Station flight controllers finish generic training

Four teams of International Space Station flight controllers completed their generic training in September and began conducting the first STS-88 flight-specific simulations. This milestone capped a year of intensive preparation that began with basic voice protocol simulations in the fall of 1997 and advanced to complex exercises using new Space Station Training Facility-provided simulators.

During their generic training, the teams simulated the most critical elements from the launch package 2A and 3A timelines, including extravehicular activities and system activation. Each flight control team worked through a series of 12 mission scenarios, which included various aspects of standalone ISS operations and integrated shuttle/ISS assembly missions.

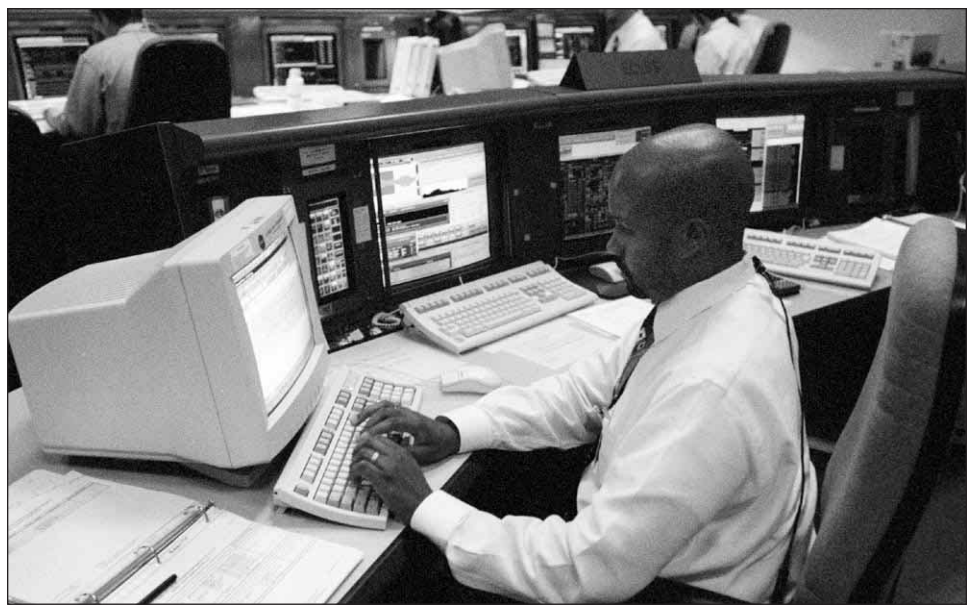
"Progress to date has been astounding," said ISS Flight Director Sally Davis. "Most of the people on these teams were not flight controllers on the Space Shuttle Program before, so this assignment is their first experience working in the space program. They have come so far and have made so much progress that they really do function like a flight control team."

Each team has its own assigned station flight director. In addition to Davis, Mark Kirasich, Mark Ferring and Jeff Hanley were named to fill these positions in June 1996. Kirasich is the lead station flight director for 2A, while Ferring heads 2A.1, Davis leads 3A and Hanley directs 4A.

For the early assembly missions, an experienced shuttle flight director will be the lead for shuttle operations and for the overall increment. Each flight will also have the lead for the station who will work issues associated with the space station.

The station teams will begin operations in the Mission Control Center-Houston (MCC-H) with the launch of the FGB. Continuous around the clock staffing will be provided during the docked phase of 2A. After the shuttle undocks, the teams in Houston will rotate, providing full Flight Control Team support for several hours each day. During this time, the teams will verify that the on-orbit elements are healthy, conduct required maintenance activities and test objectives, and review and approve the Moscow-generated flight plan.

Once these activities are completed, one individual – a shift duty officer – will staff the control center for the rest of the day. The SDO will respond to questions from Moscow and monitor high-level telemetry of the spacecraft. If any anomalous events occur, the SDO will call the flight director who will call in other team members as necessary. Twenty-four-hour support will be provided if required.



JSC Photo S98-14110 Benny Benavides

NASA Flight Controller Kwatsi Alibaruho, responsible for environmental control and life support systems, participates in a recent simulation.

"The operation of the International Space Station is a U.S.-led effort," said Kirasich. "The ISS flight director in Houston will review and approve every daily plan. The control center in Moscow will play a major role in station operations as well. The MCC-Moscow will generate the daily plans early in the program and will operate the Russian segment."

Continuous flight control team support will begin in Houston with the 4A mission currently scheduled for August 1999. With 4A, key components of the U.S. power system – solar arrays, batteries, power distribution elements – will be delivered.

The training facilities and control center have followed parallel courses of development. Last fall, the first pieces of the station control center were delivered to Bldg. 30 and the first versions of the ISS simulator were delivered to the SSTF. In the spring, the second iterations of these facilities were delivered, and the station flight control teams and flight crews began conducting generic simulations in earnest. Recently, the final flight releases became available and have been used for STS-88 flight-specific training.

The blue Flight Control Room in Bldg. 30 is used primarily for station operations. Although shuttle operations will be based in the white FCR and station operations in the blue FCR, they are interchangeable. Since station training will continue after the assembly missions start, plans are under way to develop a third FCR.

Many new systems had to be developed and installed in the control center to conduct station operations, principally those used to process telemetry and station commands. These systems passed a major hurdle with the successful completion of an end test between the control center and the flight hardware at KSC in August. Currently, the interface between the MCC-H and the MCC-Moscow (MCC-M) is being tested. This interface allows U.S. communications assets to be used by the MCC-M and Russian communications assets to be used by the MCC-H. ■

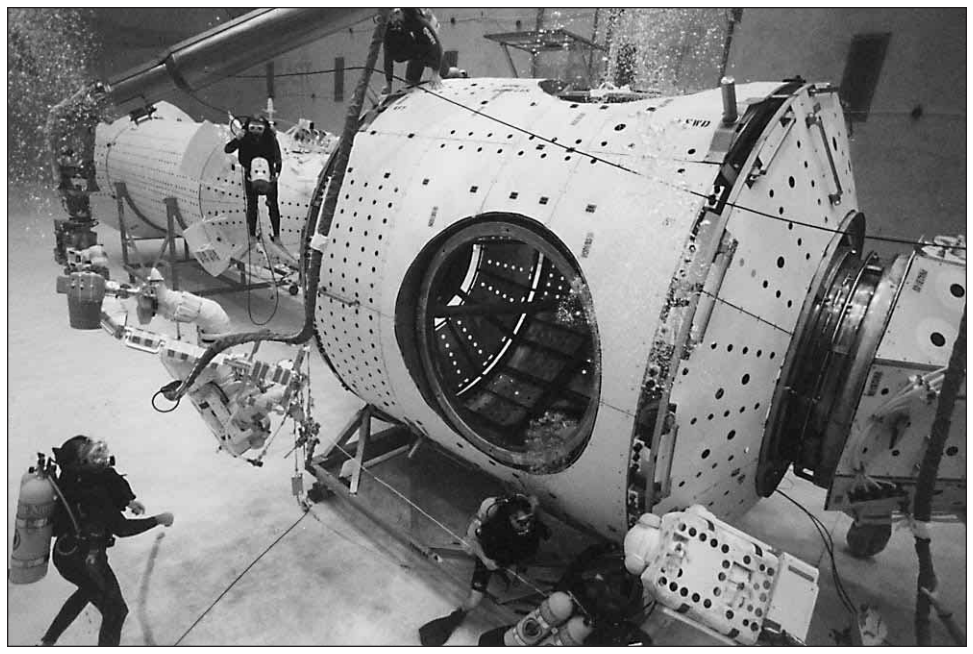
Getting down to the nuts and bolts: Putting the station together

In December, members of the STS-88 crew will attach Unity to Russia's Zarya control module. Prior to the shuttle's rendezvous with Zarya, astronauts will use the shuttle's Remote Manipulator System to lift Unity out of the payload bay. The shuttle will then dock with Zarya, using the RMS to latch Unity to Zarya. Once the components are attached, astronauts will conduct three space walks to connect power and data transmission cables among Zarya, Unity and two Pressurized Mating Adapters.

And so begins construction of the International Space Station, a project that will turn Earth orbit into a daily construction site for the next five years. Astronauts will perform more space walks in those years than have been conducted since space flight began. Approximately 160 EVAs, totaling about 1,700 crew hours, or about 850 EVA hours, are planned for station assembly–about as many EVA hours as have been conducted in the history of human space flight to date.

During the first seven shuttle assembly missions, there is no U.S. capability for space walks to be conducted from the station without the space shuttle present. The Russian Service Module provides a capability for station-based Russian space walks using only Russian spacesuits, but the U.S. capability will not be available until the Joint Airlock Module is attached to the station during the seventh space shuttle assembly mission, STS-101.

After the Joint Airlock Module is operational, the philosophy of space walk training for maintenance tasks for increment crewmembers will shift due to the increasing complexity of the station and the ability of the station crew to perform space walks. Because the station's growing size and complexity will make it next to impossible to train station crew members for every EVA task they may be called upon to perform during a mission, training will increasingly aim toward providing crew members with a general suite of EVA skills.



JSC Photo S97-11949

Astronauts perform a training session in the Neutral Buoyancy Laboratory of the Sonny Carter Training Facility.

"We have demonstrated through shuttle-Mir that we can train people and walk them through tasks so that they have an appreciation for what will have to be performed on orbit without ever having practiced that specific task beforehand on the ground," said Gregory Harbaugh, head of the EVA Office. "This philosophy differs significantly from our previous approach to EVA training."

To assemble and maintain the ISS, space-walking astronauts will work in partnership with a new generation of space robotics. The space shuttle's mechanical arm and a new space station arm will operate both as "space cranes" to maneuver large modules and components and as space "cherry pickers" to maneuver astronauts to work areas.

The largest robotic apparatus is Canada's primary contribution to the station, the Mobile Servicing System. This system will move equipment around the station, capture and release satellites, and service the payloads and instruments aboard the station.

The "arm," known as the Space Station Remote Manipulator System or SSRMS, is a larger and more advanced version of the shuttle's RMS. The SSRMS will have the new capability to move around the station's exterior like an inchworm, locking its free end on one of many special fixtures placed strategically around the station and then detaching its other end and pivoting it forward. In addition, the station arm eventually will be able to ride on a Mobile Remote Servicer Base System platform that will move on tracks along the length of the station's truss, putting much of the station within grasp of the arm.

The SSRMS is scheduled to launch in December 1999. The Mobile Remote Servicer Base System will launch in August 2000.

Canada is also providing the Special Purpose Dexterous Manipulator, or Canada Hand, a smaller two-armed robot that can handle some of the delicate tasks that astronauts typically perform, such as tightening and loosening bolts. The Canada Hand is scheduled to be launched and attached to the robotic arm in May 2002.

What will be the major challenges in assembling the station? Probably not putting the larger pieces together, according to Harbaugh. He said that since the overall mating of large structures will be validated on the ground, the major problems that may arise will concern other issues such as bringing the smaller items together and seeing that they are properly secured. But the time has come to begin that assembly process.

"We have reviewed the three space walks planned for STS-88, and that training process is very mature and the crew is ready to go," said Harbaugh. "It's time to get to work." ■