Elementary School, uses space as a theme in her classes to get her students to imagine making the impossible possible. "One of our units is 'Earth, Moon and Beyond.' We are trying to teach the children not to limit themselves to the Earth but to go beyond and to dream. If people didn't dream about going to the Moon, they never would have - they would have limited themselves. We need to teach the children not to limit their options. If they think something is possible, they need to figure out a way to make it possible. Just because we cannot do it now doesn't mean that we cannot do it in the future."

Dennis Spuck, dean of the School of Education at the University of Houston-Clear Lake, addressed the educators during a program held in the Space Center Theater. He discussed two new programs that the school is implementing. Preparing Tomorrow's Teachers to Use Technology is designed to help teachers incorporate the latest advances in technology into the classroom. Under the new Teacher-in-Residence Program kicked off this month, the university will invite a teacher from the public schools to join the UHCL faculty for a year. Spuck also discussed Web-based courses offered by the university - a topic of interest to busy teachers wishing to further their education.

NASA Astronaut Ellen Ochoa discussed her career and highlights from her three space shuttle missions. She showed two videos, one from her last mission - STS-96, the first docking to the space station - and "Living in Space," which recounts highlights from her STS-56 mission. The latter video, intended for students in kindergarten through second grade, discusses both the similarities and differences of living in space and on Earth in terms of sleeping, eating and other concerns. The video is part of the "Liftoff to Learning" series filmed specifically for teachers for use in classrooms.

"It's always enjoyable to speak to educators because they are so enthusiastic about learning new ways to engage students in math and science topics," said Ochoa.

The teachers were able to check out a presentation on the X-38, the Crew Return Vehicle being developed at JSC, and view three IMAX productions - *To Be An Astronaut*, *On Human Destiny* and *Mission to Mir*.

SCH and UHCL co-hosted the event. ■

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
Moody Gardens (2 events) (does not include Aquarium Pyramid)	\$10.75
Moody Gardens (Aquarium only)	\$9.25
Space Center Houston	adult .. \$11.00 .. child (age 4-11) .. \$7.25
(JSC civil service employees free.)	
Space Center Houston annual pass	\$18.75
Postage Stamps (book of 20)	\$6.60
September 30 - November 14	
Texas Renaissance Festival	adult .. \$16.00 .. child (age 5-12) .. \$6.50
October 21-22	
Wings Over Houston Air Show	adult .. \$10.75 .. child .. \$4.50
Franklin Planner Refills Classic Style	\$25.50
Franklin Planner Refills Seasons and Montecello	\$30.25

Check out our new website on the JSC People page at: <http://hro.jsc.nasa.gov/giftshop/>

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.

Coming in November

- ▶ Sweetwater Pecans \$6.25 per lb.
- ▶ Chocolate-covered Pecans \$8.00 per lb.

For additional information,
please call x35350.

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

2000 Inspection



Space Technologies
Commercial Applications

November 1, 2 and 3

<http://inspection.jsc.nasa.gov>

DATES & DATA**October 25**

Spaceteam Toastmasters meet: The Spaceteam Toastmasters meet at 11:30 a.m. October 25 and November 1 and 8 at United Space Alliance, 600 Gemini. For more information contact Patricia Blackwell at (281) 280-6863.

Astronomy seminar: The JSC Astronomy Seminar Club will meet at noon October 25 and November 1 and 8 in Bldg. 31, Rm. 248A. For more information contact Al Jackson at x35037.

October 26

Communicators meet: The Clear Lake Communicators, a Toastmasters International club, meet October 26 and November 2 and 9 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.

November 2

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

November 3

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 more information please call James Mulberry at x39287 or James Termini at x32639.

November 6

Space society meets: The Clear Lake area chapter of the National Space Society meets at 6:30 p.m. at the Parker Williams Branch of the Harris Co. Library at 10851 Scarsdale Blvd. For more information contact Murray Clark at (281) 367-2227.

November 7

Quality society meets: The Bay Area Section of the American Society for Quality will meet at 6 p.m. at Franco's Real Italian Restaurant on NASA Road 1. No reservations required. For more information, contact Ann Dorris at x38620.

November 8

MAES meets: The Society of Mexican-American Engineers and Scientists meets at 11:30 a.m. in Bldg. 16, Rm. 111. For more information contact Laurie Carrilo at 281-244-5203.

November 9

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.

November 10

Astronomers meet: The JSC Astronomical Society meets at 7:30 p.m. at Space Center Houston. For more information contact Chuck Shaw at x35416.

November 14

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 more information contact Larry Hendrickson at x32050.

IAAP meets: The Clear Lake/NASA Chapter of the International Association of Administrative Professionals meets at 5:30 p.m. in the Colonial Room at Grace Community Church, 14325 Crescent Landing (Hwy 3 and Clear Lake City Blvd.). Cost is \$12.

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.

November 15

Scuba club meets: The Lunarfins meets at 7:30 p.m. For more information contact Mike Manering at x32618.

Correction:

An article in the September 22 *Roundup* incorrectly identified STS-92 crewmember Bill McArthur's military service branch. McArthur has been in the US Army for more than 27 years.

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.

NASA BRIEFS**NASA SPACE SCIENCE EDUCATION RESOURCE NOW ONLINE**

NASA's Office of Space Science recently announced the release of the Space Science Education Resource Directory, an Internet on-ramp to top-quality educational resources produced by NASA's Space Science Education and Public Outreach programs.

The Web-based directory provides easy access to high-quality, online space science educational resources for teachers and students from kindergarten through high school.

"Sharing the wonders of our universe with educators and the public is the responsibility of every space science endeavor funded by NASA," says Ed Weiler, NASA's associate administrator for space science. "It's our way of investing in the future scientific talent of our nation. The Space Science Education Resource Directory will help teachers bring the exciting new discoveries of space science into their classrooms."

This first release of the directory contains more than 100 electronic resources, including lesson plans, educator guides, student activities, Web sites, and spectacular space science imagery such as auroras, comets, the birthplace of stars, and colliding galaxies. Educators, resource developers, and space scientists have worked together to design a system that is scientifically accurate and easy to use.

"This is a significant effort by the Office of Space Science to ensure that the results from their education programs are widely available," says Frank Owens, director of NASA's Education Division. "We look forward to adapting and integrating this model broader use within NASA's Education Program."

Science educators can locate science lessons and activities for their classrooms by searching by keyword or browsing by subject, grade level, and topics that align with National Science Education Standards.

One middle school teacher who reviewed the directory is impressed with its variety of resources. "Wow, this is terrific! I can find exciting, current, and accurate space science lessons and activities for my students so easily," says Susan Higley, the 1999 Maryland Teacher of the Year from Cherry Hill Middle School in Elkton, Maryland. "It's evident that teachers helped develop this Internet site - I find resources I can use in my classroom!"

The directory will be updated continually with new top-quality resources. Future plans include providing access to printed materials, CD-ROMS, videos, and posters.

To review the directory's collection, visit the Web site at:

<http://teachspacescience.stsci.edu>

NASA, LOCKHEED MARTIN AGREE ON X-33 PLAN

NASA and Lockheed Martin have agreed on a plan to go forward with the X-33 space plane program, to include aluminum fuel tanks for the vehicle's hydrogen fuel, a revised payment schedule and a target launch date in 2003. The launch date is contingent on Lockheed Martin's ability to compete and win additional funding under the Space Launch Initiative. NASA and Lockheed believe it is critical to continue work to solve the last remaining barrier to low-cost, reliable access to space.

The restructured plan focuses on providing milestone payments to Lockheed Martin's industry team for completed testing and delivery of their hardware and software systems this year. Additionally, the plan includes greater emphasis on mission safety and more ground demonstration of critical technology prior to actual flight. These steps are being taken by NASA to ensure quality and mission success. NASA is intent on ensuring that the lessons learned from other programs are taken into consideration in any go-forward planning.

The project requires no additional funding from NASA through March 2001. The project will need additional funding for completion, and Lockheed Martin can compete for those funds through the Space Launch Initiative.

SPACE CENTER Roundup

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