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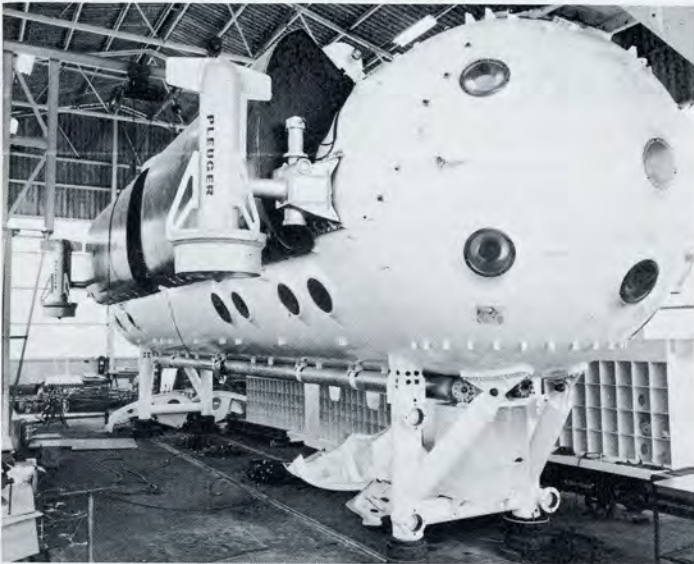
MARCH 1968

## EUROPEAN CONSTRUCTION OF PX-15 IN FINAL STAGES

### Early March Wind-up Planned — Rail/Sea Shipment Will Follow

Construction activities on the Grumman-Piccard PX-15 will be concluded on or about March 1st, at which time preparations will begin for the shipment of the 130-ton submersible to the West Palm Beach operational base. The PX-15 is being built at the Swiss factory of Giovanola, S.A. in Montthey, some 250 miles from the nearest open water.

Grumman Ocean Systems Director, Walter H. Scott, said that all of the major systems will have been installed prior



*Looking more like a submarine each day, the PX-15 awaits final external and internal fixtures at the Swiss construction site.*

to the cessation of construction next month. In recent weeks the ballast tanks, conning tower and keel have been added to the basic pressure hull, and installation of internal equipment, wiring and piping have proceeded with few problems.

Present plans call for the partially disassembled vehicle to be transported by railroad flatcar to Antwerp where it will be loaded aboard as deck cargo on a freighter for shipment to the United States. It is expected to arrive in West Palm Beach in late April, where it will be completely assembled and prepared for sea trials. No date has been set for the official launching.

### Popular Science Cutaway Diagram Shows Life Aboard PX-15 During Drift

*The full-color artist's rendition of the PX-15 which accompanies this issue of the Ocean Systems Newsletter was prepared by Raymond Pioch for Popular Science Monthly. The extremely detailed cutaway drawing appears in the March (1968) issue of the magazine as part of an exclusive by-line article by Dr. Jacques Piccard, describing the aims and objectives of the Gulf Stream Drift Mission.*

### NASA Study Compares Underwater, Space Effects on Long Duration Missions

Final reports in a six month study conducted by the Ocean Systems group at Grumman for the National Aeronautics and Space Administration (NASA) are in preparation; the project sought to determine whether data derived from exposing men to long-term submarine isolation can be applied to the physical and mental rigors of interplanetary space travel.

The preliminary objectives of the project were to learn first if placing men in an undersea habitat is a good means

*continued on page 2*



*Walter H. Scott, (right), director of Grumman Ocean Systems and astronaut-turned-aquanaut, Scott Carpenter, discuss the role of submersibles in preparing spacemen for long interplanetary flights, during one of Carpenter's recent visits to Grumman.*

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for "creating" situations and stresses similar to those an interplanetary crew will encounter during a prolonged trip through outer space.

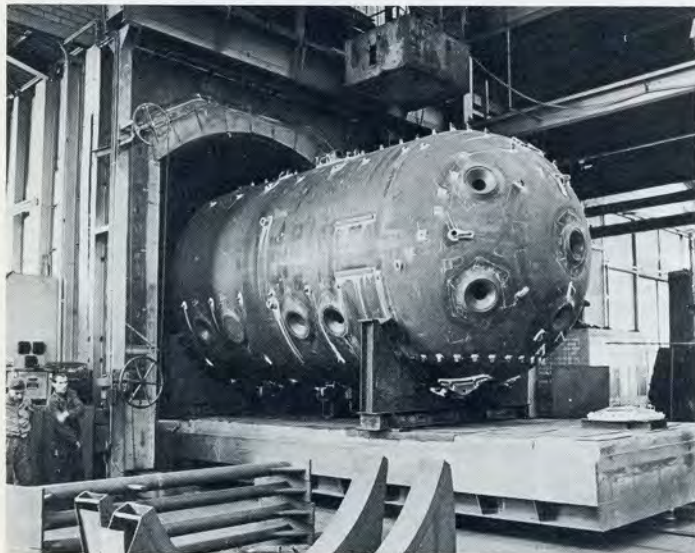
The study compared the similarities of submerged operations and space flight. It determined the degree and variety of crew stresses, identified the elements of undersea testing which will shed light on how astronauts might act during extended missions in space and evaluated contemporary and near-future submersibles that might be used to put the "in-sea" program into effect.

Because of the hostile environment represented by the deep ocean and the long-term exposure to stress which an undersea mission will provide, the Ocean Systems group devised methods for applying data obtained from such a submerged stay to a comparable journey into outer space. The study team considered life support systems, crew size and duty cycles, operational and experimental tasks, crew training and skill requirements, environmental factors, communications and data handling, navigation and propulsion as well as maintenance and repair of the vehicle and its subsystems.

### **Heat Treatment Adds Strength to PX-15 Hull**

To assure the greatest possible structural integrity for the pressure hull of the PX-15, and to increase its strength and reliability, a unique heat treatment process was devised and carried out at the Giovanola building site in Switzerland.

"Slow roasting" in a huge oven relieved residual stresses in the dual hull sections caused by welding. First the forward section was rolled into a electrically-heated oven for treatment. Over several days the section was heated to a tempera-



*A huge oven is used to slow-heat and treat the basic pressure hull, relieving any stresses or faults produced during the welding and machining operations.*



*Poised like an intruder from outer space, a workman sand-blasts the PX-15 pressure hull following heat treatment. Epoxy and final paint were then applied to the vehicle.*

ture of approximately 530 degrees Centigrade. It was maintained there for more than three hours and then allowed to cool. The aft section was treated in the same manner. Prior to and following the heat treatment each weld was checked ultrasonically, by x-ray and die checked. No cracks or serious defects were found.

Following the stress relieving, the hull sections were sand-blasted and given two coats of epoxy conditioner containing zinc to prevent or inhibit salt water corrosion. A final coat of white paint was then added.

The hull sections next were loaded on a flatbed truck for a short trip to Vevey, where machining of the vital flange



*For the specialized machining of the mechanical flange connecting the dual pressure hull sections, the aft pressure hull section was transported some 35 miles to another facility.*

which joins the two sections took place. The 3-mile journey, scheduled to take place in the early morning hours, nevertheless, evoked wide spectator interest, especially as the gleaming white structure was carefully maneuvered around winding mountain roads and through tiny villages along the route. As if to strike a contrast between the old and the new, the motor convoy transporting the forward section paused for a moment at the famous Castle of Chillon by Lake Geneva, matching, as it were, that storied old battlement with the most modern of scientific submarine vehicles!



*Walter H. Scott (center), director of Ocean Systems for Grumman, confers with two of the resident PX-15 program staff during a recent European visit. They include Richard Opsahl, (right), program manager, and Alfred Kuhn, assistant project engineer. Don Terrana, the project engineer, is also stationed in Switzerland.*

### **Special Hatch Permits Release of Film, Tapes, etc. During Drift Mission**

Regular release of photographic and motion picture film tape recordings or written commentary from the PX-15 as it drifts submerged at 2,000 feet in the Gulf Stream is made possible by a unique ejection hatch incorporated in the vehicle's pressure hull.

The "sas" or hatch consists of a hydraulically-operated door flush with the top of the submarine's pressure hull; a pressure chamber beneath it includes a hatch opening into the cabin itself.

Brightly-colored aluminum hemispheres, five inches in diameter will be loaded with exposed film, tapes, documents or small samples of marine life. The inner hatch will be opened and the sphere placed in the "sas." Once the inner hatch is secured, the chamber will be flooded and the outer door opened, allowing the sphere to float to the surface. A window in the inner hatch permits the crewman to be certain that the sphere has begun its ascent before closing the outer

door. Compressed air will be used to blow the water from the "sas" before repeating the procedure.

The aluminum spheres can carry up to two and one-half pounds of payload, and, because of their shape, will not collapse from the underwater pressure, even at depths three times greater than the PX-15's 2,000 foot operating limit.

On the way to the surface this same pressure keeps the two hemispheres sealed tightly. The brightly colored "packages" will enable surface support ships or aircraft observers to spot them more easily.

The "sas" was planned for early in the design of the PX-15 when conferences with television and wire service representatives indicated an interest in day-by-day accounts and photos of the activities within the drifting observation platform. Plans for processing the film aboard the accompanying surface ship or transporting it immediately to shore facilities will be formulated soon.

### **Communication, Tracking Systems Installed at Swiss Construction Site**

The principal electronic subsystems for the PX-15 have been acquired and are being installed at the construction site in Switzerland. The underwater telephone, backup radio system, and range/tracking equipment have been purchased from American manufacturers.

Dual underwater telephone systems produced by Straza Industries of El Cajon, Calif., will provide direct communication between the submersible and the surface support ship. One unit will be employed while the PX-15 is submerged, and the other will be reserved for use while it is on the surface.

In the event that the submarine surfaces at a distance from the support ship, the crew can rely on a standard marine radio, produced by Simpson Electronics, Inc., of Miami, Fla.

Another subsystem is the Ocean Enterprises, Inc. acoustic tracking system, purchased from the San Diego, Calif., firm to assure "fixes" on the PX-15 from the support ship.

The Straza ATM-503 telephone units will serve as the normal mode of external communication during the Gulf Stream Drift Mission. One set will operate with a conical transducer atop the hull for submerged communication with the surface ship. The second utilizes a "donut" pattern transducer mounted on the bow of the submersible for communicating with the support ship while both are on the surface. The units have a range in excess of 7,500 yards, with a carrier frequency of 8.087 kc. Messages received on the surface vessel can be relayed via radio telephone to other ships or shore.

*continued on page 4*

continued from page 3

Should the PX-15 come to the surface beyond the range of the Straza unit, the Simpson equipment will be employed. This system offers eight channels and broadcast band, with a frequency range of 2-5 mc. Output power is 96 watts, derived from 32 volt input power, drawn from the submarine's own battery system.

In its present configuration, the PX-15 will have minimal navigational capability of itself. Instead, it will rely on positioning data relayed from the surface support ship. The acoustic tracking system, operating with an output of 20 watts, will produce continuous information on range and course to those aboard the support vessel. The Ocean Enterprises unit features 28 VDC power input, a frequency of 27 kc and a range of 7,000 feet in moderate seas.



The Grumman hydrofoil gunboat "Flagstaff" (PGH-1) flies above the waves during a trial run off the coast of Palm Beach, Fla. The vehicle, built for the U. S. Navy, utilizes the Grumman base at West Palm Beach where PX-15 will be berthed.

### Ready West Palm Beach Base for Submersible's Arrival

Preparations of the Florida operational site for the PX-15 are progressing with the completion of a 9600 square foot building at West Palm Beach recently announced. Fred R. Bodnarchuk, assistant to the operations manager for the



The hydrofoil PGH-1 stands at dockside adjacent to the Grumman facility in West Palm Beach. The proximity of the site to the Gulf Stream was one of the factors in its choice for the PX-15 operation base.

PX-15, has taken up his duties at the site, preparing welding, metal working, battery service, electronic service and other equipment at the facility. Pneumatic, hydraulic and a wide range of test and evaluation equipment will also be installed at the base prior to the arrival of the vehicle this spring.

### Reprints Available

Reprints of various papers describing the ocean systems program at Grumman and different phases of the PX-15 construction are available on a limited basis. These may be requested by the following titles:

**Manned Submersible Development at Grumman**

**PX-15 Life Support System**

**PX-15 Pressure Hull Construction**

**Electrical Power System for the PX-15**

**PX-15, A Design for Future Needs**

Requests should be directed to: C. VINCENT RAU  
BUSINESS DEVELOPMENT DEPARTMENT, PLANT 5  
GRUMMAN AIRCRAFT ENGINEERING CORPORATION  
BETHPAGE, NEW YORK 11714

