

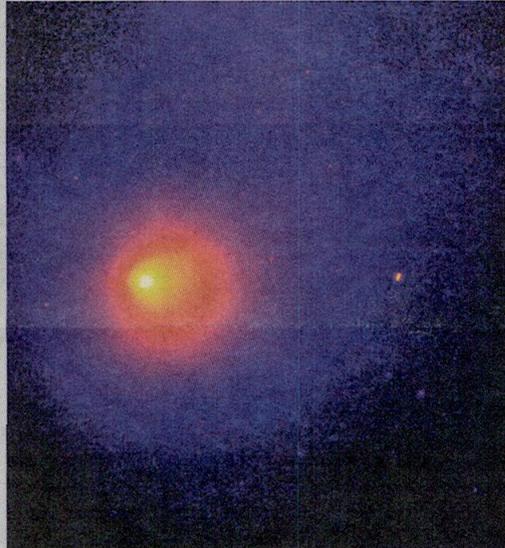
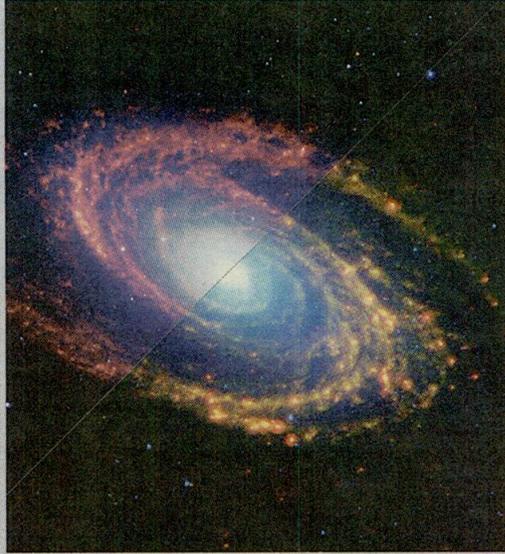
SpaceLog

Overall Pgm



NASA/JPL-CALTECH IMAGES,
ARTIST'S CONCEPTION

First Images: NASA has released dazzling images taken by the newly named Spitzer Space Telescope (above). The image of the spiral galaxy Messier 81 (top left) compares a short-wavelength infrared view (top left of image) with a view taken with the multiband imaging photometer and the infrared array camera. The top right image shows the stellar winds from an otherwise hidden newborn star called HH46-IR. The bottom left image shows Comet Schwassmann-Wachmann 1. The bottom right image shows dark globule in the emission nebula IC1396.



NASA Renames SIRTf for Princeton Astrophysicist

MILESTONES

NASA has renamed its Space Infrared Telescope Facility and released the first images from the spacecraft.

NASA announced Dec. 18 that the telescope now will be known as the Spitzer Space Telescope after the late astrophysicist Lyman Spitzer, who served on the faculty of Princeton University for nearly 50 years and died in 1997.

The new name was selected from more than 7,000 entries submitted in a NASA contest.

The spacecraft, launched in August, is designed to study the universe in the infrared spectrum and was built by Lockheed Martin Space Systems of Sunnyvale, Calif. It is the fourth of NASA's Great Observatories, which include the Hubble Space Telescope, Chandra X-ray Observatory and Compton Gamma Ray Observatory.

DELTA 4 HEAVY LAUNCH VEHICLE

Boeing Co., Chicago, rolled its first Delta 4 heavy launch vehicle to the launch pad at Cape Canaveral Air Force Station, Fla., in advance of a mid-summer demonstration launch.

The Delta 4 heavy is the largest of the

Boeing family of launch vehicles developed under the U.S. Air Force's Evolved Expendable Launch Vehicle program. The vehicle is comprised of three common booster cores bolted together. Each booster core contains a Boeing RS-68 main engine. Each Delta 4 heavy can loft up to 13,130 kilograms to geosynchronous transfer orbit.

The Air Force is funding the demonstration launch, which will carry a test satellite to gather performance data. The first two government missions are scheduled for 2005.

EXPERIMENT RE-ENTERS ATMOSPHERE

An experimental satellite built and operated by the University of Colorado at Boulder re-entered the Earth's atmosphere Dec. 3 after nearly six years in orbit.

The Student Nitric Oxide Explorer, launched in February 1998, was developed at the university's Laboratory for Atmospheric and Space Physics for \$5 million. The explorer was one of three spacecraft selected under a Universities Space Research Association program in 1994 for NASA's Student Explorer Demonstration Initiative. More than 100 students were involved in the design and construction of the satellite.

The Student Nitric Oxide Explorer measured nitric oxide in the upper at-

mosphere and its effect on the ozone layer, the intensity of X-rays from the sun, and ultraviolet light from Earth's aurora. About 60 students participated in the on-campus control of the spacecraft during its lifetime.

ASTRONAUT SETS RECORD

Michael Foale has set the record for most days in space by a U.S. astronaut, NASA announced.

Foale, the commander of International Space Station Expedition 8, surpassed the previous U.S. record of 230 days, 13 hours, three minutes and 37 seconds, held by astronaut Carl Walz, Dec. 8.

Foale has been a member of six space shuttle crews and two space station crews and also was a flight engineer aboard the Russian Mir space station in 1997. By the time Foale returns to Earth in April, he will have spent 375 cumulative days in space.

Foale's Expedition 8 crewmate, Russian cosmonaut and flight engineer Alexander Kaleri, will have logged 610 days in orbit on four flights by the end of the current mission, placing him fifth on the all-time space endurance list. Russian cosmonaut Sergei Avdeyev holds the all-time record with 748 days accumulated on three flights.

Students Tapped For Microgravity Experiments

EDUCATION

NASA selected 69 teams from U.S.-based universities to perform experiments aboard an aircraft the agency uses to simulate weightlessness.

The Reduced Gravity Student Flight Opportunities Program allows undergraduate students to propose and fly reduced-gravity experiments. The experiments take place aboard NASA's KC-135A aircraft, known informally as the vomit comet, which is based at Johnson Space Center in Houston.

Each student team will spend nine days at Johnson, where they will attend briefings and undergo physiological training before their flight. During the flight, the KC-135A flies a series of parabolas over the Gulf of Mexico that creates a weightless environment that lasts about 25 seconds.

The first of the university flights is scheduled to take place in March, with flights running through July.

NASA SEEKS TEACHER ASSISTANCE

NASA has selected 14 teachers for a program that develops educational materials for students based on the work of ongoing NASA missions and programs.

The Structure and Evolution of the Universe Educator Ambassador Program, entering its third year, is focused on teaching students about exotic forms of energy and matter in the universe. The teachers chosen for the program will undergo a 10-day seminar on high-energy and gravitational way astronomy at Sonoma State University in Rohnert Park, Calif., and Stanford University in Palo Alto, Calif.

During the program, the teachers will work with scientists involved with several NASA missions and programs, including the Gamma-ray Large Area Space Telescope, XMM-Newton, the Galaxy Evolution Explorer and NASA's High Energy Astrophysics Science Archive Research Center.

The materials they produce will be tested in classrooms and then distributed nationwide through workshops at the state, regional and national levels.

11TH GREAT MOONBUGGY RACE

NASA is accepting applications for its 11th Great Moon Buggy Race. The competition, scheduled to take place in April, challenges high school and college students to design, build and race human-powered moon buggies over a simulated lunar terrain course at the U.S. Space & Rocket Center in Huntsville, Ala.

The event, sponsored by NASA's Marshall Space Flight Center in Huntsville, was inspired by the NASA team that designed and built the lunar rover vehicle used by Apollo astronauts on the moon.

In 2003, 55 teams from 20 states and Puerto Rico competed, with prizes awarded for the fastest vehicle and for the entry judged to have come up with the best technical solution for navigating the simulated lunar surface.

SPACE NEWS

INTERNATIONAL

PROFILE:
Jim Wehri
22



WORLDWIDE NEWS

CIVIL SPACE

Financing Failure Affects Contract

The European Space Agency's failure to win government approval of the financing needed for the Ariane 5 support program will delay the signing of a multibillion-euro contract for Ariane 5 rocket production. A decision on a separate \$400 million proposal to operate Russia's Soyuz rocket (right) from Europe's launch base in French Guiana is also delayed.



See story, page 3

8 India: India has agreed to launch Israel's \$14 million Tauvex space telescope.

8 Japan: The launch of three satellites will be delayed pending the outcome of an investigation into the cause of an H-2A rocket failure.

17 Europe: Assembly of the 3.5-meter mirror for the Herschel infrared science satellite is complete.

17 Japan: Japan's overall 2004 space budget will be 272.4 billion yen, a 0.3 percent reduction from 2003.

20 U.S.: NASA wants to know why its Terra Earth observing satellite shut down temporarily in December.

MILITARY SPACE

Pentagon Procurement Criticized

The Pentagon is reviewing how it procures commercial satellite capacity in response to a report that criticizes those procedures as uncoordinated, frustrating for military commanders and overly expensive. See story, page 6

20 U.S.: The Air Force will continue funding of the Fence space surveillance system.

BUSINESS

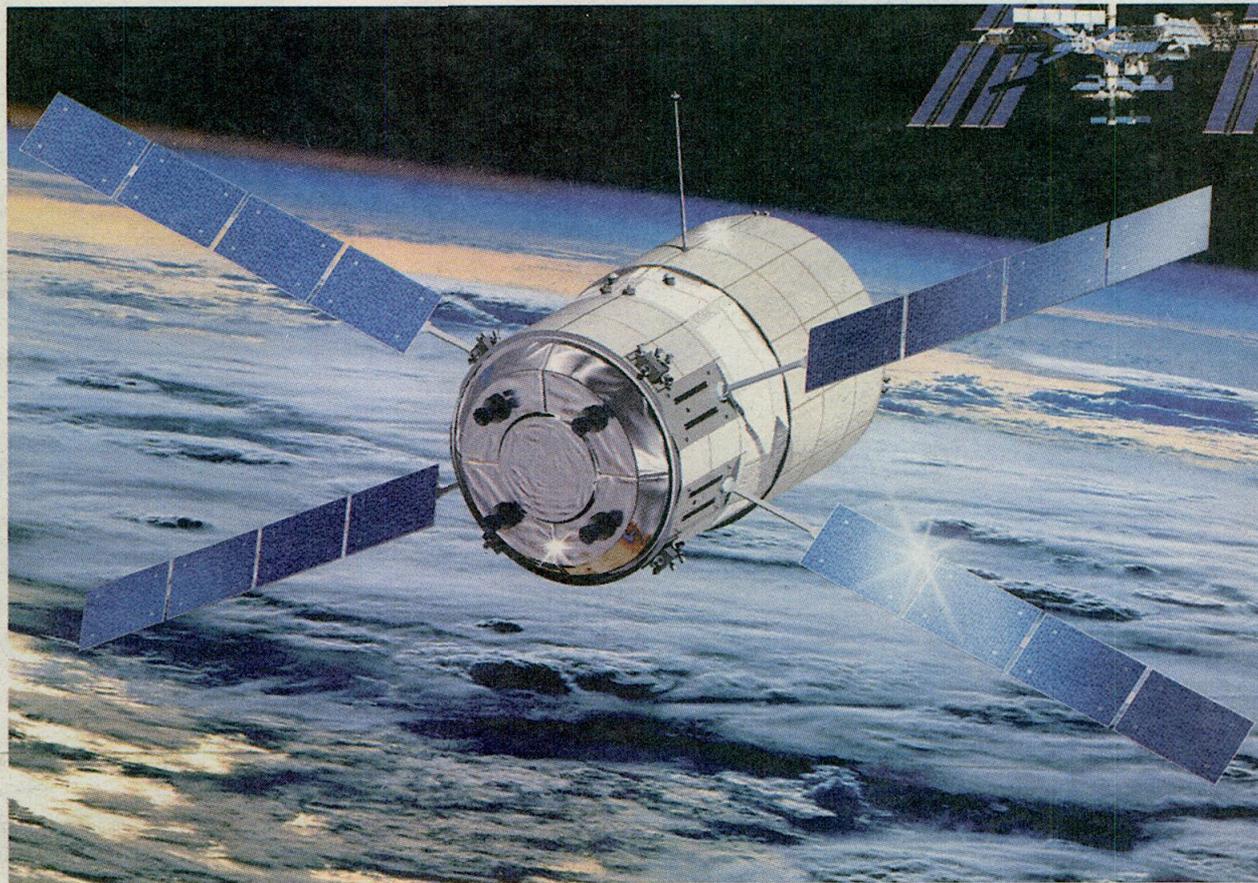
FCC Divided on Media Consolidation

Despite approving News Corp.'s purchase of Hughes Electronics Corp., U.S. telecommunications regulators at the Federal Communications Commission (FCC) remain deeply divided about the wisdom of media consolidation. See story, page 14

REMOTE SENSING

Imagery Aids Species Discovery

NASA satellite imagery combined with field data gathered as far back as the 1800s has helped scientists discover seven new species of chameleons on the island nation of Madagascar. See story, page 16



ESA ARTIST'S CONCEPTION

More Than Expected: According to new European Space Agency estimates, getting the first Automated Transfer Vehicle (above) prepared for launch will cost 200 million euros more than expected.

ATV Overrun, Shuttle Fleet Grounding Boost European Space Station Costs

PETER B. de SELDING, PARIS

Europe's contributions to the international space station are likely to cost \$600 million more than planned due to mounting cost overruns in an unmanned cargo vehicle and because of NASA's revised space shuttle launch schedule, which will delay the deployment of Europe's habitable laboratory, according to European government officials.

The new cost estimates were delivered to European Space Agency (ESA) governments Dec. 17-18 during a closed-door session of ESA's ruling council at the agency's headquarters here.

One European government official said several government delegations were left nearly speechless by the size of the overruns, even if they knew the program's cost had burst through its earlier budget ceiling.

"It was shocking news, and it leaves us wondering whether we will end up spending all our resources on

building station hardware, with nothing left over for actually using the facility," this official said.

2004 was to have been Europe's big year for the station. The Automated Transfer Vehicle (ATV) was to have made its first launch in September, carrying thousands of kilograms of fuel, water and other supplies to the orbital complex following a launch on an Ariane 5 rocket.

In October, Europe's Columbus Orbital Facility, a habitable laboratory that is Europe's most visible contribution to the station, was to have been launched aboard a U.S. space shuttle.

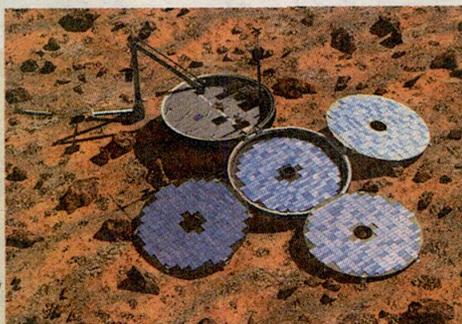
But European officials now acknowledge that neither event will take place in 2004. The Columbus laboratory, which is nearing completion, will be put into storage as NASA revises the space shuttle's manifest in the wake of the February 2003 loss of the Columbia orbiter.

Keeping Columbus development teams in place to accompany the laboratory and manage its early operations, See EUROPE, page 3

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Mars Express' Main Mission Begins

Preparations for the main Mars Express mission begin while European scientists continue to search for signs that the Beagle-2 lander (left) made it safely to the red planet's surface.

See story, page 6

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Behind the Scenes

Senior Space Technology Editor Frank Moring, Jr., (right) levitates on NASA's KC-135A reduced gravity aircraft during a flight dedicated to experiments designed by college undergraduates. With him is John Yaniec, lead KC-135 test director at Johnson Space Center in Houston. NASA will retire the KC-135A this fall and begin using a modified U.S. Navy C-9 to test hardware designed for microgravity, train astronauts and offer students a chance to sample one of the more exciting aspects of a career at NASA (see p. 31).

Hands On

Microgravity rides on NASA KC-135 lure engineering students to aerospace work

FRANK MORRING, JR./HOUSTON

Agraying NASA gives undergraduate engineers a taste of space in hopes they'll make a career of it. Microgravity flights on aircraft for student experiments are used as a no-strings enticement to promising candidates.

For six weeks this year, four days a week, a half-dozen two-person student teams have donned flight suits for 1.5-hr. flights on NASA's KC-135A reduced-gravity aircraft. While on board they go "weightless" for 20-25 sec. at a time, 30 times or more, as the 40-year-old plane arcs through 8,000-ft. parabolas over the Gulf of Mexico.

The students have won the right to fly by proposing, building and demonstrating experiments that test something in the microgravity environment the KC-135 produces at the top of the parabolas. Many get college credit for the work, which mimics real-world testing carried out on the same airplane for International Space Station and space shuttle applications. Most of the students have a blast, too.

"WE STARTED FLYING students in '97, and the objective has always been to [foster] interest in science and technology and to show there are some interesting things they can pursue," says Donn Sickorez, university affairs officer at Johnson Space Center. "We know it's a long haul if you're studying engineering and technology."

Former JSC Director George Abbey launched the student flight activity after learning of a similar program run by the European Space Agency. Like many high-technology operations in the U.S., NASA faces a demographic wall of retirements, while university enrollment in science and engineering disciplines declines.

Interest in the program has built over the years to the point that in 2003 about 70 teams flew of the 110 that proposed experiments. Overall, more than 2,000 students have flown. The idea is not to push the frontiers of science, but to give undergraduates a realistic view of one of the more exciting aspects of NASA work.

"If you've got a good solid science proposal you've got a good chance of

flying," says Sickorez, who co-manages the student program with John Yaniec, NASA's lead KC-135 test director.

For the Massachusetts Institute of Technology team headed by Air Force ROTC (Reserve Officer Training Corps) cadet Michael Heiman, the par-



Test Director Dominic Del Rosso oversees MIT students Michael Heiman (center) and Bo Shi as they use microgravity and a flight simulator to test haptic input for emergency recovery.

abolic flights offered a chance to see if technology designed to help Air Force fighter pilots overcome spatial disorientation could also serve general aviation. Heiman and classmates Bo Shi, Craig Morales and Suzanne Lo built a portable flight simulator around a commercial software package, and NASA provided the spatial disorientation.

THE MIT EXPERIMENT consisted of a pilot's seat and controls in front of a notebook computer running the simulator. The test subject and backup/assistant both wore vests fitted with vibrating buttons in four columns, linked to the simulated flight instruments to provide a haptic indication of the pilot's attitude relative to the simulated ground. Pitch up, for example, and the vest sent vibrations up the subject's back.

The experiment's software was set to throw the simulator into an unusual attitude with the onset of microgravity, and

then measure how quickly the subject was able to regain level flight using only the simulator's instruments and the haptic vest. The computer activated the vest on random runs as an experimental control, and recorded the recovery time with and without it for analysis.

Before the MIT gear could fly, it had to past muster in a test-readiness review conducted by the pilots, test directors, flight surgeons and NASA safety personnel from JSC and Ellington Field here, where the KC-135 is based. Student teams answered pointed questions from the group of about 15 reviewers, and promised to fix shortcomings before their flights. The MIT experiment

NASA/JAMES M. BLAIR

they activated the test equipment in the padded interior of the KC-135, sweltering in the Texas heat with haptic vests in flight under their flight suits.

In all, seven teams made the flight, plus test directors, photographers, a flight surgeon and Sickorez. After take-off the teams were released from seats in the back of the plane to ready their experiments, and Heiman buckled himself in at the controls of the simulator while Shi took a position in front of him.

“My role is to basically oversee the experiment, and if any computer problems come up, fix them as fast as possible,” said Shi. “But hopefully that won’t happen.”

When the plane reached its restricted operating area over the Gulf, the pilots began flying parabolas, beginning with a series of 11. Yaniec shouted cues to the students—“five seconds” as the plane reached the top of the parabola,

and “feet down” when gravity was about to return.

Shi activated the experiment, and then took advantage of the microgravity to dangle from a safety strap, feet floating in front of him, while Heiman flew the simulator. A fixed video camera recorded the activity over Heiman’s shoulder.

In flight the sensation of weightlessness comes on gently as the pilots push the plane over the top of the parabola. Students not actively involved in operating equipment quickly learned to take advantage of their short time in free-fall, bouncing off the ceiling and turning a few tentative somersaults. But there is a payback at the other end of the parabola when gravity resumes, then increases to about 1.8g at the pull-up.

Despite the lectures about preventing motion sickness, and the anti-nausea drugs administered before the flight, Shi soon learned why the KC-135 is nicknamed the “Vomit Comet,” as did

this *Aviation Week & Space Technology* editor. Heiman fared better from his stationary position behind the simulator controls, although in the end he too succumbed.

“At one point I actually felt like I was upside down,” he said. “We wanted spatial disorientation, and we certainly got it.”

AT A POST-FLIGHT debriefing for all of the student teams, Heiman and Shi postulated that their vests, worn tight to ensure they would feel the vibrations, had been too tight. Morales, the next day’s test subject, slept in his vest to accustom himself to it, and wore it looser during the flight. The team also glued Velcro to the computer keys needed to operate the experiment, on the theory that touch typing would eliminate the need for the rapid head movements that can cause motion sickness.

The modifications apparently worked, and Morales got through his flight with-

Full Service

NASA gaining confidence it can use robotics to service Hubble—for at least \$1 billion

FRANK MORRING, JR./WASHINGTON

NASA is moving ahead with the sole-source procurement of a Canadian robot to service the Hubble Space Telescope, gaining confidence the International Space Station (ISS) technology can perform all of the tasks shuttle-launched astronauts were scheduled to do before the Columbia accident changed everything.

The U.S. agency is negotiating with MD Robotics, a MacDonalDettwiler unit located in Brampton, Ontario, for a version of the Special Purpose Dexterous Manipulator (SPDM) the company developed for the ISS. The SPDM would be the business end of a throwaway module designed to replace batteries and gyroscopes, pull old instruments and install new ones before plunging to a targeted reentry over the Pacific.

Administrator Sean O’Keefe says the mission would cost \$1-1.6 billion if NASA decides to go through with it. For now the agency has decided only to push for a critical design review early next summer, and to amend its Fiscal 2005 budget request later this month to account for the ongoing work.

But on the basis of tests conducted with

the high-fidelity Hubble mock-up at Goddard Space Flight Center, Md., NASA engineers and astronaut robotics operators believe it is at least possible the robot will be able to carry out the full servicing mission planned prior to the Feb. 1, 2003, Columbia disaster.

“We don’t see anything that would indicate that doing the full mission is a much bigger effort than doing some lesser capability, and as a consequence we’ve decided to continue to pursue the full mission,” says Alphonso V. Diaz, NASA’s newly named science associate administrator, stressing that no decision to mount a robotic mission had been taken.

Without servicing, battery and gyro failure probably will disable the spacecraft by 2008, although Hubble program engineers are developing life-extending operations techniques to forestall that date. Nor is it clear whether a servicing mission can repair a key instrument on the telescope that failed Aug. 3.

An apparent problem with the back-up 5-volt DC-DC power converter on the Space Telescope Imaging Spectrograph (STIS) sent the instrument into a suspended mode. The primary converter malfunctioned in 2001. Although the

shutdown did not affect the spacecraft’s Advanced Camera for Surveys (ACS), Near Infrared Camera and Multi-Object Spectrometer (Nicmos) or the Wide-Field Planetary Camera-2 (WFPC-2), it robbed the telescope of about 30% of its observational capability.

But if the full servicing mission can be carried out robotically, it will leave the telescope with new batteries and gyros and replace WFPC-2 and the disused Corrective Optics Space Telescope Axial Replacement (Costar) with the \$83-million Wide-Field Camera-3 and \$65-million Cosmic Origins Spectrograph. At a minimum, NASA plans to attach a propulsion module to the telescope so it can be safely deorbited at the end of its service life (*AW&ST* June 7, p. 32).

TENTATIVE PLANS CALL for a two-piece, 20,000-lb. Hubble Robotic Vehicle launched on an expendable rocket to rendezvous autonomously with the telescope in its 373-mi. orbit. It would attach itself using a robotic arm and the grapple fixture designed for shuttle servicing missions. Mounted on the arm, the robotic manipulator would then carry out the tasks originally intended for spacesuited astronauts, opening doors, pulling old instruments and installing replacements.

Engineers envision using a mix of teleoperation and autonomy during the robotic phase of the mission, which would be hampered by a lag of as much as 2 sec. between the telescope and mission controllers at Goddard and Johnson Space Centers. At the end of the mis-

out physical distress. The experiment also worked as planned, and the team collected good data for analysis. Other teams flying with the MIT group reported similar results.

Tom Haas, a senior at Michigan Technology University, says his team got valuable data on inflatable structure dynamics. Michigan Tech will use the data as it develops a spacecraft called HuskySat for the University Nanosat-3 competition, which offers a ride to space for the winning spacecraft design.

The Michigan Tech experiment consisted of a one-quarter scale model of HuskySat, which will use an inflatable boom between two end masses to establish gravity-gradient attitude control. During the flight, team members tapped the floating model with a hammer at predetermined spots, generating data with the resulting effect on accelerometers in the end masses.

"We got 16 data points each day,"

Haas says. "We got all the data we needed."

One student experiment from MIT that included work by an earlier KC-135 team has found its way onto the ISS as a commercial experiment. Expedition 9 science officer Mike Fincke, himself an MIT alumnus, is scheduled to conduct experiments with the Synchronized Position Hold, Engage and Reorient Experimental Satellites (Spheres) during his stay on the station (*AW&ST* Dec. 8, 2003, p. 46).

Other student experiments may follow suit. Sickorez says several student teams have developed two-phase flow experiments aimed at finding simple ways to keep liquid flowing in pipes on the ISS and shuttles, where gas and liquid don't separate by weight as they do in gravity.

"The way we control two-phase flow now is with pumps and expandable diaphragms, but it costs a lot in terms of

machinery, power and weight," he says. "What we're looking for is a passive way to work with two-phase flow. What the students have been working with is capillarity. . . . That whole piece is very real for us, and very expensive for us."

NASA IS PHASING OUT the KC-135 this fall in favor of a C-9 inherited from the Navy, which will be easier to maintain. But the student program will continue. Overall, NASA spends about \$400,000 a year on the student flights—\$6,000-8,000 per team—and the sponsoring schools typically spend a like amount on hardware and faculty time.

Looking ahead, the reduced gravity program plans to fly teachers from NASA Explorer Schools, who will take their experience back to their elementary and middle school students. Also on tap are flights for the International Year of Physics in 2005.

"If more partners find it useful, then we will fly them," Sickorez says. ☛

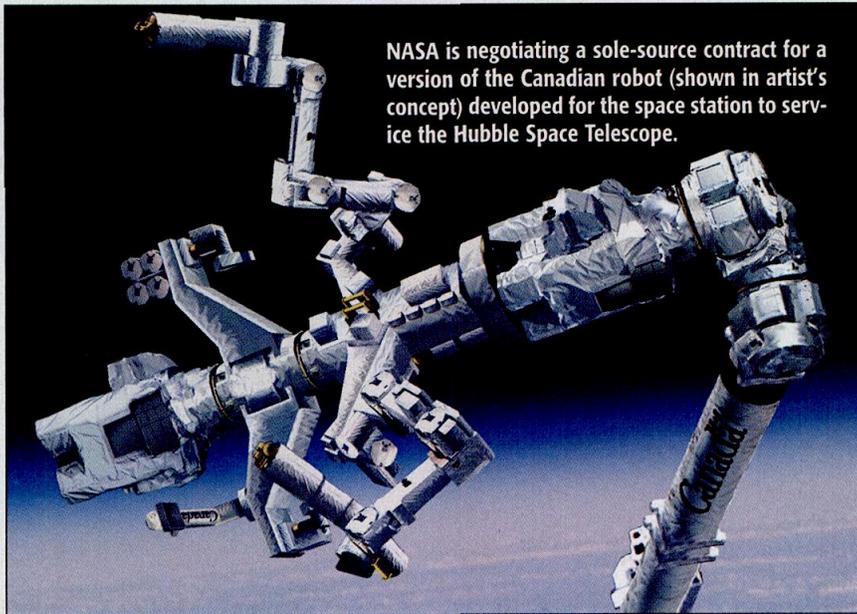
sion, the detachable module carrying the robot and the discarded parts would separate, leaving behind the propulsion module for an eventual deorbit burn once the telescope is no longer useful.

O'Keefe told *The Orlando Sentinel* that while initial estimates for the mission were as much as \$1.6 billion, it was premature to cite a final price until all of the planning is completed. Diaz

says risk analysis and mitigation will be a big part of the blueprint.

"We may identify, over the course of the next several months, risks that are associated with doing pieces of this that would require investments to mitigate those risks that would in fact differentiate this so that it would be more reasonable to do less than the full planned mission," Diaz says. "All we've said is, based on what we know now, continuing to pursue the full mission is the right solution."

A National Research Council panel has recommended that NASA keep open the option of a shuttle servicing



NASA is negotiating a sole-source contract for a version of the Canadian robot (shown in artist's concept) developed for the space station to service the Hubble Space Telescope.

MD ROBOTICS

hardware to install them. The agency announced its intent to negotiate a sole source contract with MD Robotics on June 15; no objections were filed against this plan within the allotted 15 days, according to the Goddard spokesman.

Still to be determined is whether the STIS instrument can be recovered. Installed by astronauts during the second Hubble servicing mission in 1997, it

has exceeded its specified five-year service life and was not scheduled for replacement. Astronomers were continuing to use the instrument to study a variety of celestial phenomena, including star formation, and to look for massive black holes.

NASA convened an Anomaly Review Board to look into the cause of the failure and decide whether the STIS can be returned to service. The failed converter supplies power to the mechanism that moves the instrument's shutter, but it was inactive at the time of the failure and the shuttle was closed, preventing light damage to its sensitive detectors. ☛

mission, given the complexity of robotic servicing (*AW&ST* July 19, p. 62). But in a meeting with Hubble program personnel at Goddard, O'Keefe said he still doesn't believe there is enough time before the telescope fails to mount a shuttle mission that would comply with recommendations of the Columbia Accident Investigation Board, according to a Goddard spokesman.

A NASA source evaluation board plans to spend about three more weeks evaluating bids for the robotic vehicle deorbit module, which includes options for the detachable module that would carry new instruments and the robotic

Nitty Gritty

Delta and US Airways are running low on options in their struggles to stay out of bankruptcy court

DAVID BOND/WASHINGTON



Delta Air Lines fears that failure to cut costs further will leave it with too little cash at the end of the year to survive until the spring.

JOSEPH PRIES

Like American Airlines 18 months ago, Delta Air Lines and US Airways are nearing the brink of a Chapter 11 bankruptcy-protection filing. And like American, which stayed solvent, the outcome at Delta and US Airways probably will turn on last-minute actions by their labor unions.

The carriers reached this point in dramatically different ways. Delta battled gamely through the past three years on the strength of non-labor cost reductions that have run out of steam, and it is slowly running out of cash. US Airways spent eight-plus months under bankruptcy-court supervision during 2002-03, and it is paying an escalating price for its inability to satisfy commitments it made for the credit that took it out of Chapter 11.

Delta started saying in the spring that it might have to file for bankruptcy protection if it didn't get concessions from its pilots, its only unionized workforce, but now it says there is no more uncertainty. "If we cannot make substantial progress in the near term toward achieving a competitive cost structure that will permit us to . . . access the capital markets on acceptable terms, we will need to seek to restructure our costs under Chapter 11 of the U.S. Bankruptcy Code,"

TURBULENCE RISING FOR DELTA, US AIRWAYS			
	Unrestricted Cash, 12/31/03	Unrestricted Cash, 6/30/04	Near-Term Threat
Delta	\$2.7 billion	\$2 billion	continued cash burn, no credit available
US Airways	\$1.3 billion	\$975 million	failure to satisfy loan covenants, RJ financing tests

Source: Company reports

the carrier said Aug. 9 in its second-quarter report to the Securities and Exchange Commission.

The Atlanta-based airline started 2004 with a lot of cash, \$2.7 billion unrestricted, but burned through \$700 million of it in the first half of the year. Because of low domestic yields and high fuel costs, cash flows have been worse than expected and remain so, and in the second half, Delta thinks it will have to "use a portion of our cash reserves to pay certain obligations that we previously anticipated would be paid from cash flows from operations. Accordingly, we expect our cash and cash equivalents to decline during the remainder of 2004 at a level consistent with the de-

cline during the first half of the year." That would put Delta close to \$1.3 billion in unrestricted cash on Dec. 31, a dangerously low amount in the depths of the worst cash-flow period of a network airline's year.

With high costs, low credit ratings and few assets not already being used for collateral, Delta thinks it will take "significant reductions in our cost structure"—pay and work rule concessions by pilots, mainly—to put it in a position to borrow more. And it will need to borrow in the near term. Scheduled payments on debt, including capital leases, swell from \$226 million in the second half of 2004 to \$1.2 billion in 2005. This year's contributions to pension plans have mostly been

Business to Business

Bay Area Houston Economic Partnership

A Monthly Supplement to the Houston Chronicle

December 2004



www.bayareahouston.com

Zero gravity at SJC

In today's super-technology atmosphere, some students aren't satisfied with high speed computers and digital cameras — they want something more thrilling, like experiencing weightlessness. And they can, thanks to a partnership between NASA and San Jacinto College.

The Student Flight Opportunities Program has a mission: to motivate students in science and technology.

NASA sponsors the program, with coordination and logistical support from the Aerospace Academy for Engineering and Teacher Education. The Academy, an education-industry-government collaboration affiliated with San Jacinto College, assists with administration, advertising and helping students with their experiments.

"Workforce development is one of the most important investments we can make in our economy," said Bay Area Houston Economic Partnership President Jim Reinhart-

sen. "Students who learn about science and technology through this program could become qualified to work in Bay Area Houston's aerospace, biotech or chemical industries."

To date, the program has accommodated over 2,000 undergraduate students from 46 states, all of which have experienced zero-degree gravity.

"Weightlessness is an amazing experience," said former San Jacinto student Megan Ebadat, who participated while enrolled at the South Campus. "There's no feeling I can think of to describe it. I enjoyed the program so much, I participated a second time."

Like all students, Ebadat was part of a four-student team which completed experiments in micro gravity. The lengthy process begins with presenting an experiment proposal to NASA.

"These students are researchers," says Dr. Don

Sickorez, NASA university affairs officer. "The reason they are on the plane is to operate their experiments, and get results."

Examples of past experimentation include finding answers to questions, like what happens to a flame in micro gravity, or, how do you get bubbles out of a solution in micro gravity?

As Sickorez explained, on earth coke bubbles rise to the surface. In space, they don't. The answer to the coke bubble scenario could also be the answer to an even bigger problem.

"If you're pumping fuel in space, you don't want any bubbles," he said. "Getting bubbles out of a liquid is a valid experiment for these students."

Interested college students (undergraduates only) may contact the Aerospace Academy at (281) 483-1137 or the project personnel at (281) 483-6755 for additional information.



Dr. Don Sickorez, university affairs officer at NASA, is pictured in the KC-135 which has been the vehicle for many college students to experience weightlessness. The Student Flight Opportunities Program will be using a C-9 in the future, the military version of the McDonnell Douglas DC-9 used for many years by commercial airlines.

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Jan. 5, 2005, 10:15PM

San Jac, NASA team up on project

Selected students can experience weightlessness

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In today's high-technology atmosphere, some students just aren't satisfied with high speed computers and digital cameras. They want something more thrilling, like experiencing weightlessness, and they can, thanks to a partnership between NASA and San Jacinto College.

The Student Flight Opportunities Program has a special mission: to motivate students to become scientists and technologists. The program is a result of urging from President Bill Clinton in the mid-1990s, who saw a need to inspire young people to study math and science.

NASA sponsors the program, with coordination and logistical help from the Aerospace Academy for Engineering and Teacher Education. The Academy is an education-industry-government collaboration associated with San Jacinto College.

To date, the program has accommodated more than 2,000 undergraduate students from 46 states, all of which have experienced zero-degree gravity.

"Weightlessness is an amazing experience," said former San Jacinto student Megan Ebadat, who participated while enrolled at the South Campus. "There's no feeling I can think of to describe it. I enjoyed the program so much, I participated a second time."

Like all students, Ebadat was part of a four-student team which completed experiments in micro gravity. The lengthy process begins with presenting an experiment proposal to NASA.

The team writes the proposals in September and the best ones are accepted in December. That's when students begin bending metal, assembling the devices needed for their space experiment. The actual flight takes place in March, April or July. A faculty adviser from the respective college is encouraged to participate, in a consulting capacity only.

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"These students are researchers," said Don Sickorez, NASA university affairs officer. "The reason they are on the plane is to operate their experiments, and get results."

Examples of past experimentation include finding out what happens to a flame in micro gravity, or, how do you get bubbles out of a solution in micro gravity?

As Sickorez explained, on Earth, carbonated beverage bubbles rise to the surface. In space, they don't. The answer to the Coke bubble scenario could also be the answer to an even bigger problem.

"If you're pumping fuel in space, you don't want any bubbles," he said. "Getting bubbles out of a liquid is a valid experiment for these students."

NASA's Weightless Wonder KC-135, a four-engine turbojet, has been used since 1995 by researchers to conduct experiments in a zero-gravity environment. The KC-135 is being replaced by a C-9, the military version of the McDonnell Douglas DC-9 used for many years by commercial airlines.

A typical flight lasts some three hours and consists of 50 steep climbs and drives which achieve 20 and 30 seconds of weightlessness at a time. Students experience weightlessness 30 times during a flight.

"This project brings a whole new meaning to the word teamwork," said Ebadat. "It's all about brainstorming and problem solving. You can never learn enough when you're part of a team."

Interested college students (undergraduates only) may contact the Aerospace Academy for Engineering and Teacher Education at 281-483-1137 or the project personnel at 281- 483-6755 for more information.



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Pioneers

In the span of five days, we lost two genuine pioneers of manned spaceflight. We should be in awe of their accomplishments chronicled on these pages. We should also pay attention to how they went about this business in their days, as each of their styles in approaching the unknowns of manned spaceflight couldn't have been more diverse. Gordon Cooper showed exuberant confidence in his readiness to take on this new world. Max Faget exuded thoughtful engineering excellence and innovation in solving problems in Cooper's new world. Both styles were needed then, and I suggest to you that both styles are still needed today. Continuing to fly the International Space Station safely, returning the Space Shuttle to flight and turning the Exploration vision into reality all require engineering excellence and innovation, complemented by exuberant confidence. And, as in Cooper's and Faget's days, the diversity of styles we share in this business and the mutual respect we must have for each other's talents will continue to be the foundation allowing us to continue their legacy.



Milt Heflin
Chief of the Flight Director Office

The KC-135 fades into the sunset

by Trisha Sims

On Oct. 31, 2004, Ellington Field retired the well-known KC-135 aircraft, otherwise known as the "Vomit Comet," to old age. Future plans are to replace the KC-135 aircraft with a C-9, enabling NASA to continue its reduced-gravity program.

The KC-135 was first used by the U.S. Air Force as a refueling tanker. It was brought to NASA in 1973 to replace the C-135, which had been used to replicate a weightless environment.

Astronauts in training have been required to go up in the KC-135 at least one time every year since it was brought to Ellington Field 31 years ago. This specialized aircraft gives astronauts an idea of what microgravity feels like and also provides a test vehicle for new technology.

To simulate reduced gravity, the KC-135 aircraft climbs 8,000-plus feet over the Gulf of Mexico and then begins to freefall – a procedure known as a parabola. The pilot is allotted 24,000–37,000 feet over the ocean to perform 40–60 parabolas during a two-hour mission.

In 1996, NASA gave college students the opportunity to conduct microgravity experiments while onboard the KC-135, making it possible for more than 1,600 students to perform several different kinds of scientific investigations. John Yaniec, the lead test director for the Reduced Gravity Program, said he has enjoyed seeing the excitement on the students' faces while they conducted their experiments.

Comparing all of the different projects that he has seen as a flight director, Yaniec believes that "the Reduced Gravity Program helps pave the way for students and engineers to conduct cutting-edge research experiments that will someday become major contributions to the world of science and technology."

According to Yaniec, the experiments that made the biggest impression on him involved combustion and cool flames. "The KC-135 is the only platform that can provide certain gravities such as lunar, reduced gravity, Martian gravity and a sustained hypergravity."

This is where the plane gets the nickname the "Vomit Comet." Usually one out of every three passengers gets sick while



Astronaut class number 17 on their Zero-G familiarization flight in the KC-135.

onboard the plane. Yaniec, who has performed a total of 30,775 parabolas as of Oct. 1, is one passenger who has never gotten sick. "Our crew is aware of the importance of each passenger's safety while on the plane. We are willing to help take care of sick passengers," Yaniec said.

After several years of flying onboard as a test director, he has affectionately nicknamed the plane "Bertha." Well-known passengers that Yaniec remembers taking flight in the KC-135 are Journalist Hugh Downs and Dr. Simon Ostrach, who became the oldest person to fly on the aircraft at the age of 80.

When asked about his personal feelings on retiring the aircraft, Yaniec said that "the aircraft's frame is in good shape for having performed over 34,342 parabolas as of Oct. 1. However, it is becoming logistically hard to support the engine because it is currently the only Model KC-135A still flying."

The C-9 aircraft, which replaces the KC-135, will make its debut by the end of January or the beginning of February. The new plane has a smaller research area than the KC-135, but it will serve the same purpose by simulating microgravity for future scientists and current astronauts.

NES04



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When Alissa Kuseske was eight years old her family traveled to Florida where they visited NASA's Kennedy Space Center.

Image to left: Alissa Kuseske fulfilled her dream of flying on NASA's KC-135 aircraft. Credit: NASA

While visiting the space exhibits and museum a passion was kindled in young Alissa which is still alive today.

According to her, "I loved anything that had to do with space travel, space food, KC-135 and floating like an astronaut, building models with my dad, NASA mission patches, astronauts... I had to get my hands on anything that had to do with space. I wanted to be an astronaut ever since I can remember and if you ask any friend or relative they would tell you the same thing: She is crazy about space!"



Image to left: NASA Explorer School educator Alissa Kuseske worked with her students' spinning tops experiment. Credit: NASA

That passion turned into reality for Alissa and five other educators in April 2004. NASA had selected three NASA Explorer Schools (NES) to participate in a pilot program which included a trip to Houston, Texas, where the teachers would

fly onboard NASA's microgravity platform KC-135 aircraft and test experiments planned by their students.

Students and teachers from Crossroads Elementary School in Saint Paul, Minnesota, Sioux Central Middle School in Sioux Rapids, Iowa, and Pender Public School in Pender, Nebraska, worked with NASA scientists and NASA education specialists to develop experiments that could be tested in the weightless environment of NASA's KC-135. Months were spent designing and preparing the experiments to make sure that the projects met the guidelines for flight.

Image to right: Team members from Pender Public School in Pender, Nebraska, were ready to fly. Credit: NASA

"One of the goals of the NES

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Inside the Vomit Come
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Ups and Downs on the 135
NASA's Explorer School program takes teachers the ride of their lives
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program is to provide teachers and their students with unique opportunities that are inquiry-based, 'as only NASA can,' said Peggy Steffen, NASA Explorer Schools program manager. "Developing an experiment to fly on the reduced gravity aircraft with the assistance of a NASA scientist-mentor provided the students an opportunity to investigate a real-world application of physical science."



Before the teachers traveled to Houston, students and teachers from all three NES locations participated in a video conference hosted by the Digital Learning Network (DLN) at NASA Johnson Space Center. Donn Sickorez from the KC-135 program and Chris Chilelli from the DLN provided background information about the KC-135 aircraft and communicated with the students about their experiments. A follow-up videoconference occurred while the teachers were in Houston.



Image to left: Alissa Kuseske and the other teachers went through pre-flight tests before the flight. Credit: NASA

After arriving in Houston the teachers experienced what the astronauts did in their pre-flight training. They first underwent program orientation and then physiological training in a hypobaric chamber.

Next was the test readiness review to make sure that all parts of the experiments were ready for flight. Then the excitement began! They divided into two groups and over a 2-day period alternated flight times and flew like the astronauts!

Image to right : Kim Anderson from Sioux Central Middle School never thought she'd be flying with the astronauts. Credit: NASA



The NASA KC-135 Reduced Gravity Program has been providing a three-dimensional "weightless" test and training environment for researchers since 1959. Originally the province of astronauts, and used primarily in support of NASA missions, the Boeing KC-135 provides other researchers with a venue for fabricating and testing reduced gravity experiments.

A typical KC-135 mission is 2 to 3 hours long and consists of 30 to 40 parabolas or arcs. These parabolas can be flown in succession or with short breaks between maneuvers to reconfigure test equipment. During each arc there will be 20 to 25 seconds of weightlessness.

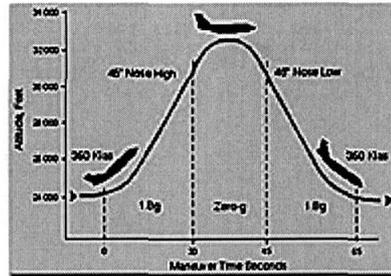


Image above: Once the KC-135 goes over the top of the arc there will be 20 to 25 seconds of weightlessness. Credit: NASA

And what did educator Alissa Kuseske think about her flight above the Earth?

"Astronaut Dan Barry gave me this advice before I flew on the KC-135. 'Remember to take the time to make the memory.' I took the time to look around the cabin when Flight Director John Yaniec yelled those three spectacular words, "Over the top!" I took the time to memorize the feeling of the body floating so I could bring the memory back to my students and family. It really was important to me to get it right; I didn't want to miss a second. This was my dream, and it could very well be a student's dream in my classroom or school. I wanted to make sure I made my time in the KC-135 count. I could not let my students down."



Image above: Flight Group A flew in the KC-135 in the morning. Credit: NASA

The NASA Explorer Schools Program, started in June 2003, establishes a three-year partnership between NASA and 50 new NASA Explorer School teams annually. The teams consist of teachers and education administrators from diverse communities across the country. During the commitment period, NASA invites teams to NASA Centers to spark innovative science and mathematics instruction directed specifically at students in grades four through nine. The selected schools are also eligible for up to \$17,500 in grants over the three years of involvement, pending continued funding. Applications for the 2005 NASA Explorer Schools Program will be available this fall.



Image above: Flight Group B flew in the KC-135 in the afternoon. Credit: NASA

Highlights of the KC-135 Flights:



Ready to Go!

NASA Explorer School teachers board NASA's KC-135 aircraft at Ellington Field in Houston, Texas. While onboard the teachers performed experiments created by their students. Part of the clip shows an animation of the flight plan that the aircraft followed to create a weightless environment.

+ View video



Pender Public School

Teachers from Pender Public School in Pender, Nebraska, experimented with balloons filled with Helium, Argon and air. The students and teachers worked with NASA scientists to develop research projects that were flown on the KC-135.

+ View video



Sioux Central Middle School

Educators Craig Cadman and Kim Anderson from Sioux Central Middle School in Sioux Rapids, Iowa, tested their students' "Turtle Project." Students developed sets of instructions that were uploaded into the Lego Robotic Controller unit while on the KC-135, and the teachers videotaped the execution of the program. The video tapes will be analyzed by the student teams.

+ View video



Crossroads Elementary School

Dr. Bill Lindquist, science teacher from Crossroads Elementary School in Saint Paul, Minnesota, flew with his students' STiMG (Spinning Tops in Microgravity) experiment. Their goal was to study the rotational motion of different types of spinning tops and compare the 1g results to the 0g results.

+ View video



What a Day It Had Been!

It had been an exciting day for the teachers. They had experienced a series of parabolic maneuvers just as the astronauts do while training for space flight missions. There were lots of stories to share with their students and colleagues back home.

+ View video

Reduced Gravity Student Opportunities Program
<http://microgravityuniversity.jsc.nasa.gov/>

NASA Explorer Schools Program
<http://explorerschools.nasa.gov>

Crossroads Elementary School
http://crossroads.spps.org/Reduced_Gravity_Flight.html

Thank You
from
North Dakota





Reduced Flight Gravity Staff,

Team ZeroG Odyssey would like to say thanks for all the support that we received from you. We had a great trip along with learning a lot from our experience. The experiment that you helped support produced valuable information that will be used in further research in this area of study. Hopefully we have also created lots of excitement on campus. Thanks again for all your support!

Team ZeroG Odyssey:

Corey Schwartz

Beth Quistad

Reese Weber

Jeff Wandler

Flying high

Tartan grad takes part in NASA research

Bethany Norgaard

staff writer

Elisabeth Quistad didn't spend her spring break like the average college student.

Rather than visiting Mexico or another exotic location, she and two classmates went to Houston in March to conduct an experiment with NASA.

Quistad, a North St. Paul native and 1999 Tartan High graduate, worked with her team to test how long-term exposure to zero gravity affects elasticity.

Quistad is majoring in electrical engineering with a biomedical emphasis at North Dakota State University. She expects to graduate this May.

The three-person team from NDSU — Quistad, Corey Schwartz and Reese Weber — was selected by NASA as one of 69 groups to participate in the Reduced Gravity Student Flight Opportunities Program at Johnson Space Center in Houston.

Quistad said the team applied for the program in

see **Flying high** on Page 22



submitted photo

Elisabeth Quistad monitors an experiment on elasticity while experiencing zero gravity aboard NASA's specially-modified KC-135 jet.

Flying high...

continued from Page 1

October.

"We found out in December that we were selected," Quistad said. "We were up against some really tough schools, but we thought we had a pretty good chance."

The experiment

An electrical engineering professor at the university, Dan Ewert, helped the students formulate a project proposal. Ewert is studying the cardiac activity of individuals in space.

"But it is unknown if there is an elastic change while in space," Quistad said.

The students used a water-filled balloon to measure how zero gravity affected the elasticity of the balloon. It was thought that if the balloon lost elasticity, it may help explain why the human heart — which is an elastic organ — is less efficient after being in zero gravity for an extended amount of time.

But to do that, the students had to experience zero gravity firsthand.

Using NASA's specially-equipped KC-135 turbojet transport — the same jet used to film the movie "Apollo 13" — the team was taken above the Gulf of Mex-

ico for a series of 60- to 80-minute flights.

"(The KC-135) flies up at a 45-degree angle where you experience two (G-forces) at that time, and then at the top, it points down at a 45-degree angle and you experience weightlessness," Quistad said. "It was basically a free fall."

'(The KC-135) flies up at a 45-degree angle where you experience two (G-forces) at that time, and then at the top, it points down at a 45-degree angle and you experience weightlessness. It was basically a free fall.'

As the plane shot upward, Quistad said it felt like the weight of the world was on her. But during its downward tangent, she said she felt weightless. It was then that the students could float inside the cabin of the turbojet.

During the 60- to 80-minute flights, the students experienced 32 cycles, each lasting just over one minute.

But only for about 20 or 25 seconds was the team weightless. The students did that for two days, collecting data the entire time.

"Our experiment was automated, so when we got up (in the air), we just had to hit 'go' and let it run the entire time we were flying," Quistad said. "We didn't have to worry about concentrating on it while we were in the air."

None of the NDSU students got sick during the rides, even though Quistad said she does have "a tendency to get carsick" on terra firma.

The rest of the team's nine days in Houston were spent touring NASA mission control areas and laboratories.

Since returning to campus, Quistad said the team is still analyzing the data it collected during their trip.

"It was fun," she said. "We got the data that we needed, and right now we're working to analyze and compile it."

Quistad's future

Quistad does not have a job lined up for after commencement in May, but said she has been going on some interviews and is trying to return to the Twin Cities. Her fiancé lives in Eagan.

"I think the biomedical field would be interesting, but it's a tough field to get into," she said.



While in zero gravity, Quistad walks along the ceiling of NASA's KC-135 jet.

submitted photo

'All of a sudden the floor drops from below you'

Student from BP experiences weightless environment as part of NASA program

By KARRIE AUSTIN
Contributing Writer

During the span of an hour, three North Dakota State University students felt like Superman.

"You can't explain the feeling," senior Corey Schwartz said of his short-term ability to fly.

Schwartz, of Brooklyn Park, and fellow electrical engineering seniors Reese Weber of Fargo and Elisabeth Quistad of North St. Paul, recently returned from the Johnson Space Center in Houston, where they experienced a weightless environment.

The students were participating in NASA's Reduced Gravity Student Flight Opportunities Program, which allows selected undergraduate teams to conduct an experiment of their choice in a reduced gravity environment. The NDSU group was one of 69 student teams selected to take part in the program out of the 150 applicants.

The three students performed experiments involving the human heart. Their project involved filling a balloon with water and measuring how a zero gravity environment affects the heart's elasticity. Quistad explained if the balloon loses elasticity, it might help to explain why the human heart loses efficiency under extended periods of zero gravity.

Six student teams at a time rode in a specially modified KC-135, the same aircraft used to film scenes from the movie *Apollo 13*. The turbojet transport flew parabolic arcs to produce weightless periods of 20 to 25 seconds. The NDSU team flew flights for two consecutive days.



Submitted Photo

Corey Schwartz of Brooklyn Park (left) and Reese Weber of Fargo experience a weightless environment at the Johnson Space Center in Houston. Both are electrical engineering students at North Dakota State University.

During each flight they experienced about 30 zero-G parabolic maneuvers over the Gulf of Mexico.

The students decided to make their experiment fully automated so they could enjoy the feeling of zero gravity.

"It's so hard to explain," Quistad said. "It's something we can't grasp because we've always felt one-G. You're sitting one minute and all of a sudden the floor drops from below you."

Quistad, Schwartz and Weber proudly displayed their Bison pride during the experiments. They had pennants, banners and rugs, which were prominent in their souvenir photos and videos.

For Schwartz, it was an opportunity to be recognized with the other widely known schools. Schwartz is the son of Rick and Diane Schwartz of Brooklyn Park.

Weber said it felt good to be competing against big names such as MIT,

Georgia Tech and Harvard.

"It was a lot of work to get to this level," Weber said.

"There were times I debated if it was still worth it, but the second we felt the first parabola — it was just an amazing feeling."

Karrie Austin is a student news writer for the university relations department at North Dakota State University.

FRIDAY

April 2, 2004

Inside

Today's paper

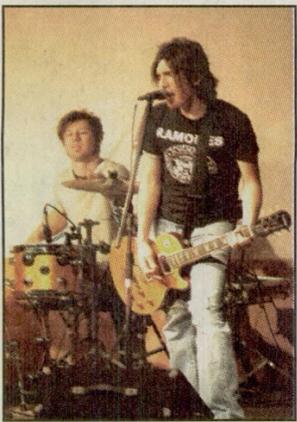
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Tales from The Turf unofficially announces their intentions to run for student president, and how to bring tradition back to SU.

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Cider in the Ballroom.

Not apple cider, but an alternative pop rock band, Cider.

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The Bison softball team cruised to a double-header sweep of MSUM.

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More than 200 college students from around the Midwest will attend the conference, held at SU.

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SPACE ON EARTH



SU students Corey Schwartz and Reese Weber hang out in zero gravity over spring break. Submitted Photo

Students team with NASA research

By Katie Murphy
Contributing Writer

Over the space of an hour, three SU students experienced the weight of the world and the lightness of a kite.

Electrical engineering seniors Reese Weber, Corey Schwartz and Elisabeth Quistad recently returned from Houston, where they participated in NASA's reduced gravity student flight opportunities program. The SU group was

one of 69 student teams in the nation to be selected.

"In two gravity, where the jet flew at a 45-degree angle up, my body felt like the weight of the world was on it," Quistad said. "When we were going down, at zero gravity, I felt like a kite flying in the sky because my feet weren't touching the floor."

As part of their senior design class, the students tested the elasticity of the heart while in microgravity for extended periods of time,

such a manned mission to Mars.

"We submitted a proposal to NASA, which included writing a paper for our class," Schwartz said. "We wanted to do something that NASA would be interested in."

The students did research on the heart.

"We tested the effects of zero gravity on a balloon filled with water, which would be similar to the effects it has on the heart," Quistad said. "The heart is

an elastic organ, and it stretches down in two gravity and stretches across under zero gravity."

To achieve a reduced gravity environment, the students flew in the specially modified KC-135 turbojet transport, which flies parabolic arcs to produce weightless periods of 20-25 seconds. The KC-135 is the jet that was used to film scenes from the movie "Apollo 13."

See NASA: Page 2

A true labor of love

By Amy Oster
News Editor
aoster@ndsuspectrum.com

Debra Ciavola says she's never felt called to do anything—except after the Sept. 11 terrorist attacks.

"To this day, I can't explain it," Ciavola told a classroom of students on Wednesday. "I felt called to do this ... why are we here? Let's have purpose."

Ciavola, a 1995 SU graduate, visited campus Wednesday to talk about what she calls her "labor of love"—a compilation of 180 letters from family members to loved ones who were lost on Sept. 11, 2001.

"When sudden death happens, one of the ways to help people work through that is being able to say goodbye to their loved ones through personal letters," Ciavola said.

Ciavola works as a licensed therapist in Dallas, Texas. After the attacks, she contacted family members of victims in New York and asked for letters to lost loved ones. The response, she said, was overwhelming.



Debra Ciavola discusses her experiences collecting letters from families affected by the 9/11 terror attacks. Matthew Perrine / The Spectrum

"The most difficult part was that it's so sad, and so painful," Ciavola said. "But the book also includes letters from survivors."

Family members shared their stories and heartache in an outpouring of remembrance. At times, Ciavola had to take time off from reading the leaders because they were causing symptoms of post-traumatic stress and depression in her own life. Ciavola also took time to visit firefighters and hear stories in New York City.

In three days, she visited 14 fire stations.

"In the fire station across from the (World Trade Center), one person was left. One firefighter survived," Ciavola said.

Ciavola also shared letters from victims' families, including one from a mother to her 25-year-old daughter.

"Although life is getting back to normal for our country," the mother wrote, "it will never be normal for our family."

See LABOR: Page 3

Beer go and ma

By Heather Vierkant
Contributing Writer

If students have ever fantasized about being drunk, giving blood and getting a massage all on the same day, they are in luck.

Beer goggles, free massages and a blood drive will be featured at the annual health fair in the MU.

Health educator for the Wellness Center, Holly Bergo, hopes the fair will be better this year.

The fair will cover the seven dimensions of wellness—physical, mental, emotional, social, spiritual, occupational and environmental. The variety aims to emphasize that exercising is not the only aspect of wellness, Bergo said. The fair will feature more than 40 vendors and many interactive booths, including the popular beer goggle demonstration.

Campus police will be in attendance to let students "walk the line" while wearing goggles that simulate the effects of alcohol.

Free cholesterol, glucose and blood pressure screen-

NDSU students experiment on 'Vomit Comet'

Three North Dakota State University students who recently performed a heart-related experiment in zero gravity also learned something about their own anatomy – specifically, that they have strong stomachs.

NDSU seniors Reese Weber, Corey Schwartz and Elisabeth Quistad took 32 rides per hour in weightlessness – each ride lasting about 30 seconds – aboard a KC-135 tanker known as the "Vomit Comet."

The NDSU team was one of 69 selected by NASA to participate in the Reduce Gravity Student Flight Opportunities Program at Johnson Space Center in Houston.



**MIKE
NOWATZKI**

*Higher Education
Notebook*

To improve their chances of being chosen, the students selected a timely topic – long-distance space travel. Their project involved filling a balloon with water and measuring how a zero gravity environment affects elasticity.

The idea, as Quistad explained during a news conference Wednesday, is that if the balloon loses elasticity, it

might help to explain why the human heart loses efficiency under extended periods of zero gravity.

That's a major obstacle to long-distance manned space missions. It's also the subject of research being done by Dan Ewert, their electrical engineering professor at NDSU.

Six teams at a time rode in the specially modified KC-135, the same aircraft used to film the weightless scenes in the movie "Apollo 13."

The teams flew 60- to 80-minute flights for two consecutive days, experiencing about 30 zero-G maneuvers over the Gulf of

Mexico on each flight.

None of the NDSU students got sick, they said.

In fact, with only 30 seconds at a time to experiment, they decided to make their project fully automated so they'd have the freedom to enjoy zero gravity.

Quistad shrieked like a kid on a carnival ride as the KC-135 began to level out from its 45-degree ascent, sending her and her long hair floating to the ceiling.

"In zero-G, you just feel light as a feather," she said. "It's an unbelievable feeling."

NOTEBOOK: Page A10



**North Dakota
State
University
senior**

Elisabeth Quistad holds on to the 'NDSU engineering project as she floats next to a water bottle aboard NASA's KC-135 aircraft, nicknamed the "Vomit Comet."

Special to
The Forum

A10 Thursday, April 1, 2004

NOTEBOOK: MSUM student receives honor

From Page A8

A videotape shows Schwartz, after sending a shot out to his parents and NDSU's electrical engineering department, curling up like a ball and letting an onboard technician spin him around.

"We had some fun," he said.

Jan 2005

VOLUME

The Metropolis Observed

Bedding Astronauts space

Portland architecture students make the prospect of sleeping in space a little easier.

For all the technical sophistication that goes into NASA's space shuttle and international space station, the comfort of astronauts on long-duration missions is still severely limited by weightlessness. In particular, it can be very hard to sleep. Not only is the spine stretched painfully by an absence of gravity, but astronauts must slumber in rudimentary sleeping bags tied to the wall.

Thanks to an annual NASA program that allows college students to conduct experiments in zero gravity aboard the KC-135 plane, however, astronauts may soon be spending fewer sleepless moments counting satellites. Recently a group of Portland State University architecture students (the first design team ever selected to participate) in the Johnson Space Center's Reduced Gravity Student Flight Opportunities program experimented with a new sleeping-bag prototype that has gained NASA's attention.

The bag uses inflatable compartments to surround the body with pressure in a way that simulates the feeling of having the weight of blankets wrapped around you and a mattress underneath, thereby positioning the body in a more natural, earthbound way. "They had an innovative approach, and I thought it was very effective," says astronaut David Wolf, who came aboard the student flight to inspect the experimental sleeping bag. "I think it has great potential to improve sleep in space."

The students, led by Portland State senior Michael Rudis, spent about six months working on the

design, which was made with silicon-coated fabric, nylon, an air pump, and other materials donated by local and international companies. "I never wanted to be an astronaut, but I'd always been fascinated by exploration—or not the exploration itself so much as the challenge of making due when you get there," Rudis explains. "I think what excites me is not, 'Well, we're here. Let's kick some stones around the Moon.' It's the sustaining of life."

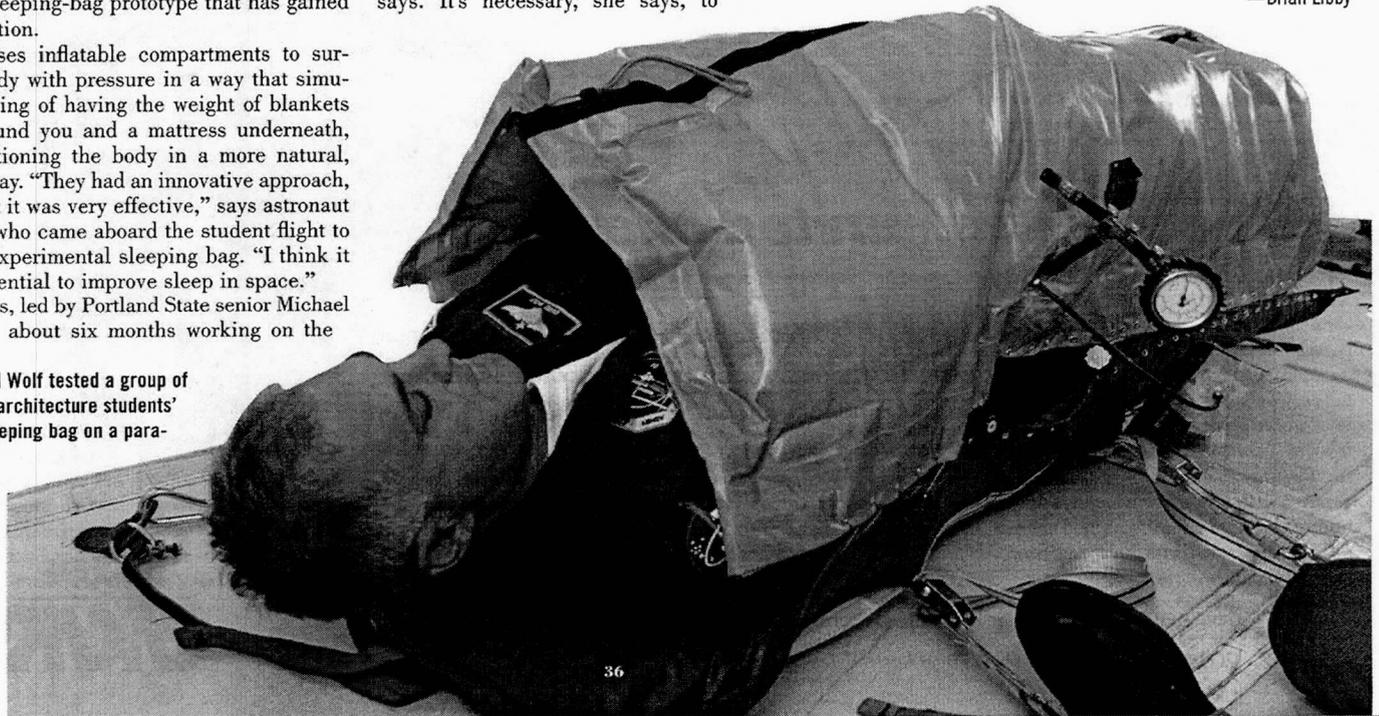
In the past NASA has overwhelmingly welcomed science and engineering experts into its fold, but as the agency imagines permanent future outposts on Mars and the Moon, architecture professionals are taking off at the agency too. "We've seen an increase in the participation and the level of responsibility of those trained in architecture over the past decade," NASA architect Janis Connolly says. It's necessary, she says, to

"approach the challenges of extreme environment design from a human-centered perspective: putting human needs and human interplay with systems front and center in the design process, using human capability and limitation as design drivers from which all else is organized."

It was at a lecture by Connolly five years ago that Rudis first got the idea of exploring what he now likes to call "off-planet architecture," also the name of his Portland State University team. Next he's hoping to pursue graduate work in space architecture, possibly at the University of Houston, conveniently located near the Johnson Space Center. "Building a skyscraper is for most architects or architecture students the best you can do," Rudis says. "But I think you'll see more of us looking beyond the horizon with the design."

—Brian Libby

Astronaut David Wolf tested a group of Portland State architecture students' pressurized sleeping bag on a parabolic flight.



AND AROUND THE STATE

Woman can't wait to be weightless

Petoskey's Colleen McCoy to participate in zero-gravity simulation

BY RYAN BENTLEY
NEWS-REVIEW STAFF WRITER

Petoskey resident Colleen McCoy has long wanted to experience the sensation of near-weightlessness, and she'll get an opportunity this spring.

McCoy, 21, is one of five Purdue University aeronautical and astronautical engineering students planning to visit NASA's Johnson Space Center in Houston for a scientific project April 1-10.

While there, four of them will board a modified jet which follows a specialized flight path in order to simulate zero-gravity conditions.

"I'm really excited to go and experience what microgravity feels like," she said. "It's something I always wanted to do."

During two days of flights, McCoy said the group hopes to observe the movement of fluid inside a spherical tank. The students would like to find out more about any effects which sloshing of liquid within the tank might have on the surrounding vessel in a zero-gravity environment.

"It's something you really can't replicate here on Earth," the 2001 Petoskey High School graduate said.

By gaining a better understanding of sloshing effects, McCoy said the students hope to draw some conclusions that could be applied to photo-taking satellites.

If more is known about the effects which movement of fuel within satellite tanks can have, McCoy said camera movements hopefully can be refined to account for them.

"It would be a money-saver for some companies," she said. "It would help with the accuracy."

Other Purdue students involved in the experiment include Chris Fles of Muskegon, James Kallamani of Gary, Ind., Pete Browning of Seymour, Ind., and Lloyd Droppers of Wilkes-Barre, Pa.

Steven Collicott, an associate professor at Purdue, will be their adviser.



McCoy

After learning of some friends' experiences performing an earlier experiment on a NASA jet, McCoy said she began looking for an opportunity to take such a flight herself. She approached some friends, and they then brainstormed ideas for an experiment with Collicott.

The students submitted a written proposal to NASA in October. About two months later, they learned they'd been selected for a flight.

NASA offers college and university undergraduates an opportunity for in-flight experiments in a modified KC-135 jet as part of its Reduced Gravity Student Flight Opportunities Program.

John Yaniec, lead test director for the reduced-gravity program, said the space agency hopes to bolster students' enthusiasm for aerospace research with it.

"It's basically to educate and really get the students excited about NASA, about maybe coming to work for us," he said.

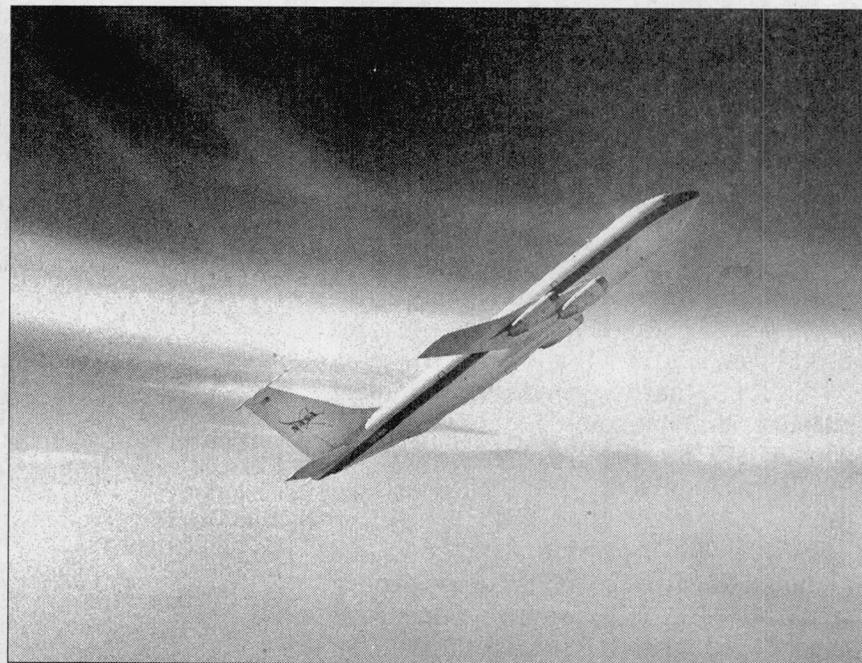
"I'm really excited to go and experience what microgravity feels like. It's something I always wanted to do."

Colleen McCoy

Yaniec's program works with about 70 student research groups a year.

After taking off from Houston's Ellington Field, pilots typically guide the aircraft in a parabolic-shaped flight pattern over the Gulf of Mexico. At the top of each parabola, those on board get to experience about 25 seconds of microgravity.

NASA will cover flight expenses for the Purdue students' upcoming experiment, while the West Lafayette, Ind., university will pro-



COURTESY PHOTO

NASA flies this modified KC-135 jet on a specialized flight pattern that allows occupants to experience near-zero gravity. Student researchers regularly conduct experiments in the plane's low-gravity environment.

vide most funding for the project itself.

McCoy said an interest in math and science helped draw her to Purdue's aeronautical engineering program.

"I've always been fascinated by airplanes and space flight," she added. "It just seemed like a natural path."

Colleen, the daughter of Pat and Bob McCoy, expects to graduate from Purdue in 2005. Afterward, she'd like to obtain a master's degree and work in aerospace research.

Lindsay Millard, a 1996 PHS graduate, was involved with another microgravity experiment on board NASA's aircraft in 2002, while she was an undergraduate at the University of Michigan.

Millard and other students from U-M and Iowa State University conducted an experiment focusing on deep-space optics. Joe Lambert, one of Millard's former Petoskey classmates, was involved with the project, while former Petoskey resident David Hartkop captured video footage of it.

Ultimately, the group wondered if temperature variations could be used to control the refraction of light as it passes through various gasses. If so, Millard said this eventually could help in developing a lightweight alternative to the bulky glass refracting lenses that are used in telescopes.

"We could see the gas forming a lens," Millard said.

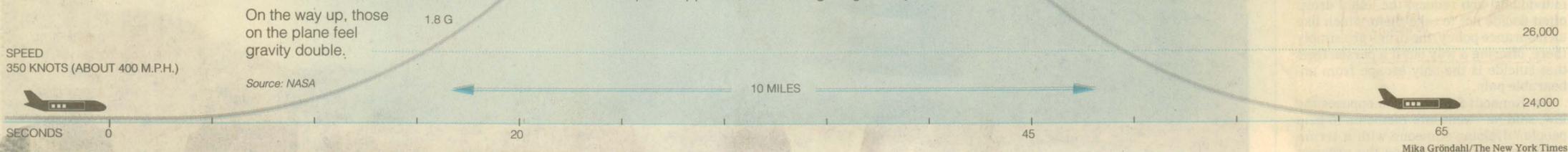
Millard worked with some other students on a follow-up experiment in 2003.

"The experiment observed the same phenomenon, but with a higher accuracy measurement technique," Millard said. "From this experiment, we developed a mathematical model of heat in microgravity."

Millard, who recently finished a master's degree at U-M and will begin working on a Ph.D. at Purdue this winter, said considerable technological development would be needed to create an actual observatory that uses gas lenses.

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Free From Gravity, These Students Taste Outer Space



By JOHN SCHWARTZ

ON THE CEILING OF THE NASA KC-135 LOW-GRAVITY PLANE, over the Gulf of Mexico — “Feet down!”

Normally, those words are a description of the world as we know it. Feet down. Head up. Horizon level.

But up here, where gravity is briefly defeated dozens of times an hour as this jet cycles through up-and-down parabolas 10,000 feet high, it is a command, and a warning. It says that the period of weightlessness is ending, that gravity is about to return with a vengeance as the plane swings up and that the passengers need to be in position for a soft landing on the plane's padded floor.

Such is life aboard KC-135, the four-engine military version of the Boeing 707 that the National Aeronautics and Space Administration uses to train astronauts for weightlessness, to test in-space technology, to help Hollywood shoot weightless scenes — and to let dozens of engineering students each year know that the space program might be a cool place to work.

“You are really the hope for the future of this country,” Gregory W. Hayes, director of external relations for the Johnson Space Center, said to several teams of college students who had traveled to Houston for a one-week program that culminates in their conducting experiments aboard the microgravity plane.

Mr. Hayes's pitch was urgent. America's pipeline in science and engineering is drying up at a time the nation is in desperate need of innovation. The year-over-year increase in the number of engineering graduates that China is turning out, he said, is greater than the total number of engineers who are graduating from American schools.

“Frankly,” he told them, “the statistics are alarming.”

Once the “industry of choice” for technical workers, aerospace now “presents a negative image to potential employees” because of years of cutbacks, consolidation and stagnation, a recent study by the Aerospace Industries Association found. Top students with scientific or technological bents are more likely to choose hot fields like biotechnology. NASA, after all, does not grant stock options.

At the same time, NASA's brains and hands are aging. Partly because of longstanding hiring freezes that are just beginning to thaw, NASA employees older than 60 outnumber those younger than 30 by three to one, according to the General Accounting Office.

The plans to return to the Moon and push on to Mars make it even more imperative to attract young engineers, NASA officials say.

“It's all going to happen in your career time,” an astronaut, Dr. Bonnie J. Dunbar, told the students.

That is why NASA is looking more than ever to educational initiatives like the student flight program, in which college students devise and build experiments that can be performed aboard the KC-135, also known as the K-Bird.

Steven H. Collicott, a professor of engineering at Purdue, said the program, which began in 1996, is like “a high school science fair on steroids.”

The plane has another nickname, from its reputation for causing nausea in some fliers. They call it the Vomit Comet. NASA has made great strides in controlling the symptoms, and scientists say they still cannot predict who will be sick and who will not. But they nevertheless distribute a government-issue motion-sickness bag to each flier, along with a lecture on “bag etiquette.”

“I am so-o going to be the one who loses his lunch!” Brian Ventre, a big, sardonic engineer from Purdue said on the first day of the visit in April.

“I won't,” Rebecca Karnes, another member of the team, said. “I'm determined.”

The Purdue project is to develop and test a new pipe that can be deployed in space, perhaps as a conduit for wires or a boom for antennas. The students have worked far into many nights on the pipe, two pieces of thin flexible Kevlar strips shaped like rounded metal measuring tape and glued together to leave an eye-shape space in the middle. The two curved pieces can be flattened together and rolled tightly around a reel for storage before flight. In space, astronauts would play out the boom, which would pop back to its original shape and stiffen.

The experiment itself is homely and has a hand-built look, not to mention its mascot, Bob, a pink plastic flamingo with Mardi Gras beads, attached to the experiment's frame with duct tape. The team T-shirt is gray with an embroidered flamingo.

The students maintain a Web site with a running account of their progress at www.livejournal.com/users/purduezerog/. NASA is eager to have them do everything they can to share the experience, including taking a reporter along with the team. The point, NASA officials say, is to spread the word about the space program to people who do not have an opportunity to ride the plane.



Adrianna Zammit said that her flight gave her a feeling of freedom, but also that “having little control resulted in some feelings of anxiety.”

Next to them in the hangar at Ellington Airfield in Houston is a team from the University of San Diego, a Roman Catholic institution in California. That team's experiment is a refrigerator-size machine that shakes racks of differently shaped containers, each filled with small beads and one larger one. The idea is to test out a physics question known as the Brazil nut problem. That problem asks why in a can of mixed nuts do the Brazil nuts almost always work their way to the top?

Understanding the physics of how

objects shake out in low gravity could help determine how to pack objects collected on the surfaces of the Moon or on Mars.

The experiment itself is so sleek that it could have been designed by Porsche, the acrylic containers precision-shaped by a contractor and the heavy-motor shaking mechanism smooth and powerful. The team itself arrived in matching blue flight suits with their names at the breast pockets.

In the movie version, the experiments would be a geeky version of

the soapbox derby competitions. The Purdue team would be the scrappy upstart kids, and the San Diego crew would be the snooty rich kids with their Daddy-built roadsters.

But this is not a competition. The rivalries are friendly. Everybody has one goal, and that is to board the plane.

That first day, another astronaut, Dr. Daniel T. Barry, told the students that the microgravity experience aboard the plane was “exactly like being in space.”

This is not just a pep talk. The sensation of weightlessness aboard the space shuttle and International Space Station is actually free fall, just like the 30-second drops the students will experience. The spacecraft are constantly falling toward Earth, their altitude maintained by their orbital speed.

Dr. Barry offered this advice: “You don't want to get too wrapped up in the experiments” and miss the experience of weightlessness. “Remember. Very few people are going to ask you how the experiment went. Everybody is going to ask you what it was like.”

The students all understand that the experiments may not produce the results they are looking for, or even function at all. The San Diego crew's motor controller burned out two weeks before the flight and had to be replaced. The Purdue team's motor turned out to be too puny to roll and unroll the flattened boom. They had to create a hand crank on the fly, so to speak.

Not everyone is a fan of the K-Bird program. Dr. Charles M. Swenson, a professor of engineering at Utah State University, argues that it is showy, but does not do much to address the need to build the ranks of the nation's engineers. Other initiatives reach more students at a more impressionable age, Professor Swenson said. He offered as an example the Hitchhiker program, which allows students to put their own experiments on the space shuttle.

The programs he favors are being scaled back to carve billions from

the NASA budget for President Bush's plan to send astronauts to the Moon and Mars. The microgravity flight program has also been trimmed from time to time, though the space agency insists that it is safe for now.

“I'm thinking it's looking pretty bleak,” Professor Swenson said.

As a recruiting tool for college engineering students, the flights can be powerful.

“I would love to do something for NASA” after college, said Adrianna Zammit, a second-time flier on the San Diego team. “I don't want to be in a cube for 40 hours a week for the rest of my life.”

NASA's plan for recruiting future astronauts.

Another student was not as impressed. Speaking without attribution for fear of offending the hosts, the student said, “I would not be interested in working at NASA,” and argued that its human spaceflight efforts seemed overly bureaucratic.

NASA scheduled two flights a day over the next week, with several groups on each.

The students are not the only ones who deal with uncertainty. On the Friday before the flights, one of the four engines on the KC-135 failed on a flight. NASA grounded it to replace the engine, delaying the schedule a day.

On Purdue's flight day, heartbreak. An engine light for the replaced engine went on, and the plane returned to Ellington after a third of its planned parabolas. The group packed its work into the two sessions. The disappointment was palpable.

The next day, San Diego flew. Ms. Zammit said that the floating sensation gave her a feeling of freedom, but also that “having little control resulted in some feelings of anxiety.”

“The slightest push off the wall sent me flying across the plane cabin,” she said.

On the last two parabolas, NASA gave the engineers in training a taste of what it would be like to walk on the Moon and Mars, adjusting the descent to simulate their gravitational pulls. The lunar gravity, one-sixth that of Earth, put a bounce in everyone's step that explains the jerky hoppiness of the Apollo-era video clips. Some students dropped down for one-finger pushups. Martian gravity, one-third that of Earth, is less bouncy but still gloriously weird. And then it was over.

“Ladies and gentlemen, that's a wrap!” John Yaniec, the flight director, announced.

Despite the predictably unpredictable glitches, the students all captured their data for later review.

Just one person, a Houston flight controller along for the ride, became ill. The controller, Colin Asekun, showed excellent etiquette.

“Somebody had to keep the name Vomit Comet alive, right?” he said.

Mild-Mannered Reporter Gets a Superman Moment

By JOHN SCHWARTZ

Since I got back from my microgravity flight, people have really only one specific question. So I'll answer it right here. No, I did not, as a friend put it, “paint the ceiling.”

I had expected to be deeply, dismally sick. I am, to use the technical term, a wimp. I have to sit down after spinning on the playground equipment with Joe, my 8-year-old. Roller coasters terrify me.

But you have to be willing to suffer for a story. And NASA hands insisted that the combination of drugs that they provide for zero-G fliers — the antinausea drug scopolamine with a little Dexedrine for the drowsiness it can cause — had greatly curtailed that particular side effect.

In the days before the flight, I got

advice from people who had flown on the K-Bird, so I knew just what to do. Don't eat. Eat lightly. Lie down on the floor during ascents. Sit propped up against the wall for ascents.

The only thing that people consistently advised was keeping the head as still as possible, because turning it from side to side adds to the middle ear's confusion.

Then we took off. For the first few parabolas, I did as the flight surgeon, Dr. James Locke, told me. Lie back in my seat with the seat belt unbuckled, holding the ends. When the plane rounded the top of the first curve, I felt a momentary dropping in the pit of my stomach and then ... gravity simply went away. I floated up from the seat. Thirty seconds later, my body pressed down against the seat once again, but with twice the normal weight as we slammed upward.

Lie down. Sit up. Lots of advice from the experts.

After growing used to the sensations through a few cycles, I pushed out of the seat and floated toward the ceiling, grabbing the canvas straps along the wall to move around. Dr. Locke told me that I was bouncing around a little too tentatively.

“Try the Superman move!” he said, stretching out his arms in an imitation of comic-book flight. I did, and gave a gentle kick against the wall and sailed to the other wall, slower than a speeding bullet, but nonetheless fulfilling childhood de-

sires I had forgotten I had.

A look through one of the two small windows in the passenger area showed a horizon gone all tilty, tipping like a seesaw. I turned a somersault. I did a “Spiderman,” crawling up one wall of the plane, across the ceiling and down another.

For people who will never be astronauts — or have the spare \$20 million for a private jaunt to the International Space Station — microgravity is as close as we are going to get. I'll just have to do without the whole-earth panorama.

That evening, I boarded a commercial jet home and found that the 32 parabolas had made an impression. When the plane leveled off from its initial climb, I felt a brief jolt of surprise at not floating out of my seat. And I felt something else: disappointment.

Touchy subject

Purdue to test tactile perception in zero gravity

By Brian Francisco
The Journal Gazette

If all goes according to plan, Jonathan Wolter won't know which way is up this summer.

Wolter, a Fort Wayne native, is part of a Purdue University team that will experience weightlessness aboard a National Aeronautics and Space Administration turbojet in late July. The five students will be testing their responses to tactile stimulators, or "tactors," small vibrating devices that attach to vests.

The tactors are programmed to buzz directionally — up and down, for example, or left to right.



Wolter

This will be the third team for the Purdue experiment since 1999. The missions are trying to determine whether a weightless environment is so disorienting that a person's touch perception is thrown out of whack.

Wolter, a 2001 graduate of Leo High School, will get to realize part of a childhood ambition.

"When I was little, I wanted to be an astronaut," he said.

He also recalls being fascinated as a child by a report of the NASA zero-gravity flights, though "I never had any idea it was something I could actually do."

He gets his chance when his team goes to Johnson Space Center in Houston to fly on a Boeing KC-135A.

The plane's test area is 60 feet long, 10 feet wide and 7 feet high. The jet achieves zero gravity in quick, arc-like climbs and descents; at the top of the arc, at an altitude of about 33,000 feet, students experience weightlessness for 20 to 25 seconds. The typical flight consists of 30 to 40 such periods over 2 to 3 hours.

The plane has been dubbed the "vomit comet" because of an occasional reaction to weightlessness.

"It's more of a legend than a reality," NASA official Donn Sickorez said about the nickname. "There's a 70 percent chance you'll get through the flight with little or no discomfort. Every once in a while, you feel a little queasy and have to sit down."

"The other 30 percent actually throw up or feel bad enough to go in the back and get strapped in," Sickorez said.

Just in case, everybody is equipped with plastic bags. The vomit comet crew includes a physician and safety technicians.

Wolter, a 21-year-old industri-

al engineering major, sounds like he's ready to be a frequent flier.

"Talk about a cool job," the Purdue senior said about the NASA crew. "It's like riding amusement park rides all day and getting paid for it."

All in the name of science, of course. NASA's Reduced Gravity Student Flight Opportunities Program each year invites proposals for microgravity experiments. More than 100 are submitted for about 70 slots. NASA officials at three centers — Johnson, Marshall Space Flight Center in Huntsville, Ala., and Lewis Research Center in Cleveland — review and rank proposals.

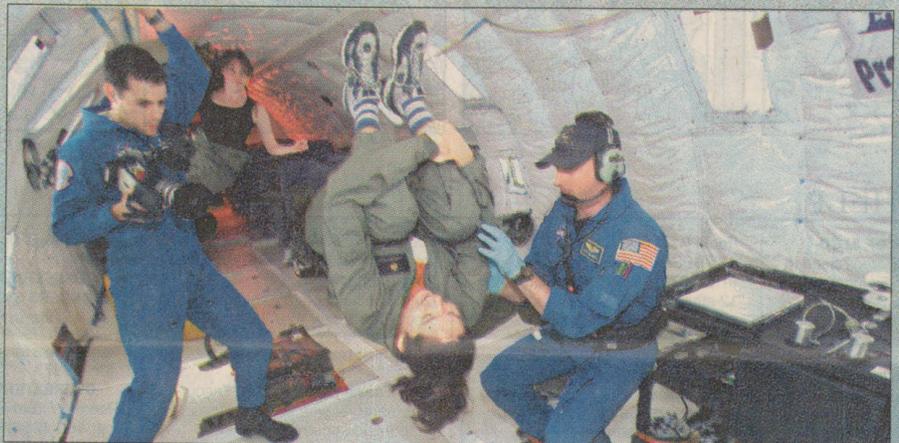
"All you have to do is good, solid science," Sickorez said. "One of our teams did a welding experiment, and a reviewer said, 'We are not going to have astronauts welding in space.' But another said, 'It's a solid experiment,' so we flew it."

Among zero-gravity experiments flown this year, a Brown University team tested eyedrops in spray and syringe applications, and New Mexico State University students filtered wastewater. Dartmouth College will try out muscle exercises, Harvard University plans to perform CPR on a floating patient, and Portland State University will run an experiment on "sleep hardware," fabrics that simulate the feel of blankets.

Hong Tan, an associate professor at Purdue's School of Electrical and Computer Engineering, directs the tactors project — officially known as The Perceptual Effects of Altered Gravity on Tactile Displays.

"Nobody has proven under an altered-gravity environment that touch is valid," she said. "There is very little study to tell us what happens to touch."

Her teams' research so far shows only 40 percent of weightless subjects can tell what direction the tactors are vibrating. Earlier flights proved the tactors worked fine, Wolter's



A college student does a somersault in zero gravity aboard NASA's KC-135A as part of the agency's Reduced Gravity Student Flight Opportunities Program at Johnson Space Center in Houston.

group will be testing whether students' ability to concentrate is disrupted by zero gravity.

"We are left thinking it's the person — that we are so disoriented that there is a cognitive difference that causes a load on our brains," Wolter said.

Some students will float; others will be anchored.

"They should perform better when they are strapped down because they are less distracted," Tan said. "One student said that to even talk in zero gravity is hard."

Tan can see practical applications for tactors. They not only could help astronauts find their bearings in space, they could be used by sea divers and stunt pilots, she said.

The Purdue students will fly twice during a 9-day stay in Houston. The five-member team first will receive physiological training, including a stint in a pressurized chamber to experience the effects of hypoxia, or oxygen deficiency in the body.

Then the students will preview their experiment at a test readiness review, or what Sickorez calls "roughly a science fair," before NASA scientists, pilots, flight surgeons and safety ex-

perts. "We are all going to be flying with these experiments," Sickorez said. "If something goes wrong with a student experiment, we're all in this together."

Sickorez said NASA once aborted a flight because an electricity experiment produced a burning odor. The experiment, and the flight, went off without a hitch the following day.

In addition to monitoring the experiments, the NASA flight crew helps keep weightless students from bouncing off the walls of the plane.

"They can get a little disoriented and start kicking," Sickorez said. "You take care of their feet so they don't kick anybody."

Wolter seems confident his team will need little, if any, assistance.

"If NASA lets us, our team wants to get Superman shirts to wear underneath our jumpsuits," he said. "We'll unzip the jumpsuits and fly through the cabin like Superman."

Wolter's levity didn't come cheap, or easy. His team raised \$10,000 for travel, food and lodging expenses, much of it through Purdue and private sponsors, including British aerospace manufacturer BAE Systems, which produces aircraft controls in Fort Wayne. And part of the tactors project has team members talking to elementary, middle and high schools about the experiment.

The vomit comet could lead Wolter in career directions. Some participants have ended up as NASA engineers, Sickorez said.

"One of our fliers, from North Carolina, was a biology major," he recalled. "After coming here, he said, 'I know exactly what I want to do.' And he's in Navy flight school right now."



College students exit the NASA jet after performing a scientific experiment in a weightless environment. A Purdue University team, including a student from Fort Wayne, will fly on the plane in late July.

About the flight

Who: Five students representing Purdue University, including Jonathan Wolter of Fort Wayne

What: Experiments on how humans' sense of touch is affected by gravitational forces

When: July 22-31
Where: NASA's Johnson Space Center, Houston. Students will experience zero gravity aboard a NASA turbojet.

Description: Purdue students in the zero-gravity environment will wear vests containing tactile stimulators — small vibrating devices — that are turned on and off by a computer. Students will try to record which points are vibrating. Students will be tested in two environments: while free-floating and while strapped down.

Background: Previous work by Hong Tan, an associate professor in Purdue's School of Electrical and Computer Engineering, and student teams have shown people experiencing zero gravity in the NASA plane are able to determine the direction of vibrations only 40 percent of the time; the rate was 100 percent in ground tests. One hypothesis is that the sense of weightlessness distracts test subjects enough that they are unable to concentrate on the vibrations.

For information:
<http://microgravityuniversity.jsc.nasa.gov/>

Source: Purdue University



Shelburne firm supplies the parts to diehard fans of the Chevy Corvair

Hilltown Life, page 6

Injustice anywhere is a threat to justice everywhere.
—MARTIN LUTHER KING, JR.

Shelburne Falls INDEPENDENT

CHILI TODAY



In a friendly family competition Chris Throne, his girlfriend, Christine Hicks, and her 12-year-old son Mark vie for votes for the most enticing chili during the Charlemont Inn's Annual Chili Cook-Off. The event raised funds for fireworks at the Yankee Doodle Days summer festival. See story, page 2.

A line in the gravel

The town of Charlemont and the owner of a gravel pit face a land court date to answer, among other questions: when you buy property, does the special permit come with it?

By Laurie Wheeler Burrington
lw@shelburnefallsindependent.com

CHARLEMONT—The town of Charlemont and New England Investment Holding Corporation, doing business as Zoar Sand & Gravel, appear to be heading to land court within the next 16 months after several years of failing to reach agreement.

"Ultimately we're hoping to have a settlement reached before we go the full court system," said Planning Board member Charlotte Doney, adding that at a Feb. 4 court conference among both parties it is her understanding they will have to agree to involve a mediator. "Perhaps the court mediator will have better luck than we had."

At the heart of the conflict are special permits issued by the town's planning board outlining conditions under which an owner may use property for a particular purpose. The involved parties are debating whether, and under what conditions, special permits remain in effect after property changes hands.

Under scrutiny is whether property owners forfeit a special permit if owners don't avail themselves of the privilege within a certain length of time, how rock crushing falls within the scope of allowed uses, and how an administrative error has invalidated a building inspector's cease-and-desist order.

about the rights of a property owner, the rights of his neighbors and how a town board interprets and applies limits set by its predecessors.

"We [New England Investment Holding Corporation] purchased an ongoing business in Charlemont, one which came with a special permit for business use," said Earl Bowen, president of New England Investment Corporation and owner of the Zoar Road gravel pit operation. "We're operating a gravel bank that has been run continuously."

The planning board disagrees. It says that between April 1999 and April 2001 there was no "substantial use" of the gravel pit.

More deeply seeded are issues

continued on page 4

Friendships bind over time and race

Descendants of a plantation-owning family, among them a Buckland resident, bond with the families of its slaves

By Genie Zelger
gz@shelburnefallsindependent.com

BUCKLAND—"Everyone's talking a mile a minute," says Clara Nelson, great-granddaughter of George Singleton, a former slave at the plantation. "There's no bitterness, no animosity. It's fantastic to be part of history. We've been meeting for about five years, and the good feeling keeps growing."

"When we all get together, we have a lot of fun," says Walt Chapman of Buckland, great-grandson of Robert Singleton, the former slave owner. "It feels good, like we're all cousins."

What forged the bonds between the white Singletons and the black Singletons — who, as was common practice, adopted their owners' surname — is an inspiring piece of history.

It began circa 1843, the year in which two Singletons were born: George, who was black, and Robert, who was white. Eighteen years later, the Civil War began and Robert enlisted in the Confederate Army.



Left: Mr. and Mrs. Robert Singleton hold Leonard F. Chapman, the father of Buckland resident Walt Chapman. Below: Walt Chapman and his niece, Danielle Chapman, who is in line to inherit the property that draws the descendants of masters and slaves alike.



continued on page 3

Mohawk, parents join to create 'safe homes'

BUCKLAND—Organizers of the Safe Homes Parent Network in the Mohawk Trail Regional School District have published the first edition of the "Safe Homes Resource Guide."

"For those families who have been successful in influencing their children's decision making abilities and encourage good judgment, the Safe Homes project hopes to support their efforts," said Mark Keller, a parent committee member from Plainfield. "For those families struggling with their children's less than desirable choices and risks associated with youth and substance abuse, this project's hope is to join the list of many strategies needed to creatively address the problems."

Included in the guide are the names and phone numbers

continued on page 4

Ashfield hires Llamas as new town administrator

ASHFIELD—Andrea Llamas of Conway will start as the new town administrator Jan. 24.

She replaces David Dann, who resigned to take a similar job in Shutesbury. Dann was the town's first administrator, serving for about two years.

Llamas has worked as the administrative assistant for the town of Conway since 2001.

Her work there included overseeing all aspects of the day-to-day operation and serving as a

motivating force in a number of key initiatives including the realization of the streetscape project, the establishment of the Economic Development Committee and a review of town road issues.

Road research led to a petition to the county for road discontinuance and the adoption of a new town road and layout of statutory private ways.

Since June 2004 Llamas has also been the town's assistant treasurer

continued on page 2

Heath engineering student to experiment at NASA

By Laurie Wheeler Burrington
lw@shelburnefallsindependent.com

HEATH—"Ready to do your air work" are words most of us won't hear in our lifetimes.

For participants at NASA's Microgravity University, though, there is an air space reserved just for them.

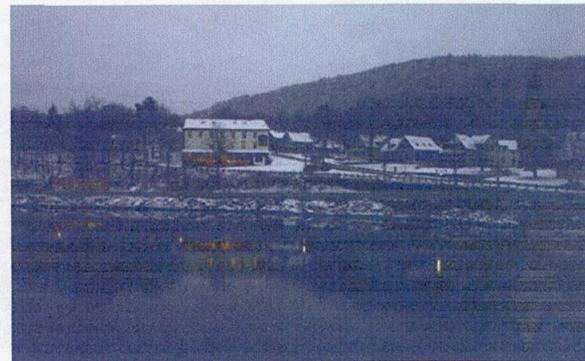
Sarah Wodn-Schwartz of Heath, a sophomore at Smith College, will

be heading skyward from Houston's Johnson Space Center in July. Wodn-Schwartz and three other women from Smith submitted a plan for their original mechanical engineering experiment and were awarded a spot in NASA's highly competitive Microgravity University.

Wodn-Schwartz, 19, is studying general engineering and plans to

continued on page 2

LAST LIGHT



Warm light glows from the shops at Salmon Falls Marketplace as late afternoon slips into a cold winter evening.

SFJ photo/Jeff Potter

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George and Robert

from front page

Although it was not uncommon for slaves to accompany their owners to the war, Robert initially went alone.

But as the fighting continued and circumstances grew more difficult, he wrote to his mother, Fannie, from a battlefield in Kentucky in a letter still held by the family.

"Ma, I would like to have George awhile this winter if he wants to come and you can conveniently spare him," wrote Robert. "The Negroes are all gone from the company nearby and I find it very hard to get my washing done. I have never tried it myself, but will have to try as I am."

George was informed of the request, decided to join Robert and remained by his side for about a year. Then came the Battle of Stone's River in late December of 1862 in Murfreesboro, Tennessee, just 20 miles from the Singleton farm. Stone's River was a major battle narrowly won by the Union Army at a high cost—thousands of casualties on both sides. As winter set in Confederate and Union armies drew defensive lines, ceased fighting and rested not far from each other.

Although President Abraham Lincoln had yet to sign the Emancipation Proclamation—the document that officially freed all slaves—Union Major General William S. Rosecrans freed all those in the nearby field land, including the Fairfield area.

That meant George was free to go or to stay. He stayed and on the day after the battle, noticed that Robert was missing from camp. George searched and found him seriously wounded, having been hit by a "mimo" ball, a primitive weapon made of half-inch lead whose impact almost always resulted in amputation of the affected limb.

Although he was captured, as a wounded prisoner of war Robert was allowed to go home to mend. George went ahead to the farm to inform Robert's family of his circumstances and returned to the encampment in a wagon with Robert's mother to find Robert and take him home.

"Without George, my great-grandfather may have died. I believe he saved his life," Chapman says. "He could have taken off—he was free—but he didn't. He went back to the farm."

Robert's father, a farmer and doctor, amputated Robert's leg above the knee. After he healed, Robert was reunited with his mother and offered himself to the Union army, and subsequently spent two years in a prison camp. George joined the Union army, as did many freed slaves. He served for two and a half years and attained the status of sergeant, the highest rank a black man could earn at the time.

'Uncolored cousins'

When at last the war ended, George chose to return to the plantation and the family he had been close to and share his federal pension with all Singletons, black and white.

"That's why these reunions aren't loaded with any bitterness or need to get things resolved," Chapman says. "We're not asking for forgiveness from the black folks; it's more like they're the reason I'm even here. We're so grateful. My great-grandfather wouldn't even be here if George hadn't gone looking for him, God bless him. There's a lot of mutual respect between these two families."

At the time George returned to the farm, it was the leanest period after the war. Robert's disability made it difficult to farm and most southern farms had been virtually stripped by Union forces. Living conditions were extremely difficult, and there was little food to be found. Many southerners were barely surviving and so the \$50 per month George shared was a huge sum at the time. He kept everyone alive, no matter what their past relationship, no matter their color.

George married a former slave named Barbara and the family lived and farmed on land given to them by the white Singletons. Robert married a local white woman, Sarah Scott, from the farm next door in 1877.

"There was no intermarriage, they just kept the family name," Chapman explains. "George could have chosen any name he wanted, but he kept the Singleton name, and so we're unofficial cousins, but that's how I think of them. In the South, the term 'cousin' is not a precise term; it's used kind of loosely."

Particularly poignant to remember in this incredible story of friendship over a century is that in Robert's letter, the letter surviving today, he did not demand George's services, he requested his company on the battlefield.

"If he wants to come," Robert wrote.

"And when he came he had to walk like the length of Tennessee to get to where Robert was," Chapman says. "It can't have been



Summoned to defend Robert Singleton in the Civil War "if he wants to come," George Singleton, then a slave, walked the length of Tennessee to get to the battlefield. "You can just tell this was not the usual relationship between white slave owners and slaves and that's why this is special," says Buckland resident Walt Chapman, Robert's great-grandson.

member who personally knew George and who remembered his own grandfather, Robert? Chapman says. "My Dad had a great memory and could really tell some stories."

"He gave us back some of our history because he remembered," Nelson says. "He remembered not only George, but Otis Kay, one of his daughters, who had been his name."

The next summer, while the younger Chapmans were visiting the homestead with the elder Chapman, "a bunch of Singletons just came over," Walt Chapman says. And the reunion grew from there.

"It's gotten bigger and bigger," Chapman says. "Sometimes there are in excess of 100 Singleton descendants camping on the property for the reunion."

Welcome to the family. Leonard died in January of 2006, but in the summer of 2002, Walt Chapman attended the family reunion, as did his niece, Danielle, a student at the University of Virginia, who is in line to inherit the farm.

At the reunion Danielle was informally adopted by George's descendants in a christening ceremony presided over by Elwood McMahon and his sister, Elsie, whose mother was a Singleton, in

the river next to the farm. "Elsie took Dani right into the river and gave her an old-fashioned baptism-style dunking to welcome her into the family," says Chapman. "It's a pretty friendly scene down there."

Elwood and his wife, Nanny, are the current caretakers of the homestead, and that, in a sense, brings the story full circle.

"That's the land his great-grandfather walked on, right there," Chapman says. "I think we've reconciled informally," Nelson says of the two-family friendship. "We've never discussed it, but mostly we know that although our ancestors were indeed slaves, they were not abused, they were respected. George was taught to read, and that was unusual."

Chapman points out not only was that unusual, but if George had been taught to read while he was still a slave, it was actually illegal at the time.

"You can just tell this was not the usual relationship between white slave owners and slaves and that's why this is special," Chapman says. "This is really about how they feel about it. Obviously I'm grateful, because otherwise, I wouldn't be here."

"History cannot be ignored, but it's not the issue," Davis says. "The Singletons, both black and white, were different. It was an issue of that time, but not of these people. Had it been an issue of these people, the bond that we have could never have nurtured itself."

"When I tell people about these reunions, they can't believe it," Davis says. "It's all family," says Virginia Ray contributed to this article.

Heath student at NASA

from front page

work as a mechanical engineer with alternative engines in automotive technology.

"I think that it is really important for engineering students to understand the field that they are entering," said Wodin-Schwartz. "This experience can be gained through many outlets including internships and co-op programs, but I like the idea of working on a real project to gather real world usable data."

She and her classmates designed the experiment that they will test under microgravity conditions while flying in a C-9. Their investigation, "The Effects of Variations in Gravity Upon Grit Contaminated Lubricated Joints," will study abrasion patterns and temperature changes under zero gravity and with comparison tests in earth's gravity.

The importance of the experiment lies in the team's understanding that metal joints may still wear down under microgravity contamination by particles in the very substances used to lubricate them. In their joint experiment they are creating a joint that will be in contact with grease tainted by diamond dust. In order to explore how contaminated joints cause joint failure, the team will record abrasion and temperature changes in the metal.

Wodin-Schwartz expects the final experiment apparatus, still in its early construction stages, to be four feet by three feet, including its motor. Their team has worked on the project since late summer. Applications and initial designs were sent in Oct. 2004, and applications received notice in Dec. Before heading to Houston the team needs to complete medical exams, paperwork, submit a test equipment data package that describes the project in detail to the reduced gravity office lead test director at the Johnson Space Center and ship their experiment to Houston.

In training. The process for application, the building of the experiment, and maybe a few excited, sleepless nights, lead up to landing at Johnson Space Center.

As students arrive on the Thursday of their flight week, they find themselves in a hangar, standing next to a Boeing 707.

"They show up, they think it's a field trip," said Donn Chapman, NASA's Johnson Space Center university affairs officer. "Then they find themselves talking to astronauts, field test engineers, flight surgeons and safety engineers."

The program is realistic and rigorous in its expectations of the students.

"We don't give you an incomplete," said Siskore. "Once students report in they go through a safety orientation, set up a table to run their experiment, give the project final tweaks, and



Delivered. Sarah Wodin-Schwartz, a Smith College student from Heath, will study grit-contaminated lubricated joints under microgravity conditions at NASA's Johnson Space Center in Houston.

field questions from the engineers who will be flying with them. In a classroom setting students learn about hypoxia and take a "chamber ride," said Siskore. In the hypobaric chamber the oxygen flow is reduced to what the air would be like on a mountain at 20,000 feet.

If all goes well, following a formal, final review in which their experiment's test readiness is reviewed by the pilots, field engineer, safety engineer, flight surgeon and test directors, students load up their experiments. Each team flies in pairs, one on Tuesday and one on Wednesday, which allows them to adjust their experiment if necessary after the first day's trial.

"Feet down, coming out." This is the literal heads up for students aboard the C-9 to put their feet back toward the floor as their pilot pulls out of the bottom of the parabolic flight maneuver which creates a state of weightlessness inside the aircraft.

The crew of the C-9 enters designated airspace over the Gulf of Mexico at 25,000 feet and 350 knots. The pilot begins a very steep ascent to 35,000 feet, climb two miles in 30 seconds. The plane slows to 220 knots at the top and the pilot begins to dip its nose. The crew begins entering a period of microgravity - when the plane and its contents are traveling at the same rate of descent and appear to be floating - which lasts approximately 25 seconds. The parabolas themselves last one minute. The pilot takes the C-9 and crew through about 32 parabolas during its airtime.

Despite a squeamishness that may be experienced at the thought of this kind of maneuvering, Siskore described it as "an incredibly

gentle process." "Students feel the Gs coming off, getting lighter, lighter and lighter, and they feel as though they're weightless, and then they're weightless," he said.

More than an experiment. The eight-year-old program is the brainchild of Bob Naughton, chief of Johnson Space Center's Ellington Field, and George Abbey, former center director.

"He [Abbey] was worried about where his flock of engineers would be coming from," said Siskore. After Abbey encountered a student program through the European Space Agency, he knew he had a solution.

"They'll have an amazing experience taking into account microgravity," said Siskore. "What the students find out is more than science experiments." After courses in analysis, research and statistics, students are able to apply information learned in the classroom and solve a real problem.

"It's project management," Siskore said.

Every year there is space for 50 students in Microgravity University's Reduced Gravity Student Flight Opportunities Program. This year's docket includes student teams from across the country, including another Smith team and those from the Massachusetts Institute of Technology and Purdue University.

Wodin-Schwartz's team's flight was originally scheduled for spring break, she said, but moved to July because NASA needed the aircraft for astronaut training.

Costs. NASA covers the costs - \$8,500 per flight hour - of the plane, crew, flights, expenses for student experiments and candidates' physiological training.

"We invest \$7,000 \$8,000 per team," said Siskore. "The rest of the cost - for medical exams, tools, equipment, travel and expenses for the 10-day stay in Houston and shipping - is the responsibility of the teams. Wodin-Schwartz and her teammates obtained more than 25 grants for their expenses."

Many students use the experience as college credit or as their senior project. Wodin-Schwartz and her colleagues are hoping to create their own special studies as a technical elective around the project.

After their flight Wodin-Schwartz and team members make presentations to local schools, create an educational Web site and offer events for local youth groups.

When not working on engineering projects, Wodin-Schwartz is likely to be found paddling her kayak, working at Zoar Outdoor, or scaling an outrageous outcropping of rock.

A kiss is but a kiss

... except when it's used in art to raise money for charity.

Sandra Bertrand assists Eric Lucecentini with the application of lipstick for his contribution to "Kissing by Numbers," Junice Sorensen's art project designed to raise money for the tsunami relief effort and benefit local food pantries. "I'm amazed by people's willingness to help," said Sorensen, a Backland artist and co-owner of Stone's Throw Gallery on Deerfield Avenue. "It's what I love about being in this town. I don't know if we're just in an amazing pocket here in Shelburne. I think we are. There is such a density of good people."



ST photo/Emily Schwaner

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Monday, August 2, 2004

Weightless Wildcats

UK engineering students fly with NASA to perform tests



Mail this page

By Larry Muhammad

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The Courier-Journal

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It's a modified turbojet called the KC-135A that's used in aerospace experiments and that simulated microgravity for the 1995 movie "Apollo 13."

Commonly known as the "Vomit Comet," it flies parabolic arcs that make some passengers lose their lunch while floating weightless in the cabin.

Last week, a team of University of Kentucky student researchers visited the Johnson Space Center in Houston to take a ride.



PHOTO COURTESY OF NASA
UK team members Britton Wainscott, left, and David Jones experienced weightlessness aboard the KC-135A along with NASA's Donn Sickorez.

"It's pretty crazy, kind of difficult to describe," said Ben Morgan, a UK mechanical engineering senior who traveled to Houston and who also rode the plane while doing research last year.

"It's the same sensation as a roller coaster — like you experience different gravities when you're coming out of your seat — but it's magnified. You just float around," he said.

"They quoted a percentage of people who get sick, something like 30 percent, but you don't see that on the video, of course. Last year four of us flew, two got sick, and I was one of the lucky ones who didn't."

The six-member UK group is called the Weightless Wildcats. They're all mechanical engineering majors at the Paducah extension campus, and they're one of 72 teams chosen this year for NASA's Reduced Gravity Student Flight Opportunities Program; 117 had applied.

The program provides undergraduates the opportunity to perform microgravity experiments of their own design under the auspices of the National Aeronautics and Space Administration. The UK experiment is testing how a lack of gravity affects the contour of a precipitation radar screen — research that helps improve weather forecasts.

"Basically, what we're looking at, if you hold a piece of fabric, it wants to sag in the middle," said David Jones, a UK junior and the team leader. "In zero gravity, what it wants to do is ripple under its own weight. So what NASA is trying to do is eliminate those ripples in the surface contour, and they've done computer simulations on the radar shield that take the



gravity out.

"Our experiment will take data in zero gravity, on the KC-135A, to validate those computer models."

In addition to Jones and Morgan, the other Weightless Wildcats are senior Adam Cook, juniors Britton Wainscott and Chris Thompson, and Justin Hastie, a recent graduate who was a senior when the project began earlier this year.

Their home base, the Paducah campus of UK's School of Engineering, once raised political hackles and sparked debate among educators who questioned the need for an extension campus in Western Kentucky, before it opened in 1997.

Now the school is located in a 53,000-square-foot facility and is a cooperative program taught by professors from West Kentucky Community and Technical College, Murray State University and UK. It has graduated 61 mechanical and chemical engineering students since 2000.

"The NASA research shows that students from this region of Kentucky can compete with students from anywhere in the country, that they're as good as the best from MIT, Cal Tech, University of Texas and Purdue," said Jack Leifer, assistant professor of mechanical engineering and faculty adviser to the Weightless Wildcats.

"Most of the students we serve would not have majored in engineering without this campus, because they were not in a financial position to leave home or were nontraditional students."

And because of the skills they learn participating in the reduced-gravity program, Leifer said, one of them, Chris Meyer, was selected to work at the Langley Research Center in Hampton, Va., on an in-space diagnostic measurement system for a solar prototype that NASA hopes to demonstrate.

Team member Morgan is doing a summer internship at Langley and won a National Science Foundation Graduate Fellowship, Leifer said.

"So I'm just very pleased and thrilled, and very proud of all these students."

University of Kentucky students have participated in NASA programs for seven years, and this is the second year a Paducah team has worked on the radar screen in the Reduced Gravity Student Flight Opportunities Program.

Any U.S. citizens taking undergraduate college courses full time who can pass a Federal Aviation Administration medical exam are eligible, and they needn't be engineering majors.

Teams consist of four members and a faculty supervisor, with an alternate member and a ground-crew member optional.

Applicant groups submit original proposals for microgravity experiments they intend to perform, and NASA program officials score them on technical merit, safety and outreach.

Top scorers go to the Johnson Space Center in Houston to perform their in-flight experiments aboard the KC-135A.

Leifer, who has worked several summers in the NASA Faculty Fellowship Program in Langley, said the UK student project "is an offshoot of work they're doing in Langley, in all sorts of ultra-lightweight and inflatable structures, like solar sails. ... I wanted a student experiment to use some of the techniques that I learned, on a project small enough to set on the KC-135."

And findings of the Weightless Wildcat research will be used at the Jet Propulsion Laboratory in California, said Bernardo Lopez, a research engineer there. "The new antennae for mapping weather is ultra-lightweight and can furl for easier transport, then roll out like a window shade and be in the correct shape," he said.

"The work that the UK students are doing is in support of a production of new antennae for space. It will mean enhanced, more accurate weather prediction."

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Dear Program Administrators + Staff,

I cannot begin to convey how much fun I had down in Houston for those two weeks. It was an experience I'll never forget. The whole week was sooo much fun! You guys were more friendly and exciting than I thought you were going to be (I thought it was gonna be drab, but everyone was cracking jokes). I've never been down there before and it was so cool. The tours were amazing (esp. Mission control). The chamber testing was sooo cool and interesting. I learned a lot that day. And what can I say about the Flight Day!?! Jeez. That was a total dream come true! It wasn't a goal I set, it was a dream that I thought would NEVER happen and you guys made it come true for me at age 21! wow am I blessed. You put so many smiles on people's faces in the past, present, and will continue to do so in the future. You all should feel so proud that you help make so many people have awesome memories. My parents are so thrilled and I'll be able to tell my kids that I did something not a lot of kids or adults get to do... be weightless. The whole week was a blast and I couldn't have asked for anything else... well maybe the little throw up I had could've been wised away... but seriously it was great. on behalf of my team I want to say thanks so much for giving us this opportunity to reach our dreams!!

Sincerely,

Matt Hughes and

Team Tenacious Terps

from University of Maryland,
College Park.



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our team is not responsible for the grammatical errors found in this article.

Students collaborate with NASA



Students experience zero-gravity in a KC-135A research plane.

MATT DOMINICK

By Jen Rasmussen
NEWS EDITOR

Six USD students spent their weekend at 36,000 feet over the Gulf of Mexico. Matt Dominick, Emily Perttu, Doug Sangillo, Tom Spellmire, Andre Watson and Adriana Zammit developed a microgravity research project and proposed it to NASA. Their experiment tested how weightlessness affects the separation of particles. They developed this experiment based on the observation that Brazil nuts always end up at the top of a can of mixed nuts. "It

Our test equipment passed NASA standards and worked like we had planned," said Dominick.

The team will publish a report of their findings, which will be submitted to NASA. "This has a practical application in controlling mixtures in food processing, pharmaceutical drug preparation and mineral purification and separation," said Perttu. The team also plans to speak at San Diego area high schools to encourage students to study engineering and science.