# TEKTITE—

## A Study of Human Behavior in a Hostile Environment

**AAAS Symposium • 27 December 1969 • Boston**

In his quest for increasing knowledge, man is leaving the hospitable land surfaces of the earth and projecting himself further and further into inner and outer space. He is beginning to explore worlds where he must take his environments with him to stay alive. The longer he ventures into these hostile environments, the greater the stresses that are imposed upon him and the greater his reliance on others for performance and safety.

At the present time, we have only an imperfect understanding of the characteristics of man and his behavior, both as an individual and as a member of a small social group, that permit him to function adequately under the various stresses under these alien surroundings. The Tektite project was initiated to provide a multidisciplinary study that encompasses marine sciences and ethology, human behavior and small group dymanics, physiological and bio-medical research, and engineering and architectural design for habitability. The project involved the close and continuing coordination of several governmental agencies (U.S. Navy, Department of the Interior, the National Aeronautics and Space Administration and the College of the Virgin Islands) and industry (General Electric Co.).

The Tektite habitat was constructed for use under water. It consists of two vertical tanks, each divided into two rooms with an interconnecting tunnel between the top two chambers. One two-story tank contained the command-control room on the upper deck with the crew quarters below. The second tank contained the engine room with a 5-foot cupola on top. The lower deck consisted of the wet laboratory. Access to the water was through the bottom of the wet lab, through the ever-open hatch, and then out through the shark cage. The hatch remains open at all times since the air pressure inside the habitat equalled that of the water at the 42-foot depth. The hatch is located 5 feet above the roof on which the habitat rested.

The prime objective of Tektite was to determine the feasibility of the utilization of an undersea habitat for a small group of men to perform scientific tasks under nitrogen saturation conditions for extended durations. The behavioral research was performed to study individual and group dynamics and performance capability while accomplishing a real-life mission over a long-time period in a hazardous environment.

Last 15 February 1969, four marine scientists entered the Tektite habitat anchored 47 feet below the surface of Great Lameshur Bay on St. John Island in the U.S. Virgin Islands National Park. The project required them to live for 60 days in the underwater habitat pressurized at nominal 42-foot depth in an oxygen-nitrogen, two-gas system at a pressure equivalent to 2.15 atmospheres composed of 8 percent oxygen, 92 percent nitrogen. The crew was isolated for the full 60 days since they were precluded from coming to the surface due to nitrogen saturation. Denitrogenation of the body tissues required 20 hours in a decompression chamber to avoid the bends.

The marine sciences studies that were made by the four aquanauts include the areas of marine biology, geology, and oceanography.

The behavioral study was designed to provide information on the aquanauts personal adjustment, social interaction, and task performance. The research was carefully planned to provide information that would be useful to the man-in-space program as well as man-in-the-sea. Data was gathered in

**SPEAKERS AND TOPICS**

December 27 (morning)

*Chairman:* Stanley Deutsch, (National Aeronautics and Space Administration).

*On-Line Behavior Measurements,* Roland Radloff (Naval Medical Research Institute).

*Physiological Indices,* Nicholas Zill (Bellcomm).

*Biomedical Program,*

*Habitability,* Theodore Marton (General Electric Co.).

*Subjective Responses of the Lead Aquanaut,* Richard Waller (Department of the Interior).

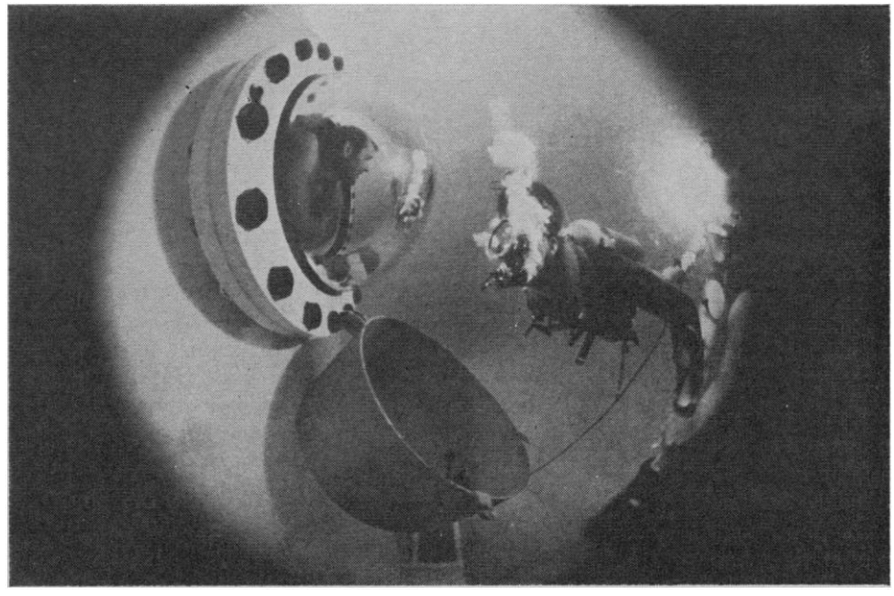
*Habitat Engineering,* John Tenney (General Electric Co.).

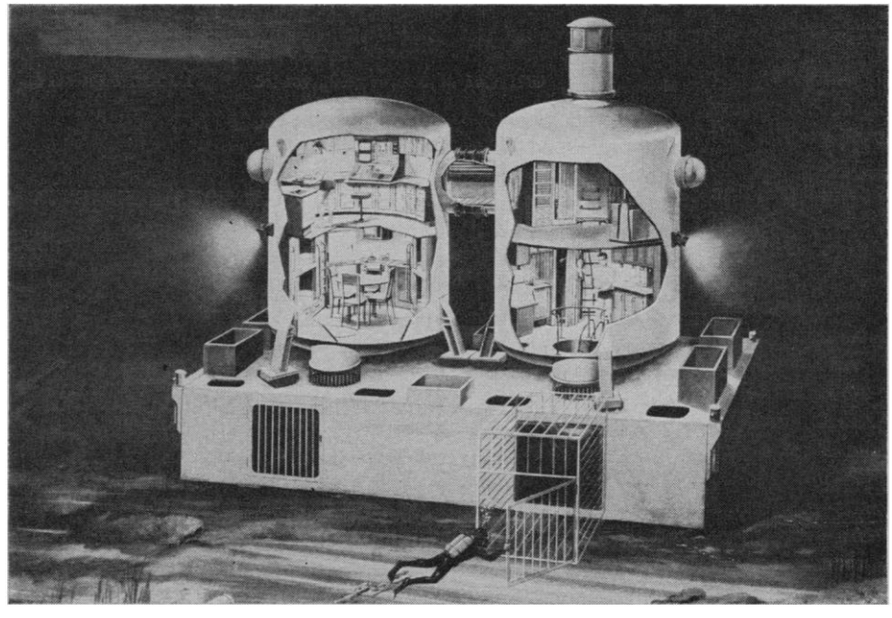
*Long-Term Research,* Stanley Deutsch.

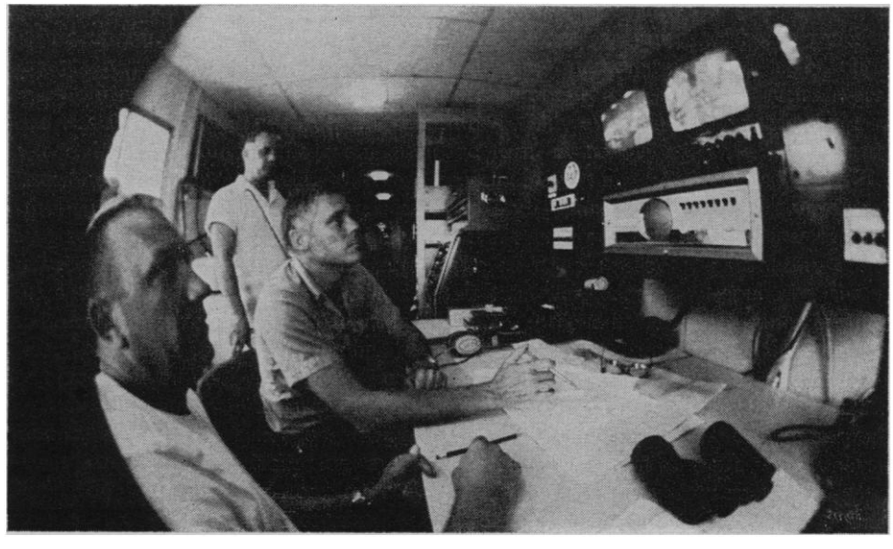
(Top) Aquanauts exchange greetings through one of the portholes.

(Center) Cutaway of Tektite habitat.

(Bottom) Aquanauts were observed by the behavioralists as well as safety and engineering personnel.







the areas of crew selection; habitability for working, eating, sleeping, waste management, and recreation; architectural design; and psychomotor performance. The behavioral data was obtained primarily by direct observation using television cameras and open microphones located strategically around the four chambers in the habitat. Additional TV cameras were located on the ocean floor. The aquanauts were observed continually while in the habitat from 0615 to 2345 each day. A team of psychologists in the surface barge monitored the video and audio transmissions in a special behavioral room not accessible to other topside personnel. In addition, the equipment in the habitat was fitted with timers and automatic switches to provide information on usage. Electroencephalographic data was obtained on three of the four aquanauts during sleep periods.

The biomedical program was divided into two areas; the first was predicated on obtaining research data on the physiological effects of nitrogen saturation for 60 days, including correlation with the behavioral findings. The second purpose was to provide for the crew safety by monitoring health status.

A new dimension, a study on habitability, was introduced. This discipline has received inadequate attention in the past, yet has become recognized as a major factor in contributing to the success of space and undersea missions. The technical content involved is so diffuse that a general classification in the behavioral, biomedical, or engineering research areas was difficult. In general, it was subsumed in the behavior program primarily because the data were correlated with the responses and performance of the aquanauts. However, the engineering requirements were evaluated as well.

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*NASA, Washington, D.C.*

*Preliminary program information appears in the 15 August and 12 September issues of* Science. *Registration forms for the meeting, hotels, and tours appear in the 12 September issue.*