

## Continued from page 6 .....

# JSC celebrates 40 years

used to train astronauts for spacewalks. When it proved inadequate for spacewalk training in anticipation of International Space Station assembly, plans were put into motion for the Neutral Buoyancy Laboratory, a 6.2-million-gallon, 102- by 202- by 40-foot pool. Built to support ISS construction, the Sonny Carter Training Facility was retrofitted to house the new NBL, which began operations in January 1997. Complete with mockups including those of station components and the Hubble Space Telescope in the water, the facility is used to train astronauts in procedures they will perform during upcoming missions.

Ellington Field hosts center flight operations. The aircraft include a KC-135 four-engine jet used to produce space-like weightlessness by flying a series of arcs, a twin-engine Gulfstream specially modified to perform like a landing shuttle orbiter and T-38 jet trainers with state-of-the-art instruments that are flown by astronauts to maintain their proficiency.

### America's Nerve Center for Mission Operations

Liftoff from Launch Complex 19 at Cape Kennedy was at 10:16 a.m. EST June 3, 1965. The spacecraft with astronauts James A. McDivitt as command pilot and Edward H. White II as pilot was placed in an orbit with a perigee of 100 miles and an apogee of 175 miles.

Gemini IV, with McDivitt and White aboard, landed about 48 miles short of the intended target, the *USS Wasp*, at 11:12 a.m., Houston time, June 7, after making 62 revolutions of the Earth in 97 hours and 56 minutes. Both crew members were in fine shape and were returned to the *Wasp* by helicopter.

For the first time, flight controllers performed their jobs from the new Mission Control Center at the Manned Spacecraft Center. Gemini IV became the first flight controlled from Houston and the longest duration mission to that date. The Cape Kennedy control center provided backup services for the initial launch and trajectory, and Goddard Space Flight Center's computer center provided support for the entire four-day mission. GSFC was the communications center. The computers were in the new MCC for the first time.

This flight established JSC as the nation's home for Mission Control. But this responsibility could have easily gone to Goddard Space Flight Center or to the Kennedy Space Center and, had it, JSC would not be the nerve center for space shuttle and International Space Station flight control operations that it is today.

The concept of a ground-based flight control team to manage human space missions was implemented from the beginning of Mercury. Flight control remains a key element of the mission planning process. For the most part, program offices delineate mission activities and objectives. With its vast expertise, the flight control team uses spacecraft and space station systems to accomplish mission objectives and to monitor the status of flights as they occur.

As Mercury began orbital missions with John Glenn's flight on Feb. 20, 1962, equipment and procedures needed to be created. And when Gemini came on line, the system established for the

Mercury Program had to be updated. The Mercury control center at Cape Canaveral used commercial off-the-shelf electronics gear, but more was needed. It became obvious that existing equipment was inadequate. A study of the needs and options for a new mission control center was begun.

Were flight operations to be part of the design center, MSC in Houston, or part of the operations center at Kennedy Space Center in Florida where Mercury controls were housed? Goddard Space Flight Center in Maryland had the attraction of being conveniently located near the nation's capital and NASA Headquarters. Would travel requirements be greater or less if the control center were located in Maryland, Texas or Florida? It was soon decided that mission control and operations would become a major component of MSC responsibilities.

"Discussions among MSC management quickly recognized that operations requirements would be a critical factor in the design of all manned spacecraft," said former JSC Director Dr. Christopher C. Kraft. "Therefore the location of the astronauts and the flight operations engineers adjacent to the engineers responsible for the management of the aerospace companies building the hardware became a highly desirable requirement. Also it was recognized that once the launch had taken place, the location of a control center on Earth was not a significant factor. Considering these factors, it was decided that the best location for a Mission Control Center and the facilities for training the astronauts would be with the Manned Spacecraft Center in Houston."

The MCC enables the flight control team to perform its critical duties. With the knowledge of the Mercury experience and a vision of what Gemini and Apollo would require, designers and developers began defining the parameters of the MCC in Houston along with its network, recognizing that its hardware would evolve over the years.

Construction of the control center began in late 1962. Evolution of the concept of a control center continued throughout the Apollo Program. Floor space was allocated for representatives of the spacecraft program office who, along with JSC engineering and vehicle contractors, supported each mission. This increased presence strengthened the problem-solving capabilities of the MCC team. The spacecraft program office support team occupied what became known as the "SPAN" or Spacecraft Analysis Room. JSC and industry engineering teams supported missions in this room.

This arrangement allowed immediate contact with key JSC engineering and industry representatives in case assistance were needed in resolving any technical anomalies that might arise during missions.

Houston's initial MCC directed that Gemini IV flight and all subsequent Gemini and Apollo flights and some space shuttle flights. The original MCC working life began with the first spacewalk during that Gemini mission in June 1965 and ended in March 1996 with the

launch of STS-76, which saw the first spacewalk of U.S. astronauts outside of the Russian Mir space station.

By the 1990s, the MCC was becoming outdated. Technology had moved on from the 1960s technology that was supporting the center, but the MCC continued its work until a state-of-the-art center replaced it. The new MCC became operational in July 1995. That original MCC is now a national monument.

Mission operations have matured significantly over the years. Mercury had begun with a fairly simplistic aircraft flight operations approach. The process matured during the Gemini operations when a systems handbook and direct interface between flight control teams and the crew provided real-time, ground-to-air interactions. During Apollo, the operations teams worked together on all issues involving flight systems, flight design, science and human operations.

The shuttle era brought radical changes. Shuttle flights had greater and more diversified capabilities and more participants in terms of federal agencies, institutions and even foreign nations. Shuttle design and construction involved close support from the mission operations team. The shuttle was built with the understanding that good flight operations required something of a symbiotic relationship between the human occupants and the machine.

Fewer operators worked the MCC at JSC than in the days of the Apollo lunar missions, but shuttle flight operations required a networking of the support team composed of the flight control team and the multi-purpose support rooms with the payload operations control centers located at JSC or elsewhere, including Goddard.

Shuttle flight control became much more streamlined than during Apollo flights and depended on advanced information systems and computer programs. The shuttle required all new computer software – adjusted and reconfigured for each mission. Mission planning for early shuttle missions began three or four years in advance.

Today, MCC activities take place in one of two Flight Control Rooms (FCRs or "Fickers"), the White FCR (for shuttle operations) and the Blue FCR (for station operations). Here flight controllers, in performing their command/control and monitoring functions, get information from console

computer displays or projected displays and coordinate with the crews. FCRs use a generic platform that can support all U.S. flight activities. FCRs also support simulations – mission dry runs in which specific tasks may be rehearsed or potential problems and solutions may be addressed.

With the launch of Zarya, the first International Space Station component, in November 1998, station flight controllers and engineering support teams in Houston and Moscow began operations. In the Blue FCR, since the launch of Zarya, to this day and for many years to come, ISS flight controllers conduct continuous joint ISS operations in conjunction with their counterparts



NASA JSC S69-40023

Continued on page 8

## In the beginning

I was one of the lucky few that worked for NASA when Houston became a vital part of our vocabulary. I began with Space Task Group at Langley on May 8, 1961, as just a young country boy from Iowa. Thus, when I heard the news that we were going to Houston, I said GREAT. I figured Virginia was not my home and since I had only been there under a year, I saw it as a great opportunity to see another part of this great country. First, we thought we would see cowboys, cattle and ranches all over the place – but then the news at that time was dominated by the damage of hurricane Carla, so we were not sure what to expect. Needless to say, I was ready when asked if I would transfer and did so on Jan. 2, 1962.

John J. Thiel  
Retired Contracts Manager

From 1959 until we moved to Houston in 1962, my wife, Catherine T. Osgood, and I worked at Langley. She worked in Mission Planning at the Space Task Group for Chris Kraft, and I worked in the Mercury Tracking and Ground Instrumentation Unit for Barry Graves and Paul Vavra. When the announcement came that the MSC site was to be Houston, we were faced with the decision of whether or not to move to Texas. We had hoped that Tampa would be selected since we had previously lived in South Florida. We had found that Hampton was somewhat insular and hoped that Houston might be a little more cosmopolitan. So we decided to move and here we are.

Donald R. Osgood

At the height of the Cold War, the USSR shocked the world by announcing the 1958 launch of an Earth satellite called Sputnik. The nation was galvanized. The U.S. Congress created a new space agency called NASA, and many young Americans dreamed of flying in outer space. I was 16, a junior in high school, with a love for science and engineering. We made toy rockets with mailing tubes and our own fuel formulations of powdered charcoal, sulfur, and potassium perchlorate and launched them from any broad field we could find.

At age 19, a sophomore in college, after accepting a job through the school's cooperative engineering department, I began a career with the newly formed Space Task Group at Langley Air Force Base, Hampton, Va., and reported for work in June 1961. It was the fall of 1961 and I was back at school when everyone learned the Space Task Group was moving to Houston. When I returned to work in the winter of 1962, everyone was infected with excitement about the prospects of a new life in Texas, and so I also followed Aldous Huxley's advice to "Go West, young man." My first co-op tour in Houston was in the Houston Petroleum Center (HPC Building) at I-45 and Wayside. Looking back, it has been a rewarding and exciting career. After nearly 40 years in Houston, I think I have been transformed into a Texan.

Joseph Thibodeau

I cannot be sure what my reaction was, but I think it was a feeling of relief that a decision had been reached despite the last-minute reconsideration of Boston as a possible site for MSC. As I recall, personal feelings of most of the employees were mixed. That is, most of the employees considered that the Langley Field area was "home" – either by having been born and raised there or by adaptation from having lived and worked there for many years. In spite of that, I feel that most of us realized that there just was not room in the Langley area for both the Langley Center and MSC. So we reluctantly made plans for moving.

Paul Purser

I was working in the Space Task Group at Langley Field when NASA announced that we would relocate to Houston. I was really thrilled. I didn't like the other sites that were being considered. My husband, Raymond, was working for NASA-Langley and he transferred to the Space Task Group. We were both glad to head for Houston.

Betty Ensley, retired secretary to Dr. Faget