NASA Facts

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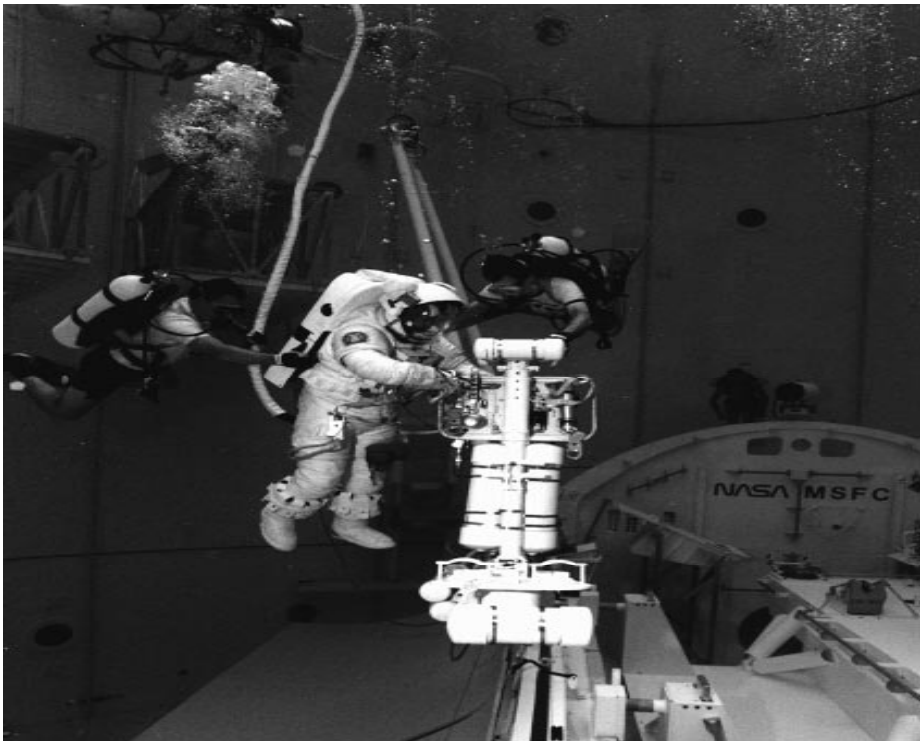
Marshall's Neutral Buoyancy Simulator

Since the late 1960s, the Marshall Space Flight Center's Neutral Buoyancy Simulator (NBS) has provided NASA investigators and astronauts with the closest simulation of microgravity available on Earth.

By attaching a system of floats and lead weights to people and objects, engineers counter the effects of water on NBS test subjects to closely simulate weightlessness. The floats and weights compensate for water displaced by a subject's volume and density, making the subject "neutrally buoyant: — it neither sinks nor floats.



The NBS provides an excellent environment for testing hardware designed to operate in space while also affording the opportunity to evaluate techniques that will be used in space to assemble structures such as the International Space Station and to service spacecraft such as the Hubble Space Telescope.

History

NASA began operating the Neutral Buoyancy Simulator at Marshall in 1968 because the agency needed a readily available, practical location to develop, test and refine techniques and hardware used in space.

In 1973, engineers used the NBS to develop the procedures that saved Skylab after the spacecraft suffered damaged to its sunshield during launch. In the early 1980s, engineers used the simulator to practice the intricate space repair procedures that revitalized the Solar Maximum Mission Satellite. In 1985, after perfecting assembly techniques in the NBS tank, NASA astronauts constructed the first structures (EASE and ACCESS) built in space. The simulator was also used to test and refine the Manned Maneuvering Unit, a jet-powered backpack that propels astronauts untethered through space. In 1985, the Department of the Interior designated the simulator a National Landmark, a result of its critical support in space missions.

In recent years, the NBS has been the site for developing assembly techniques of structures too large to launch fully assembled; for familiarizing astronauts in the techniques used to deploy satellites; and for the development and practice of techniques required in handling sophisticated hardware such as the Hubble Space Telescope.

Recently, engineers and astronauts prepared for the highly successful Hubble Space Telescope servicing mission with simulations in the Marshall water tank. Currently, NASA and its aerospace contractors are using the NBS to test further concepts and construction techniques for components of the International Space Station. Simulations for the next Hubble servicing mission also are scheduled.

The NBS Facility

The NBS facility incorporates a 75-foot wide, 40-foot deep, 1.3 million-gallon simulation tank; a three-person, double-lock hyperbaric chamber; an overhead crane for lifting hardware into the tank; a floating crane for moving hardware underwater; a removable roof section to accommodate large, one-piece mockups; an observing room for visitors; four Shuttle pressure suits with underwater primary life support systems and umbilicals; a full-scale Shuttle payload bay mockup; a fully operational Remote Manipulator System; and several previously used hardware mockups, structural beam mockups, and various crew restraints and tethers.

Engineers direct NBS activities from a state-of-the-art control room located on the first floor adjacent to the tank. The control room includes consoles for six participants, television monitors that provide 14 views of the tank's interior, direct communications with test subjects, an audio/video taping facility, and life support data displays of test subjects.

The simulator tank readily accommodates structures and observatories as large as the 43-foot Hubble Space Telescope mockup and anything that fits into the Shuttle payload bay, such as the space station modules being provided by NASA and its international partners.