Sonny Carter Training Facility

Setting the stage for space walks

Story by Lisa Tidwell

"Thanks to all of the members of the NBL who made it possible for us to learn all of the techniques in the water tank for EVA activities in space."

–Astronaut Franklin Chang-Diaz, Ph.D., at the crew-return ceremony of STS-111

"Thanks" may seem a routine remark. However, when it comes from an astronaut who has completed a space walk, it is a sentiment cherished by the entire team at the Sonny Carter Training Facility (SCTF).

Much work goes on behind the scenes in Houston to ensure success in space. This feature spotlights the SCTF and the teams that work diligently to set the stage for astronauts to perform well-orchestrated space walks.

Who was M.L. 'Sonny' Carter, Jr.?

The entire facility was named for Astronaut M. L. "Sonny" Carter, who was instrumental in developing many of the current space-walking techniques used by the astronauts. On April 5, 1991, while traveling on NASA business, Carter died in a commercial airplane crash.

"Sonny was a driving force in a number of advances we made in the field of space medicine, particularly the evaluation of the Extravehicular Mobility Unit," former JSC Director Carolyn Huntoon, Ph.D., said at the SCTF dedication. "Sonny Carter left a lasting impression on the Johnson Space Center and our nation's space program."

To learn more about Carter, his astronaut biography is located at: http://www.jsc.nasa.gov/Bios/htmlbios/carter.html

The facilities

The SCTF is comprised of three buildings:

Neutral Buoyancy Laboratory (NBL)

Many NBL visitors are surprised by the immense size of this famous pool as they stand on the observation deck. In the world's largest indoor pool, space walks are the focus. "We have the ability to train astronauts in a simulated space environment here on Earth," said Robert Durkin, Facility and Operations Manager at the NBL. More than 200 employees, including 60 core divers, work there.

Logistics and Mock-up Facility (LMF)

Housed at the LMF are the suit and tool labs. "All of the processing of the suits, buildup, maintenance, modifications for each crew member and all the functional testing is done here," said Don Smith of the Extravehicular Mobility Unit (EMU) Training Lab.

Software Development and Integration Laboratory (SDIL)

About 150 people work at the facility; most are contract employees of Boeing. Many facilities are housed in the SDIL including: ISS Power Laboratory, Integrated Test Rig, Hardware/Software Integration Lab, Software Verification Facility, Prime Software Development Facility and Mission Build Facility. Test and verification of all ISS flight software is done at the SDIL. "In a nutshell, SDIL is the integration and verification facility for the avionics software of the ISS," said Allen Brewer, SDIL Facility Manager.

It takes teamwork

In place at the SCTF is an intricate system of teams working together to teach astronauts how to perform space station assembly tasks, which are the most extensive and complex space walks ever attempted.

Those teams are:

Astronauts:
Perform space walk and bailout training at the NBL.

Breathing Gas System (BGS) Group:
Produces and controls all of the breathing gas, Nitrox, which the divers use.

Communications Operators:
Monitor the communication systems during water tests.

Divers (Safety/Utility/Camera):
Help the suited subjects with all of their tasks. There is a minimum of four divers per suited subject.

Engineering Group:
Works with designing the shuttle and station mockups.

Environmental Control System (ECS) Group:
Ensures test subjects receive adequate suit conditions.

Integration Engineering Team (IET):
Decides the configuration of the pool for a set of tests and generates animation of the test configurations to check layout and clearances.

Long Range Planning Group:
Schedules the training events that go into the tank.

Mockup Maintenance Group:
Performs planned and unplanned maintenance on the mockups.

Medical Team:
Physically examines test subjects and divers before each test. Always present while divers are in the water to ensure health and safety.

Reconfiguration Group:
Works in the evening to reconfigure the pool for the next-day training sessions.

Robotic Arm Team:
Takes care of the maintenance repair and testing of the shuttle and space station remote manipulator system (SRMS, SSRMS).

Suited Subjects:
An astronaut or engineer in the EMU.

Suit Team:
Works to ensure the EMU or suit is in top condition for each suited subject.

Test Conductor (TC):
Stays with an assigned crew while training for a space walk. Gives the training manager input.

Test Director (TD):
Ensures everything runs smoothly, such as environmental control systems, gas flow, cooling to suit and communications.

Test Safety Officer:
Ensures test safety during the training in the pool.

Tool Team:
Provides tools for the training events (these tools are downgraded flight units that are used for training).

Topside Monitors:
Watch from the pool deck during tests and ensure the safety of the divers.

A closer look: Divers

Divers are the backbone of the system and work in one of three major roles: A utility diver, a camera diver or a safety diver. "The divers are the lifelines, teachers and coaches for the astronauts while training for a space walk," said NBL Director Ernest Becker.

Through the divers, the astronauts are taught how to open hatches, use tools and move in the weightless environment at the SCTF. "Most of the task training and timeline training are done at the NBL," said Lisa Spence, an NBL Flight Lead.

The team determines the most efficient and convenient way to perform tasks needed for a space walk. The flight lead puts together a rough procedure, but it is not until the divers hit the water that the orchestration takes form.

Astronaut Scott Parazynski, MD, said the divers are as knowledgeable as they are helpful. "They work with (space-walk) training everyday, and they can tell right away if you are developing a bad habit and they help you correct it," he said. "They are really good teachers."

A special bond

Members from all of the SCTF teams exude pride when discussing their work. "The astronauts come back and say, 'Thanks for that little technique you showed me,'" Diver Bill Radford said with a smile.

To watch an astronaut perform a space walk that has been rehearsed repeatedly at the SCTF is a powerful moment for all at the facility. "While watching space walks," Diver Ashley Porter said, "we can take a step back from the everyday work and realize what it is we are doing."

Dr. Parazynski, who has flown four missions and performed more than 20 hours of space walks, said the SCTF team is never forgotten when it is show time in space.

"They are part of your team," he said, "and you wish they were there."

NBL AT-A-GLANCE

- On May 19, 1997, the NBL officially opened
- The NBL pool, at 40 feet deep by 102 feet wide by 202 feet long, is still not large enough to fit the completed space station, which will be 350 feet by 240 feet
- The pool is centered at ground level, making it 20 feet below ground and 20 feet above
- It contains 6.2 million gallons of water
- The temperature is kept around 86 degrees for the divers' comfort
- Water in the pool recycles every 19.5 hours
- The NBL is 12 times larger than the Weightless Environment Training Facility it replaced
- The 500 truckloads of cement it took to pour foundation stopped traffic all the way to I-45
- It took more than one month to fill the pool
- The NBL is fully outfitted and large enough to run two training exercises at a time
- The pool is ideal for training astronauts on specific jobs that only require particular hardware pieces
- Astronauts spend seven hours in the water training per one hour of a space walk on orbit
- In a traditionally male-dominated field, the NBL Dive Team is proud to have eight women recently join the ranks
- Astronaut Jerry Ross, former chair of the NBL Operational Readiness Inspection committee, was the first suited astronaut to dive into the pool
- The entertainment industry has used the facilities in the filming of *Armageddon* and *Space Cowboys*

The photos on the right capture just some of the work that goes on at the Sonny Carter Training Facility:

A. Don Smith inspects the latches on a space suit helmet. All suits are thoroughly inspected prior to hitting the water.
B. Divers keep a close watch on all astronauts practicing for space walks in the NBL to ensure their safety.
C. Patrick Santana attaches the tools that Astronaut John Herrington will need for his space walk during STS-113.
D. Diver George Dyson takes a moment to brief STS-113 Pilot Astronaut Christopher 'Gus' Loria on the day's test procedures.
E. Test Directors monitor the space walk training from one of two control rooms directly above the pool.

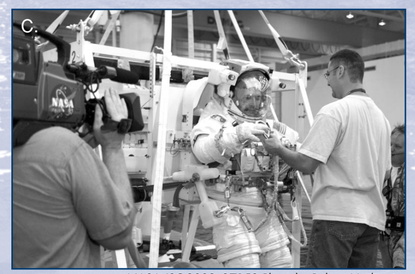
A.

NASA JSC-2002e27132 Photo by Robert Markowitz

B.

NASA JSC-2002-00507

C.



NASA JSC-2002e27153 Photo by Robert Markowitz

D.

NASA JSC-2002e27501 Photo by Robert Markowitz

E.

NASA JSC-2002e27503 Photo by Robert Markowitz

NASA JSC-2002e01448 Photo by Robert Markowitz