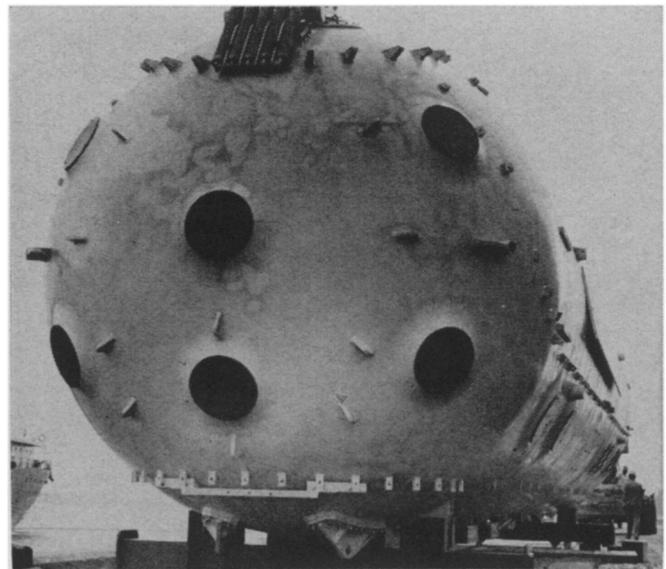


Naval Oceanographic Office

Velocities of waterflow within the slow-moving Gulf Stream (profiles at right) vary with both depth and time of year.

Chasing the Gulf Stream

Six weeks underwater should clear up some of the mysteries of the current first charted by Benjamin Franklin



Grumman

PX-15 preparing for launch in Florida.

The Gulf Stream carries 22 times as much water in its northward flow as all that discharged by all the rivers of the world. It was first charted by Benjamin Franklin nearly 200 years ago. That chart was necessarily inaccurate; even now the stream's course is not accurately known.

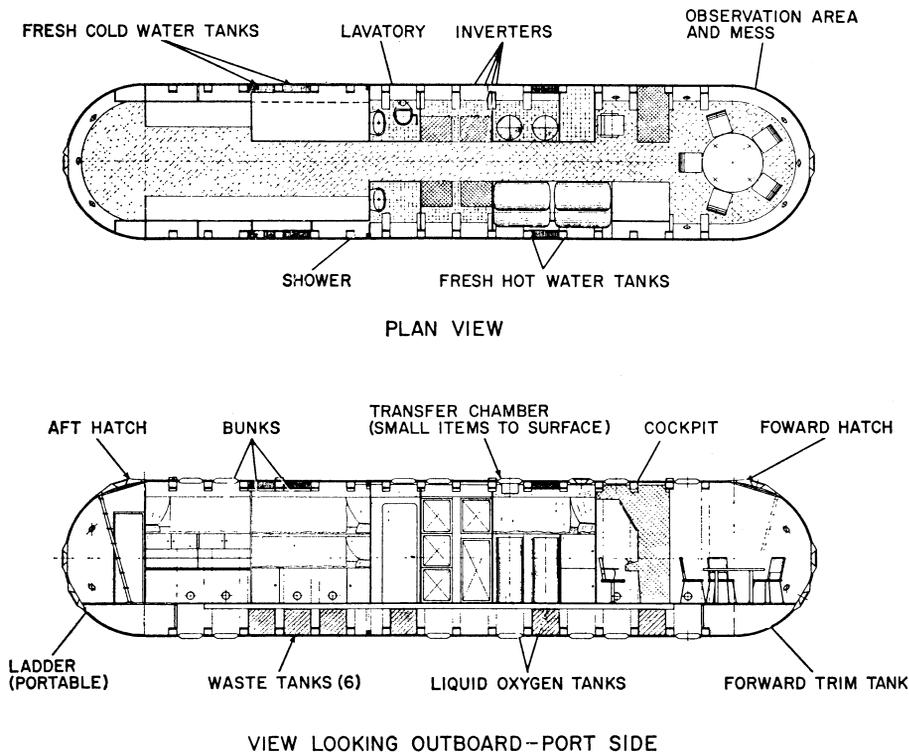
Franklin made his own observations of water temperatures on several Atlantic crossings by picking up buckets of

water, and recommended this method to sailing captains to guide them as they entered or left the stream's relatively warm waters.

More precise data should come from a four- to six-week study of the ocean current, to be begun within a year by six scientists drifting silently in a submarine at between 300 to 2,000 feet below the ocean surface.

Temperature testing will also be used

as a crude navigation method by the sub, to be christened the Ben Franklin by the time it makes its first long underwater journey—1,500 miles—next spring. The sub will be powered mainly by the sun's energy as embodied in this great ocean current. The trip of Dr. Jacques Piccard's PX-15, as it is now known, has been planned since 1966, with most of the \$2.5 million spent so far on the project from Grumman Air-



Two views of the Ben Franklin—adequate space for six men for six weeks.

craft Engineering Corp. in Bethpage, N.Y. First suggestion of the concept of the PX-15 came in Sept., 1964. But the Gulf Stream drift mission might still be just an idea instead of approaching reality, says Dr. Piccard, had it not been for Grumman, which believes deep work vehicles on the order of the PX-15 hold great promise. Valuable experience for building the PX-15 was gained during the construction of the Auguste Piccard, the world's first mesoscaph, which made 1,100 dives in Lake Geneva in 1964, introducing some 30,000 people to the underwater world. The Swiss sub was named for Dr. Piccard's father. The Franklin is scheduled for launch on Aug. 21, from West Palm Beach, Fla. All of the equipment except the hull will have been thoroughly tested for ability to stand pressures at least twice those encountered at 2,000 feet below the ocean surface, the lowest depth at which the vessel is expected to sail. The hull is designed to withstand pressures down to a minimum of 4,000 feet, but will be tested further by trial dives and a one week cruise between fall and the long spring journey.

One of the prime scientific purposes of the trip, according to Dr. Piccard, is the charting of Gulf Stream's scattering layer, tiny plankton that drift toward the surface at night and lower during the day. Sonar waves bounced from such plankton layers are often confused

with the echo from the real ocean bottom, yielding false depth readings and confounding navigation.

Another aim is to make measurements of the temperature, salinity and other physical characteristics of the Gulf Stream itself, in which the Ben Franklin will drift at an estimated average of two knots.

The Gulf Current drift was originally planned for this year; it was postponed to allow participation of the Naval Oceanographic Office in the project. Three of the six crew members will be Navy scientists. Skipper of the Grumman craft will be Donald J. Kazimir, a former U.S. Navy submarine officer.

Captain Kazimir's chief worry, as it is for all submariners, is the chance of a leak. Because of the water's pressure, it is difficult to spot the leaking point; the water from even a tiny pinhole streams through with such force that it ricochets many times, making location of the source difficult.

For Dr. Piccard the only foreseeable hazard is the unknown meanderings of the Gulf Stream north of Cape Hatteras, where it veers eastward from the continental shelf into deep water.

The Ben Franklin differs from the usual submarine in its ability to drift at a given depth. Most submarines have hulls that are more compressible than water; when they dive, their volume shrinks, making them more dense than

their surroundings. They can, therefore, stay at a desired depth only by using propellers or constantly regulating water ballast.

The Grumman drifter, however, is less compressible than water. It will, therefore, not tend to keep going down once it has been ballasted for a certain depth. Nor will it rise, since its rigid steel hull subtracts density less quickly than the surrounding water.

Because it is soundless, instruments aboard the Ben Franklin will be able to record the background sounds of the ocean, a subject of great importance to specialists in underwater acoustics.

The submersible was built in Switzerland according to Dr. Piccard's basic design, then disassembled and shipped to the United States. It has 29 viewing ports and a life-support system that can sustain six men for up to six weeks.

Crew members of the Ben Franklin will eat dehydrated food mixed with either hot or cold water; 1,568 pounds of each will be carried on board. To conserve energy, the hot water will be heated before departure and stored in well insulated tanks that will keep it hot for at least six weeks.

Although the Gulf Stream will supply the main motive force for the research ship, propulsion for maneuvering will come from four 25 horse-power alternating current electric motors, giving it a speed of four knots if needed. The motors can be fully reversed and rotated, thus providing up, down and reverse thrust as required. The mission will be terminated when about 80 percent of the total 750 kilowatts of power have been depleted.

Since the vessel will remain submerged after being towed to its diving point, it will not be able to determine its position with sufficient accuracy for its scientific missions; they will require that all data recorded during the drift be correlated with respect to depth, latitude, longitude and time. For that reason it will be in communication with an overhead mother ship, both by underwater telephone and by occasional release of five-inch spheres containing exposed film and records. These will be fished out of the water by the surface ship.

The mother ship, which will be used for experiments in connection with the submersible, is expected to set a record of its own. Since the Ben Franklin will be drifting at about two knots from 300 to 2,000 feet down and the Gulf Stream's current is about four knots at the surface, the ship will have to travel in the opposite direction at two knots to stay on station.

Dr. Piccard's comment: "It should be the first time that a ship has sailed 1,500 miles backwards."