Launching a new star

Unity node ready to launch

By James Hartsfield

Launching aboard *Endeavour* in December, the six-sided Unity connecting module, the first U.S.-built space station component, will lay a foundation for all future U.S. International Space Station modules in orbit, just as it has already done on the ground.

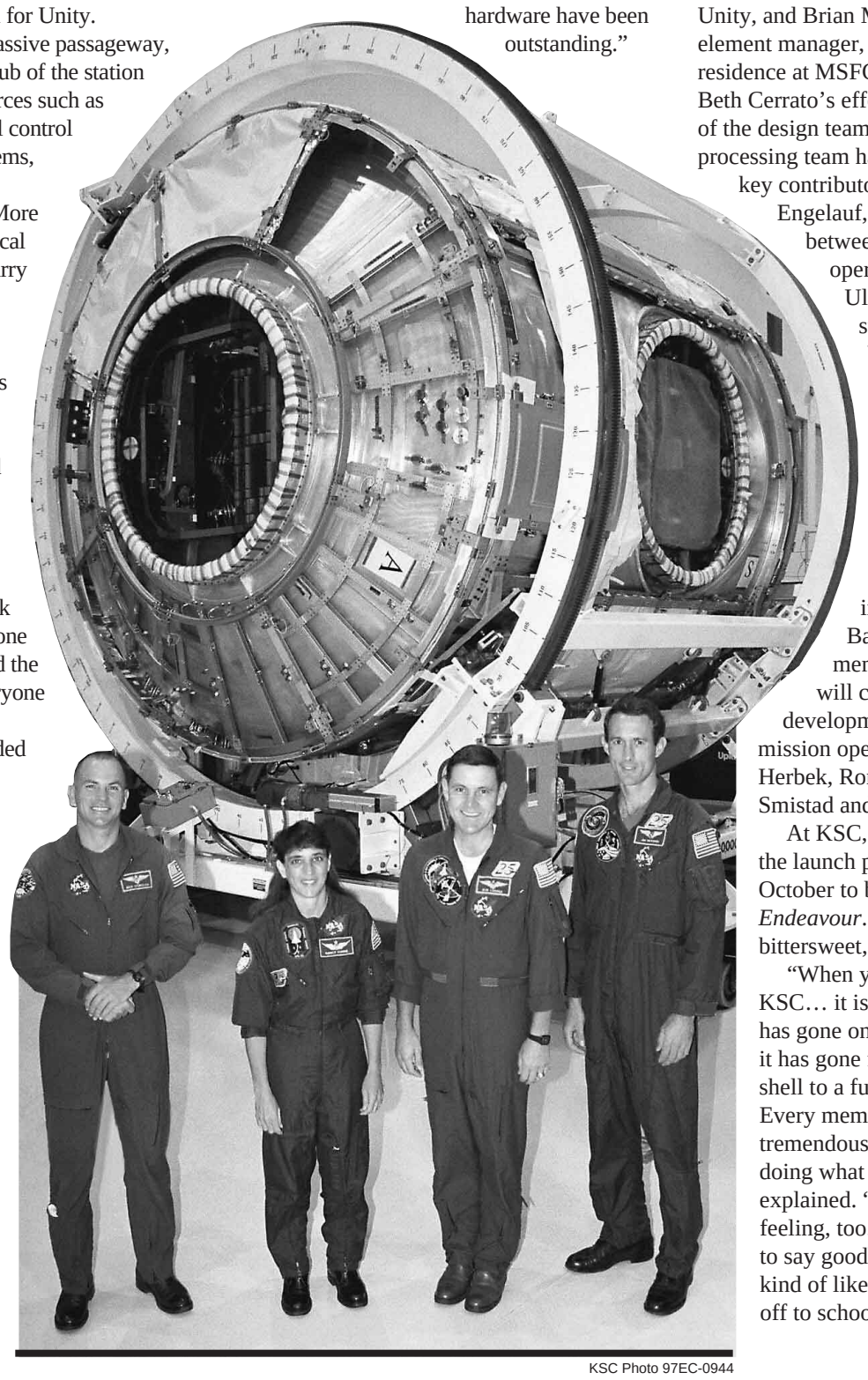
"The biggest challenge we've had is in being the first," explained Bill Bastedo, who has overseen much of Unity's construction as the launch package manager for the last two and half years at JSC. "We've had to handle all the processes first. In many cases, we've had to invent the processes needed to build it and the processes to deal with those who'll launch and operate it. We also made all the mistakes you would expect when you're doing things for the first time."

Construction of Unity began in the fall of 1994 at a manufacturing facility at the Marshall Space Flight Center. In June 1997, it was shipped from Marshall to Kennedy Space Center for final assembly and launch preparations. Simultaneously, two conical mating adapters that are attached to Unity for launch were built in Huntington Beach, Calif. Unity has six berthing ports, one on each side, to which future modules will attach. With the two mating adapters attached, it weighs about 25,350 pounds and measures 36 feet in length and 15 feet in diameter.

"In 1996, it was tough just to coordinate our team meetings – we had people spread out in four time zones: at Kennedy, Marshall, Houston and Huntington Beach," Bastedo said. "And we had four different cultures and sets of work control systems to integrate." Bastedo and about 10 other engineers in the station program's mission integration and vehicle office work on the launch package team for Unity.

Although it is a passive passageway, Unity is a complex hub of the station through which resources such as fluids, environmental control and life support systems, electrical and data systems are routed. More than 50,000 mechanical items, 216 lines to carry fluids and gases and 121 internal and external electrical cables using six miles of wire had to be installed in the module. The detailed and complex hardware installation required more than 1,800 drawings. Bastedo said the work on Unity has often gone far above and beyond the call of duty, and everyone at JSC, Boeing and elsewhere has exceeded each challenge.

"We have had to track literally hundreds of interfaces that Unity must make," Bastedo said. "It makes hundreds of connections on orbit and that translates into many test requirements and specifications. It is no accident that every time we leak check it, it is better than the specifications by more than a factor of 20 – an outstanding achievement when you have 172 sealing areas. The engineering planning, the workmanship and the overall quality of the hardware have been outstanding."



KSC Photo 97EC-0944

Astronauts (from left) C. J. Sturckow, pilot; Nancy Currie, mission specialist; Bob Cabana, mission commander; and Jim Newman, mission specialist, pose with the Node 1 of the International Space Station.

Among those instrumental in the team's success have been Randy Galloway, former element manager for Unity, and Brian Mitchell, the current element manager, both JSC employees in residence at MSFC, Bastedo said. Also, Beth Cerrato's efforts to integrate efforts of the design team and the launch processing team have been vital. Other key contributors have included Karen Engelauf, a primary liaison between the team and mission operations personnel; Kim Ulrich, who was a key to successfully integrating Unity into the shuttle; Paul Marshall, the developer of the basic concepts used to certify the Unity and other equipment as ready for flight; and Elizabeth Smith, who performed several key integration functions, Bastedo said. Key members of the team who will complete the development and support of mission operations include Dave Herbek, Ronnie Johnson, Eric Smistad and Linda Kurz.

At KSC, Unity was moved to the launch pad at the end of October to be installed in *Endeavour*. The milestone is a little bittersweet, Bastedo said.

"When you go see it there at KSC… it is clear how much work has gone on. In less than two years, it has gone from an empty pressure shell to a fully outfitted spacecraft. Every member of the team has a tremendous sense of pride. We're doing what we set out to do," he explained. "But we all get a funny feeling, too. After awhile, you have to say goodbye. I guess it feels kind of like watching your kids go off to school." ■

Zarya node: A testament of U.S. and Russian teamwork

By James Hartsfield

The Zarya control module, the first component of the International Space Station to launch, has reflected the nature of the International Space Station program as a whole throughout its development, said JSC Russian Elements Manager Mark Geyer.

"This is the first really major piece of hardware built jointly by Russia and the U.S., and in that aspect it is a microcosm of the station itself," Geyer said. "It started our processes of how we work with Russia… how we perform tests together, how we build hardware together, even how we write software together."

Zarya will be boosted to orbit by a Russian Proton Rocket from the Baikonur Cosmodrome, Kazakstan, on Nov. 20. Built by Russia but owned by the U.S., construction of the 42,600-pound module began in late 1994 at the Khrunichev State Research and Production Space Center in Moscow under a subcontract to The Boeing Co.

Instrumental in overseeing the construction of the module from JSC since its inception has been Doug Drewry, the station program's launch package manager for Zarya.

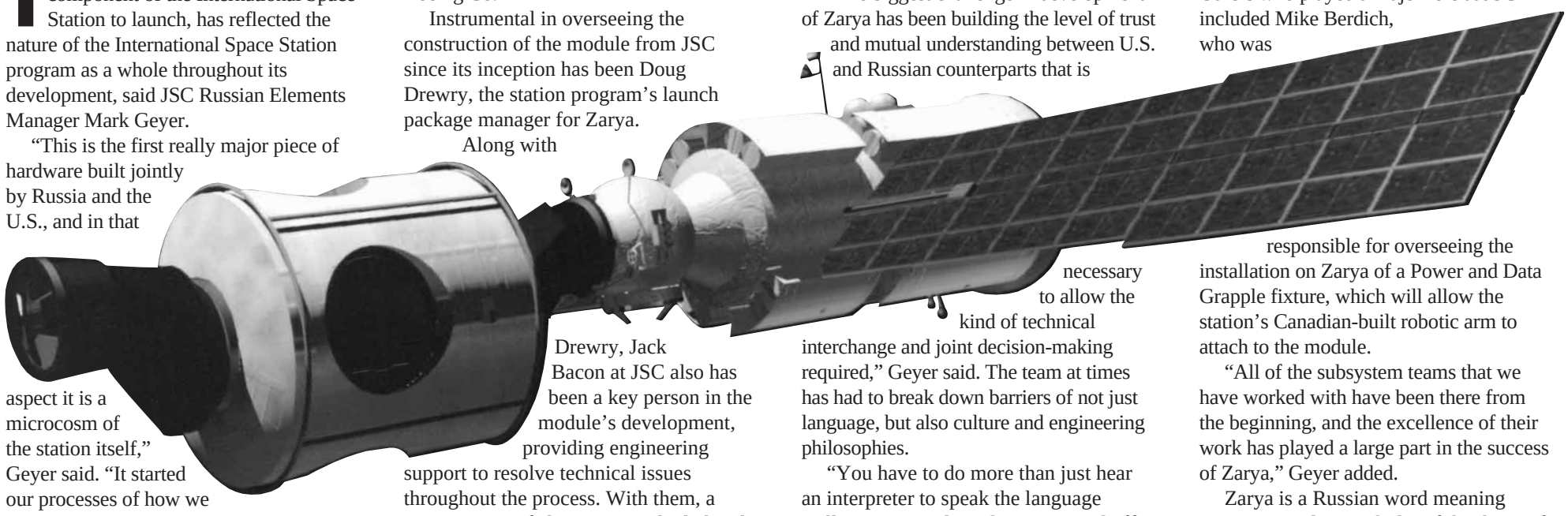
Along with Drewry, Jack Bacon at JSC also has been a key person in the module's development, providing engineering support to resolve technical issues throughout the process. With them, a Boeing team of about 10 people, led early on by Ginger Barnes and now by Mike Wood, has provided oversight of the module's construction, including a resident Boeing office at Khrunichev.

Working on the Zarya development has meant spending many nights away from home and family, said Geyer, with the average number of trips to and from Russia during the last four years standing at between 15-20 for almost everyone.

"The biggest challenge in development of Zarya has been building the level of trust and mutual understanding between U.S. and Russian counterparts that is necessary to allow the kind of technical interchange and joint decision-making required," Geyer said. The team at times has had to break down barriers of not just language, but also culture and engineering philosophies.

"You have to do more than just hear an interpreter to speak the language well," Geyer explained. "We started off with really no processes agreed to among us and now we have hundreds, hundreds that we use for not just the Zarya but also other components. We have made a lot of progress."

Geyer said the Boeing team that has been on-site at Khrunichev in Moscow has been instrumental in maintaining the lines of communication concerning day-to-day activities in development of the module. Others who played a major role at JSC included Mike Berdich, who was responsible for overseeing the installation on Zarya of a Power and Data Grapple fixture, which will allow the station's Canadian-built robotic arm to attach to the module.



"All of the subsystem teams that we have worked with have been there from the beginning, and the excellence of their work has played a large part in the success of Zarya," Geyer added.

Zarya is a Russian word meaning "Sunrise" and is symbolic of the dawn of new international cooperation in space. Zarya will provide orientation control, communications and electrical power to Unity, as well as the ability to rendezvous and dock with the third component, the Russian-provided Service Module, an early living quarters, in July 1999. ■