Their support MERits acclaim

Boeing experts advise NASA during shuttle, ISS assembly missions

By Ed Memi

In TV commercials for a wireless communications company, you see a "network" of people behind someone making a telephone call. Likewise, when NASA performs the most complex International Space Station assembly missions ever attempted, a network of Boeing and industry workers supports its Mission Evaluation Room.

The MER is a large room at Johnson Space Center in Houston where Boeing engineers assemble. There are separate MERs for the shuttle and the ISS, and they're staffed around the clock during shuttle missions—including the Space Shuttle *Atlantis* mission (STS-115) to the International Space Station in September. Spaceflight operations are extremely complex, and problems can occur that are not covered by NASA's flight rules. That's where the MER comes in.

The MER concept garnered lots of attention during the Apollo 13 mission in 1970 when a ruptured fuel cell caused severe damage and engineers devised a number of solutions for the crew's survival and return. Although life-threatening situations are rare, Boeing engineers in the MER work complex issues on every shuttle flight and station-assembly mission.

"We rely upon the MER to provide sound technical advice to the station's Mission Management Team," said Kirk Shireman, chair of the NASA space station Mission Management Team (MMT), a senior leadership team. "The team provided outstanding support during this mission."

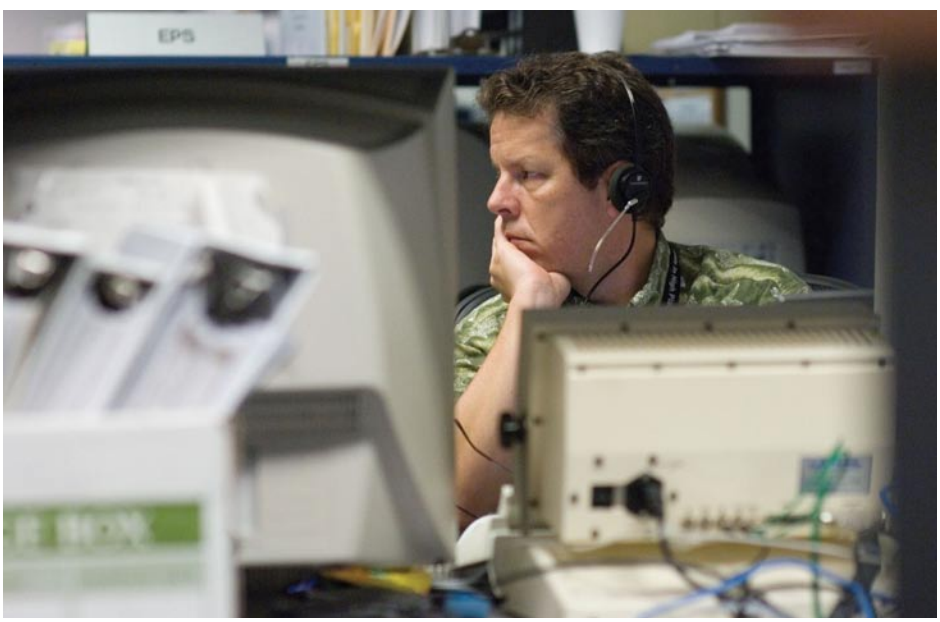
NO MAJOR ANOMALIES

The crew of STS-115 delivered the Boeing-built Port 3/Port 4 integrated truss segment to the ISS and conducted three successful spacewalks to prepare the truss and its solar arrays for operation.

"We really didn't have any major anomalies during this mission," said Matt Duggan, ISS MER manager. "We accomplished every space station task we wanted to do. This assembly mission was an unequivocal success."

Boeing staffs the ISS MER console positions around the clock during an assembly mission. MER managers are split 50-50 between Boeing and NASA. The ISS MER also conducts traffic analysis when a large number of vehicles approach and leave the station. In fact, during STS-115, a Russian cargo craft undocked just before *Atlantis* docked, and the Soyuz spacecraft docked shortly after *Atlantis* undocked.

"An approaching vehicle will fire thrusters to slow down, and thruster plumes will impact the ISS, so we determine the configurations to minimize the impact, which might include turning the solar arrays," Duggan said. "We have to balance those actions with the operation of the station itself.



NASA PHOTO

Boeing engineer Barry Williams works at a console in the ISS Mission Evaluation Room at Johnson Space Center during Space Shuttle *Atlantis'* recent mission to the International Space Station. He's monitoring on-orbit assembly operations after the Boeing-built P3/P4 truss was installed on the ISS.

Boeing engineers help staff the NASA Space Shuttle Mission Evaluation Room at Johnson Space Center in Houston. NASA and its industry team of engineers assist with trouble-shooting of any prelaunch or on-orbit problems with the space shuttle.

The MER does that for every vehicle."

Although the mission went well, there were a few situations where Boeing engineers provided their expertise to the NASA MER manager, who often will brief NASA's station or shuttle MMT.

During STS-115 when astronauts reported two bolts missing from two covers on the P3/P4 truss, the ISS console operators immediately sprang into action and started to gather the necessary subsystem experts. "We'll start to develop a story on the impact," Duggan said. "If the items are not needed, then you start to develop a 'work around' to keep the station running smoothly."

"From our earlier analysis we knew the covers would be fine with only three of the four bolts. We also helped NASA understand the conditions in which the aircraft-like fastener bolts and their washers could separate, so procedures could be modified," said David McCann, a Boeing ISS manager of structures and mechanical systems who worked many hours in the ISS MER. McCann said more than 300 bolts were turned during the assembly mission.

PRELAUNCH CHALLENGES

The *Atlantis* flight was a success, in part, because NASA identified and overcame several challenges close to launch. A lightning strike and a tropical storm were just some of the things that held up the shuttle launch. While *Atlantis* sat at the launch pad, there was a problem with a cooling-pump motor on one of the orbiter's three electricity-producing fuel cells.

"Whenever we have a problem we kick off 'tiger' teams, which include experts on all the affected shuttle subsystems. We get all the right folks onto the team to solve the problem and look critically at the mission components. The entire event is chaired out of the MER and run by those tiger team leaders," said Tim Reith, Boeing's assistant chief engineer on the orbiter and on console in the shuttle MER.

Reith said there was good consensus between the industry and NASA team that the pump motor would work fine, and it did.

NASA reported some debris floating by the shuttle after it undocked from the station. Once again, Boeing engineers in the MER called together a tiger team to look at the orbiter and determine if anything was missing. Boeing engineers worked closely with NASA and its industry team as the shuttle's robotic arm and a 50-foot boom were used to inspect and clear the orbiter's critical systems for a safe landing.

"The Mission Management Team relies on us to get the right answer," Reith said. "It's not just what you know but what you don't know that typically helps us to figure out the right way to go."

During the next shuttle flight to the ISS, now scheduled for December, Boeing engineers will be on duty to assist NASA as astronauts deliver the Port 5 truss segment and reconfigure the station's primary cooling and electrical systems. ■

edmund.g.memi@boeing.com