

# Glitch-free

Boeing continually improves software that is the 'central nervous system' of the International Space Station. By Ed Memi

Upgrading personal computers with new software often introduces glitches that we learn to accept and work through. On the International Space Station, however, software glitches are not an option. As they live and work some 220 miles (350 kilometers) above the Earth, astronauts entrust their lives to the software that keeps station systems functioning.

Software engineers at Boeing Space Exploration wrote, tested and recently updated the space station's Command and Control Software (CCS), which allows new spacecraft and modules to be attached to the station. The software update, with about 730,000 lines of code, was loaded in August and is the eighth major software update since 1998.

Serving as the brains of all the other space station software, the software is necessary for each mission to:

- Control the operation of the on-orbit vehicle portion of the station, as well as audio and video equipment.
- Manage data communication between the spacecraft and the ground, crew and external vehicles and the distribution of the data between functional areas of the ISS.
- Provide added capability for current and future vehicle dockings such as the Japanese H-II Transfer Vehicle, an unmanned supply spacecraft used for ferrying supplies to the ISS.

"All of the space station's interaction with mission control, ground facilities and other space station systems comes through our computers," said Cary Cheatham, Boeing manager of the CCS development team. "The system monitors any and all events that pose a safety issue for the space station. It automatically initiates valve closing and isolation maneuvers, and it monitors data

from all the other ISS computers to decide what actions to take."

Dale Kohn, Boeing hardware and software integration manager, said the update "has gone seamlessly. We have done it before with earlier versions, but this is the very first time that we have done an update with the international partner elements attached."

"It is always amazing to see a CCS software transition go so smoothly since the software must interface with both the U.S. and international elements," said Boeing CCS software implementation lead Joy Millican.

Boeing has a long-term schedule of updates for the CCS, which includes software release updates about every two years beginning in 2012. ■

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**PHOTO:** Command and Control System (CCS) software developer Jason Anderson sets up equipment for a software test at Johnson Space Center in Houston while Boeing CCS manager Cary Cheatham looks on. ELIZABETH MORRELL/BOEING

**Software developers and operators train** for each space station mission at NASA's International Space Station Software Development and Integration Laboratory in Houston, where engineers can test the software in an environment similar to that on orbit. In preparation for the recent software upload, Boeing software engineers created an identical system in the integration lab to mimic the configuration on orbit. Boeing had a team of experts in the lab and in NASA's Mission Evaluation Room on Sept. 10 to monitor the software when the Japanese H-II Transfer Vehicle docked to the space station for the first time.

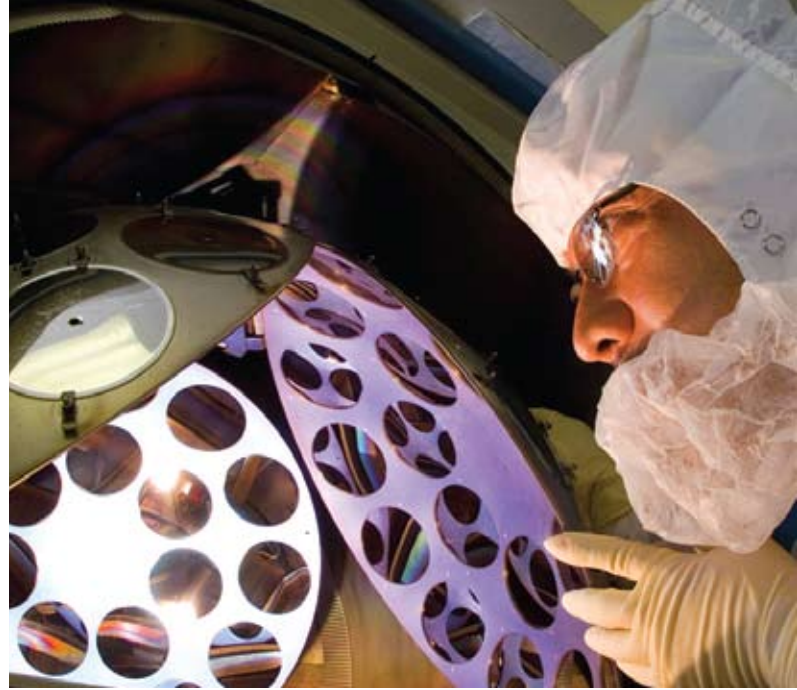
# Sunny today with record highs

**R**ecords are made to be broken—even at the cellular level. Spectrolab, a wholly owned Boeing subsidiary that has been producing solar cells for the space industry since 1956, recently announced that it has set a record for terrestrial concentrator solar cell efficiency.

The National Renewable Energy Lab in Golden, Colo., verified that an Earth-based solar cell by Spectrolab of Sylmar, Calif., converts 41.6 percent of concentrated sunlight into energy. The previous 41.1 percent record was held by Germany's Fraunhofer Institute.

Solar cells in concentrator systems are smaller and use a lens or mirror system to amplify sunlight, so fewer cells are required to produce the same electrical output as conventional solar cells. Though still a prototype, Spectrolab's cell could help energy producers generate more electrical power from typical industrial solar panels. And that would mean lower costs to homeowners and businesses.

— Dave Garlick



**PHOTO:** Wafer-processing technician German Rivera inspects a semiconductor wafer that will yield numerous solar cells used to generate power for telecommunications satellites and spacecraft such as the Spirit and Opportunity rovers currently exploring Mars. BOB FERGUSON/BOEING

# Choose well

Annual enrollment for health and insurance benefits begins Nov. 10 for most Boeing employees and retirees. The company provides a variety of benefits, programs and resources designed to promote healthy lifestyles and help employees make informed decisions. This enrollment opportunity allows individuals to examine plan offerings and choose benefits that contribute to their well-being.

In most cases, current benefit elections will continue automatically into next year. But the costs of certain benefit features may be changing. "That, coupled with employees' own changing needs and goals," said Rick Stephens, senior vice president, Human Resources and Administration, "makes this a good time for employees to re-evaluate health and insurance plan choices and choose the plans that are right for them."

Benefits Updates and Enrollment packets have been mailed.

Employees wishing to make changes to existing benefits or enroll in a flexible spending account must do so by 11:59 p.m. Dec. 3. After that, benefit changes cannot be made until next year's enrollment period unless there is an event like marriage, establishment of a certified domestic partnership, or birth or adoption.

"Enrolling is just the first step in making smart choices about benefits," Stephens said. "It's as important to use those benefits wisely throughout the year to improve your health and well-being. In the end, that also helps control benefits costs for everyone."

— Ron Taylor



2009 FALL ENROLLMENT  
Benefits Information



Time to  
choose  
well.

**Alyssa D.H.**  
10 years at Boeing  
Expecting her third son  
Alyssa and her family  
health benefit options,  
including dental, vision,  
flexible spending accounts

Enroll for 2010 health and insurance benefits November 10–December 3.

- ✓ **Review** the contents of your enrollment packet.
- ✓ **Explore** your Benefits Resources to help you make informed decisions.
- ✓ **Enroll** or make changes by the December 3, 2009, deadline.
- ✓ **Check** your confirmation statement.

Well Being  
Choose well. Live well.

**GRAPHIC:** Individuals eligible for fall health benefits enrollment have been mailed enrollment guides like this. BOEING