

**I**t is now 2002 and we have a human outpost in space with permanent international presence, where micro gravity research is well under way.

The International Space Station is a bright new star darting overhead every 90 minutes, making its rounds over 95 percent of the Earth's population, and it is a beacon of something new. Human space flight has been transformed through ISS, and evolved into cooperative endeavors of world nations, businesses and academic institutions. There is great hope ahead, and many countries are betting on the returns from operating and using this incredible new station in Earth orbit.

The year 2001 has been both tough and tremendous: Tough because of the criticism NASA has received about cost management of the Program; tremendous because of the 20 space flights that were executed safely and extraordinarily well in the last 18 months.

The international technical teams have performed spectacularly, and continue working side-by-side to triumph over obstacles encountered large and small, while doing things never done before.

As we move into the future we will be challenged to keep the financial aspects of the Program on par with our technical performance. The budget situation on the NASA side of the house presents us with an interesting and difficult challenge. We need a path through this wilderness and we are forced to consider a broader set of issues beyond the Program management's reach, such as NASA-wide reorganization, research prioritization and guidelines for commercialization, to name a few.

The future of ISS will also depend on the things we can do:

- ◆ Safety first always – safety for the crew, safety for ground teams and safety for the hardware
- ◆ Maintain technical excellence
- ◆ Adhere to schedules
- ◆ Proactive and positive response for improving cost management and improving management information systems
- ◆ Keep our core values front and center: Safety, commitment, integrity, trust, respect for people and technical excellence

We've been directed to implement a set of recommendations per the ISS Management and Cost Evaluation (IMCE) Task Force Report issued November 2001. There is much work to be done to resolve the differences between the "U.S. core complete" baseline (defined by the Office of Management and Budget and NASA, and confirmed by IMCE) as the program baseline – with three-person crew, minus the Habitation Module and Crew Rescue Vehicle – and the Program baseline approved by the ISS partnership.

These challenges will need to be overcome as we continue our "climb up the mountain," building and operating the ISS.

## The amazing year (and a half) of space flight

The July 12, 2000, Service Module launch set in motion an unprecedented succession of space flights – nine U.S. and 11 Russian.

In the year and a half before the Service Module launch, four missions went to ISS. A total of 24 flights (12 U.S./12 Russian) gave us the 300,000 pounds of micro gravity facility we have today, with nearly 15,000 cubic feet of living and working space, and our fourth Expedition in progress.

We've added 19kw of power with the P6 solar array on STS-97, quintupled on board computing and activated a fully functioning laboratory delivered on STS-98 in February 2001. All major systems are functioning nominally.

On ISS flight 6A, STS-100 in April 2001, we added state-of-the-art robotics system by deploying Canadarm2. We also installed an American joint airlock Quest in August 2001 and a Russian docking compartment called Pirs in September 2001, enhancing an aggressive schedule of spacewalking activity.

We have deployed 12 major elements on orbit: Zarya, Zvezda, Unity, 3 PMAs, Z-1, P6, Destiny, CanadaArm2, Quest and Pirs. The Station has a Soyuz lifeboat, reusable moving vans (MPLMs) and refuel/resupply (Progress) services.

We've logged 50,000 hours of U.S. payload run-time since STS-106 (September 2000). We have been experimenting in both U.S. and Russian segments and Expeditions have been averaging about 19 hours a week since April 2001. Our fourth Expedition crew arrived in December 2001 and is just beginning their increment, which will include work on 25 scientific payloads. Its been characterized as "the most diverse, most complex research program of any Expedition so far."

Amazing also describes the work done by ISS technical teams on the ground and on orbit to overcome challenges of all sizes – from delivering a series of extremely complex elements, to managing and executing the most intricate space operations in history, to recovering from multiple main computer failures. From learning how to deploy and fix the largest solar array, to re-programming robotic joints, to managing traffic jams.

Enormous effort has been expended to keep every aspect of ISS flight and operations "in a box" and moving at a safe pace. Review teams agree that the technical integration and engineering achievements building and operating the ISS have been "extraordinary." And that's because extraordinary people, in every sector of this Program, have done their job superbly.

## The challenges of Phase 3: What's ahead for ISS

Phase 3 assembly and operations of ISS focuses on expanding and powering up the station toward its permanent configuration. We have an executable plan for 2002 and 2003, where we will expand the ISS structure, add more power and enable international support capability.

All of the U.S. hardware for the next two years is completing processing and will soon be ready to go. Japan and Europe continue to work on their laboratories, "Kibo" and "Columbus," to prepare for arrival on orbit in 2004 or early 2005.

Enhanced utilization and research is also a major goal for Phase 3. During this increment, we'll take up two more research racks, bringing the total to seven racks on orbit, and install additional scientific equipment.

The IMCE confirms NASA's near-term goal for ISS as "U.S. core complete." The report further suggests that, when the Program/NASA shows adequate acknowledgment and correction for deficiencies identified in management structure, institutional culture and cost estimating within the next two years, there are opportunities to pursue a path to an "end state" with enhanced capabilities.

Our partners have pointed out that "U.S. core complete" is not defined in ISS international agreements, and that their expectation is to have enough crew time on orbit to perform research planned in the multiple labs. The IMCE does not consider it within its scope to recommend how to bridge the gap between what the United States has promised and what the partners expect.

Fulfilling the commitments NASA has made to ISS partners will require support and leadership beyond Program boundaries. We have embarked up this mountain together – to build a bridge for the future and leverage investments in science and people that are expected to yield considerable benefit for the future. We will continue to rely on our "due processes" to keep every aspect of building and operating the ISS moving in a positive direction.

The overall research budget has been reduced 40 percent from the original plan, requiring reorganization and a reprioritization of resources and research goals. This will not be an easy or happy task. We are not relieved of our requirements and obligation to the nation and our partners to perform world-class research in our micro gravity facility.

The Program has already begun rigorous responses to the IMCE recommendations. You will be hearing more details as they develop. We are putting plans in place to improve our processes and management information performance. Success will require the same level of dedication and commitment that resulted in the amazing year and a half of space flight.

## The long-term future

We are living in a changing world and human space flight is changing along with it. When the Apollo Program brought back images of what the Earth looks like from space in the 1970s, it had an impact on the way we perceived life on our planet. We are still learning from that experience.

Images from the ISS returned since the beginning of the 21st Century show American and Russian commanders routinely handing off control of a one-of-a-kind space research facility, while an international team of space flight experts hardly miss a beat preparing for the next steps.

I remember the Synthesis Report in 1991 entitled "America On the Threshold." Synthesis Group Chairman Thomas Stafford, in his opening remarks, recalled the great Chinese fleets of the 15th Century that set out to explore the world's oceans beyond where man had ventured before.

A change of policy during the Ming Dynasty arrested the movement and the "great fleets" were burned, just as a new set of explorers from Portugal began venturing out. The lead exploration role soon fell to Spain, and then Britain.

His point was: "Nations lose their leadership position when they give up the role of exploration...and the question is which path to take with regards to the oceans of the 21st Century."

## The future is a wide-open door

The ISS Program is not just American. NASA is leading in an effort that is international and every bit as important to Russia, Europe, Canada and Japan as it is to the United States. We may even see "Taikonauts" (Chinese word for Astronaut/Cosmonaut) in Earth orbit sometime in the future.

I believe we will one day conquer the space 240 miles above our head, and we will move back to the Moon 240,000 miles away and onward to Mars, more than 48 million miles further – and beyond.

You've heard me say before that building the International Space Station is like climbing a mountain. Well, we are deep within the mountain range and we've just climbed the steepest peak so far. But the cold wind is in our face, we have to find a place to regroup and get back our view of the summit.

We're on to the challenge around the next bend. It will take patience, innovation and endurance but I'm confident we'll get there. See you on top! ❖

# Space Shuttle: Flights to set records

By James Hartsfield

**F**resh on the heels of making space history in 2001 by completing the first phase of International Space Station (ISS) assembly in orbit, the Space Shuttle will continue a string of space firsts during six missions in 2002.

"In the past 12 months, we've completed some of the most challenging space flights in history," Space Shuttle Program Manager Ron Dittemore said. "In the next year those challenges will continue with missions just as complex. The team continues to excel safely and successfully, and 2002 promises to be just as rewarding as the past year."

The coming year will be marked by the shuttle fleet matriarch *Columbia's* return to space on the first non-station shuttle flight in more than two years. Flights by *Atlantis* and *Endeavour* will begin the expansion of the ISS. *Discovery* will remain on the ground in 2002 for standard maintenance and inspections.

"We have simultaneously been planning, training and flying the most complex shuttle missions we have ever done, and the results have been truly awe-inspiring," Chief Flight Director Milt Heflin said. "The team has tremendous reason to be proud of its accomplishments, but not much time to bask in them because the year ahead holds more of the same. But it is exactly that challenge on which I think Mission Control, the planners, the trainers, the crews and the entire team thrive. These kinds of missions are why they work here."

During 2002, shuttles will add more than 50 tons of additional components to the station. They also will service the Hubble Space Telescope and conduct an extended research mission. NASA will break a record set only last year for the most space walks ever conducted in a single year.

"Space walks will never become routine, but we have entered an era of space exploration now where they will continue to become more common," Heflin said. "But no matter how many or how often crews leave their spacecraft, each EVA remains just as exciting to prepare and conduct and just as rewarding to complete."

From space shuttles alone, 15 space walks are planned this year. Coupled with seven space walks that are planned by crews from the ISS, the record for annual space walks will be shattered.

In 2001, 18 space walks were conducted – 12 from the shuttle and six from the station – the most by far of any year to date. This year also will see the shuttle carry more than three dozen new experiments to the station and two new laboratory experiment racks. ❖



## Here's a look at this year's scheduled missions:

### February

*Columbia* will start out the new year's shuttle missions with a flight to the Hubble Space Telescope on STS-109, the fourth mission to service the space telescope since its launch in 1990. Five space walks will be conducted during the flight to install an advanced new camera system, attempt to reactivate an existing infrared instrument system, install new solar arrays and install a new power controller. The mission will extend the lifetime and capabilities of the now-famous orbiting telescope.

"*Columbia's* flight to service Hubble, as we continue to oversee station operations, signals a return for us this year to conducting two distinct activities in space, completely independent of one another," Heflin added. "That's something we haven't done in awhile, and it adds yet another element of complexity to the year ahead."

When *Columbia* launches, it also will become only the second shuttle ever to fly with a new "glass cockpit," which was installed as part of maintenance and modifications completed in 2001. *Atlantis* was the first shuttle orbiter to debut the new cockpit in May 2000 on mission STS-101.

The new cockpit has 11 full-color, flat-panel displays that replace 32 gauges and electromechanical instruments and four cathode-ray tube monitors in the old cockpit. The new cockpit is lighter, uses less power and sets the stage for a future "smart cockpit" for the shuttle that is now in development – a cockpit that will feature new, more intuitive displays to reduce pilots' workloads during critical periods.

### April

*Atlantis* will lift off on STS-110 to begin the shuttle fleet's expansion of the station, delivering the first of three giant truss segments to be launched this year. The truss will form the central segment of what will eventually become a more than 300-foot cross-beam for the station to support future solar arrays, radiators and external experiments.

*Atlantis* also will carry the first part, called the mobile transporter, of a system that will provide a mobile base for the station's robotic arm to allow it to move up and down the eventual football-field-long truss. Four space walks will be conducted from *Atlantis* to install the new station components in one of the most complex station flights of the year.

### May

*Endeavour* is scheduled to launch on STS-111 to carry a fifth crew to the station, as well as the Leonardo logistics module filled with experiments and supplies. *Endeavour* also will deliver the mobile base system to the station, the second part of the mobile platform for the station's innovative Canadarm2 robotic arm. Two space walks will be conducted while *Endeavour* is at the station to hook up the arm's base and perform other assembly tasks.

### June

*Columbia* will fly again on STS-107, an international mission dedicated to micro gravity science that will carry a double Spacehab module filled with 32 experiments involving 59 separate investigations. A suite of eight additional investigations in *Columbia's* payload bay, together called FREESTAR, will include studies ranging from fluid physics to a student satellite. The mission's scientific work will involve the fields of materials science, combustion, fundamental physics and biology. The mission will be an extended flight with a duration of 16 days.

### August

Expansion of the ISS will resume as *Atlantis* makes its second visit of the year to the complex, carrying the first starboard side truss segment. The new segment will be attached to the end of the central segment delivered in March. The connections will be finalized during two space walks.

### September

The final mission of 2002 will see *Endeavour* visit the station again, attaching a port side truss segment to the station, completing almost half the length of the final truss. *Endeavour* also will deliver a sixth crew to the station. Two space walks will be performed to connect the new truss segment, and the truss will measure about 133 feet long by the end of the year.

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**Roundup**

# Profiles

## Sue Leibert



### carried the Olympic torch

By Beth Nischik

JSC's Sue Leibert could easily describe her recent experience in two words: **Just awesome.**

On Dec. 10 at 3:01 p.m., Leibert, who works in Human Resources, participated in the 2002 Salt Lake Olympic Torch relay.

Her experience, while unique to most, will be shared with more than 11,500 torchbearers and 4,500 other support runners along the torch's path.

The torch began its journey through Houston on a 30-mile loop that began with Olympian Laura Wilkinson at 1 p.m. in Downtown Houston and ended with a

final run from Olympian Mary Lou Retton at 8 p.m. at The George R. Brown Convention Center.

For three minutes, Leibert was a part of Olympic history. While she was running with the torch, Leibert said all she could think of was, "Wow, this is really happening!" The torch was heavy at first, but as she was running, "the torch felt light as a

feather," she said. "We were welcomed to run at any pace, there were people in wheelchairs and runners, a range of paces and people."

Leibert's best friends, Jeff and Diane DeTroye nominated her through a contest sponsored by Chevrolet. Nominees were selected not by athletic ability, but for their fire within.

Leibert had no idea she was considered, let alone selected, for the honor. She was notified via a FedEx package from Chevy after returning from vacation. As she read through the material, she at first thought it was a joke. However, the many legal forms and thorough logistics told her it was legitimate.

Even after learning she was selected, she was still clueless about one important aspect: "I had no idea who nominated me, until I got an e-mail note from my friends."

The theme for the contest was inspiration and illumination. Diane DeTroye said she and her husband nominated Leibert because her extensive community involvement is indeed inspirational to them and others.

"Needless to say, we were thrilled when she was selected," DeTroye said.

Leibert is involved with the Bay Area Turning Point, and served on the board of Trustees. She taught English as a second language through the United Way and the Harris County Library for about five years.

She started at NASA in 1984 and, within 17 years, has been involved in a number of organizations and numerous achievements. Leibert was selected as Federal Employee of the Year in 1998 by her managers in HR, and she received the NASA Certificate of Commendation.

With her family and friends present on that December day, Leibert successfully completed her torch run, and then went on to celebrate. "I think I had more pictures of me that day than I had in my entire life!" she said.

The Olympic Torch Relay has been a tradition since 1952 when it was adopted from an idea proposed by a chairman of the 1936 Berlin Games. Symbolizing spirit, knowledge and life, this event delivers the Olympic Flame from Greece to the host country.

The Flame of the 2002 Winter Games was lit November 19, 2001, in Olympia, Greece. It traveled to Athens before arriving in Atlanta, Ga. – the previous U.S. city to host the Olympic Games. Now, it's headed to Salt Lake City, Utah.

What was it like for Leibert to have this honor? "It was one of the best experiences of my life." ❖



## Don Bogard

### honored for his work with 'poor man's space probes'

By Aaron Wyatt

Don Bogard never underestimates the importance of meteorites. "Meteorites have been called the 'poor man's space probes' because we don't have to travel into space to get them," he said.

"We have learned a great deal about the origin and evolution of our solar system from their study, and there is a great deal more to be learned."

The JSC scientist's dedication to studying meteorites has earned him a prestigious honor. Bogard will be the 2002 recipient of the Meteoritical Society's Leonard Medal for his outstanding contributions to the field of meteoritics. The Leonard Medal is the society's highest honor.

According to the nomination, Bogard will receive the medal for "his distinguished contributions to noble gas geochemistry and the chronology of the solar system."

The award was established in 1962 in memory of the first president of the society, Professor Frederick C. Leonard, with the purpose of encouraging original research in the broad field of meteoritics. Bogard will receive his award at the society's annual meeting next July in Los Angeles.

Society member Ed Scott said Bogard is best known for dating meteorites and lunar samples. "His work provides the definitive proof that a rare group of meteorites came from Mars," Scott said.

#### Don Bogard

##### Place of birth:

Washington County, Arkansas ("That's in the Ozarks")

##### Time at JSC:

1968-present

##### Organization:

Planetary Sciences, Earth Science and Solar System Exploration Division (SN), JSC

##### Position Title:

Senior Scientist, Planetary Materials (Planetary Studies)

##### Education:

- B.S., chemistry, University of Arkansas, 1962
- M.S. radiochemistry, University of Arkansas, 1964
- Ph.D., nuclear geochemistry, University of Arkansas, 1966
- Post-doctoral fellow, Department Geological & Planetary Sciences, California Institute of Technology, 1966-68

##### Hobbies:

Gardening and old railroads

Bogard has been employed at JSC for 33 years and currently works in Planetary Sciences, Earth Science and Solar System Exploration Division (SN). In 1982, he performed the research that demonstrated certain meteorites derived from Mars.

Bogard also participated in the construction of the Gas Analysis Laboratory in the JSC Lunar Receiving Laboratory and served as a member of the Preliminary Examination Team for Apollo returned lunar materials.

He served as a member of NASA's Mars Sample Handling and Requirements panel in 1997 and 1998, as well as NASA's Solar System Exploration Subcommittee from 1995 to 1999.

Currently, Bogard is conducting a research program at JSC involving noble gas isotopic measurements on planetary materials. Scientific objectives of the research include the establishment of chronologies and thermal histories for the moon and asteroidal parent bodies of meteorites, and investigation of the composition and origin of volatile components in the solar system.

Members of the society choose the Leonard Medal recipients. Bogard said the most meaningful awards are those given by peers because they can be quick to criticize.

"When you give a science talk and say something dumb, they'll let you know," he said. ❖

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