

## OCEANOGRAPHY

# Inner Space: The Oceans

Men of science today are turning to the vast oceans as a rival to outer space in mysteries, adventure and benefits to mankind. The restless seas offer valuable resources.

By BARBARA TUFTY

► THE OCEANS are rivaling the moon as the next big objective of multi-million dollar scientific research.

Relatively neglected for hundreds of years since the voyages of the Phoenicians and Greeks, oceanography is now taking breathless new strides forward as biologists, physicists, mathematicians, geologists, chemists, engineers and many young and old neophytes turn enthusiastically toward our inner, not outer, space.

Until three or four years ago, lack of adequate funds, facilities and trained personnel prevented man from searching the ocean depths with any degree of thoroughness. Most equipment was limited and improvised, ships were archaic and the few men interested were relatively powerless to act.

Gradually Federal, scientific and popular interest began to grow, and now much needed funds are being appropriated to fathom the seas. Events such as the tragedy of April 1963, when the submarine Thresher went down with 129 men off the coast of Cape Cod, gave further impetus to understanding the vast fluid mass of water that can be a destructive enemy as well as a powerful benefactor.

## Sea Knowledge Urgent

Now plans, projects and Congressional bills to coordinate a national program for oceanography and establish a unified agency reflect a growing sense of urgency to overcome our astonishing lack of sea knowledge.

About \$135 million is in the President's budget for the fiscal year 1965, and a ten-year program calls for \$2.3 billion for ocean study—still only a tiny fraction of the cost involved in projects reaching for the moon and the space beyond.

One immediate tangible result of this new surge of interest is the fleet of newly designed, modern instrumental research ships that are quietly slipping into the seas off the Atlantic and Pacific coasts.

Basically there are three kinds of ocean research vessels: above-surface ships, mobile submarines, and the more cumbersome but deeper diving bathyscaphes.

Until recently the surface ships were usually reconverted tankers, freighters, schooners or other ships to which scientific equipment was added. Now efficient surface ships are being specifically designed and built for ocean research from the keel up.

Mobile submarines of marvelously weird designs are being built to probe into nooks and crannies around the bottom of the shores and continental shelves. Many of these odd vessels, like mechanical robots

from outer space with their comic bug-eyed windows and jointed mechanical arms for plucking up sea treasures, have crept into the ocean last year, and more will soon follow.

The circular two-man Diving Saucer is now peering around ocean shelves a thousand feet deep off the California coast; the perky 22-foot long, two-man Alvin at the Woods Hole Oceanographic Institution can dive to 6,000 feet; the Jules Vernish searchlighted Aluminaut was launched to probe the dark depths of 15,000 feet; the three-man Deepstar will dive to 4,000 feet later this year; two other models of the Deepstar are designed to dive to 12,000 and 20,000 feet.

Bathyscaphes are spherical, thick-hulled vehicles designed for deeper diving than most submarines. These vessels are less mobile than the subs and move essentially only in a vertical motion instead of horizontally around the ocean floor. Built much like an ascension balloon, they have a gasoline-filled bag or float from which is suspended the gondola with men and equipment. The Trieste, which set the world's deepest diving record by descending

35,800 feet in 1960, is of this class.

Another strange vehicle, the Navy's Sealab, will set no depth records, but four Navy divers—a doctor and three enlisted men—will live in the vessel, 200 feet below the surface, for three weeks. The divers will leave their 40- by 9-foot home from time to time, but only for research purposes. Throughout the experiment they will remain submerged.

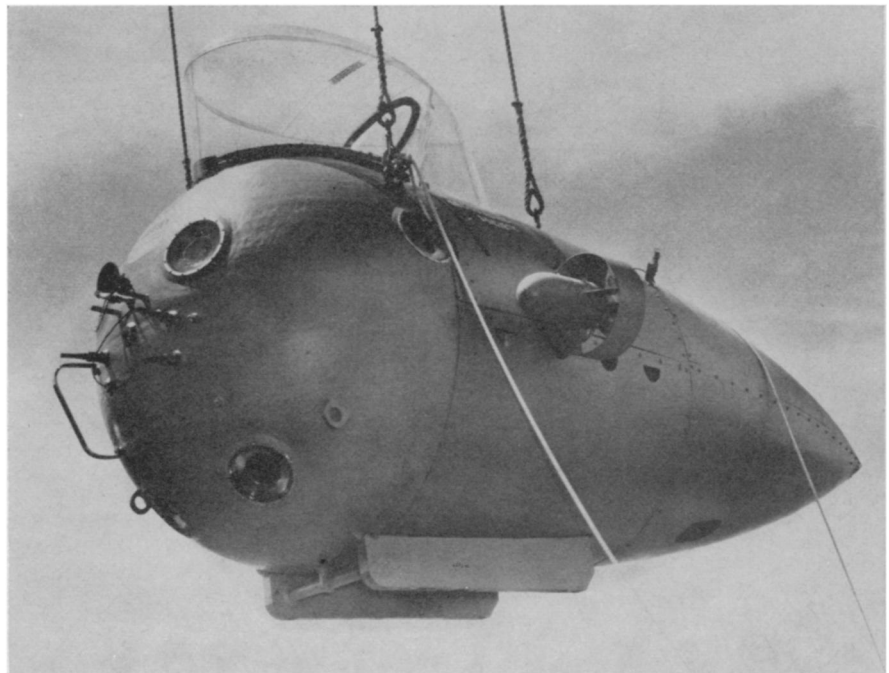
A new charter service, the Westinghouse World Wide Charter Facilities, now leases undersea diving vessels, equipment and experts.

## Flip Named Literally

There are also other types of research ships, such as the remarkable 355-foot long ship, Flip, which literally flips up on end, the lower tubular part forming an immersed vertical laboratory in the sea.

A variation on Flip is SPAR, short for Seagoing Platform for Acoustical Research. SPAR is smaller than Flip, only 354 feet long, but instead of carrying a human crew as Flip does, it operates automatically, radioing some of its data back to shore and processing the rest on board.

As this small armada of individual ships slowly inches deeper into the murky uncharted depths, man is beginning to discover new volcanoes, powerful currents and dark mountain ranges within the seven



General Dynamics Corporation

**SHIPWRECK SEEKER**—This two-man submarine was used for the first time last summer on archaeological expeditions from the University of Pennsylvania Museum searching for ancient shipwrecks in the Aegean Sea off the coast of Turkey. The two two-horsepower motors, enabling operation at speeds up to four knots, can be rotated 360 degrees so that the submarine can hover in helicopter fashion.

shining seas that cover more than 70% of the earth's surface.

The maps we now have of the ocean floor are about as crude as the land maps guiding explorers of the 18th century. Only about three percent of the ocean bottom has been reliably mapped. Some scientists point out that we know more about the surface of the moon than we know about the bottom of the oceans. Once considered flat and uninteresting, the seascape of the ocean is now being revealed as a fascinating region. Here in the eerie cold darkness at depths where sunlight cannot penetrate, deep-sea canyons dwarf anything we know on land.

### Deepest Canyon Known

The deepest sea canyon yet discovered is the Mariana Trench under the Pacific Ocean near Guam. It plunges 35,810 feet below sea level—about a mile deeper than Mt. Everest thrusts into the atmosphere.

Underwater mountain ranges soar much higher than those that rise from land into the air. Giant unexplored ranges run down the middle of the Atlantic Ocean from Iceland, curving around the tip of Africa into the Indian Ocean and meeting another mountain chain that loops down into Antarctica and up through the Pacific Ocean to the coast of lower California.

From measurements of heat flow that radiates from the earth's core, generated from radioactive materials and tremendous pressures, scientists believe that rocks of the earth's mantle are slowly rotating in huge circles, much like thick oatmeal boiling slowly in a pot. These giant wheels of molten rock, thousands of miles in diameter, flow out from the earth's interior and may cause the movement of the continents.

Then there are the mighty rivers that course through the oceans, some of which have influenced the weather and climate on the land for eons, and aided sailors across watery tracts for centuries without their realizing why.

The Gulf Stream, with its northward flow of warm tropical waters from the Caribbean Sea, has been sweeping ships eastward and keeping England and Europe relatively warm from winter freezes.

South of the equator, another huge current rotates in the opposite direction, and similar great circles of currents sweep across the north and south Pacific Ocean. These and other currents result from effects of wind, temperatures and the spinning of the earth.

### Study Effects of Currents

By understanding more about these currents, perhaps controlling them, meteorologists hope to alter climates and weather over the land masses.

Recently scientists have discovered a huge underwater jet stream flowing westward under the eastward-flowing Equatorial Current—with a volume about 1,500 times that of the Mississippi River.

Other powerful flows of water result from the gravitational pull of the moon and sun—the tides that move around the oceans with their crests and troughs about six

hours apart. Pulled more toward the nearer sky body, the moon, these humps of water constantly collide into the rocks and sands, harbors and rivers of our continental coasts, sometimes causing a powerful rising and falling surge of the sea that is even now being harnessed by man for generating electrical power.

### Bountiful Treasures Suspended

Suspended throughout the ocean lie bountiful treasures, eyed by mineralogists—vast supplies of precious sodium, calcium, sulfur, magnesium, boron, cobalt, iodine, vanadium, gold and silver.

Scientists estimate that more than 166 million tons of dissolved salts float in one cubic mile of seawater. Engineers are working to improve methods for gathering these rich minerals, perhaps in the same huge desalination plants where fresh water is being extracted from the sea.

Other scientists are probing the regions under the sea floor for deposits of gas, coal and oil to replace our fast depleting supplies under the land.

Across the enormous sunlit surfaces of the ocean, in layers ranging from the surface to 900 feet deep, lie many secrets of life closely inspected by biologists searching for sources of food for hungry humans. Here drift the green pastures of microscopic sea plants.

Perhaps 15,000 different kinds of these delicate, beautiful cells drift with the wind and currents, sources of food for the next link in the chain of sea life, the tiny sea animals called zooplankton.

These microscopic creatures in turn are eaten by small fish such as herring and sardines, which are engulfed by larger fish in the complex and ruthless succession of life feeding upon life.

### Life Feeds Upon Life

In death, the remains of these plants and animals sink from the blue-green surface into deeper, darker, cooler waters, where bacteria release the nutritious phosphates, nitrates and silicates into the sea again. Here the ever-moving ocean lifts these molecules upward toward the surface, where they adhere to air bubbles to form tiny bits of brown shapeless matter, vast supply of food for the life cycle in the sea.

The rest of the falling debris sinks deeper yet into the ocean, to become food for strange fish with luminous lights, inhabitants of the deep inner world of cold, tremendous pressures and total darkness.

At the very bottom of the sea creep even stranger creatures of brittle stars, sea cucumbers and tiny crustaceans, sources of inspection by men probing how to withstand tremendous pressures.

Thus flows the restless ocean, that whose resources and power are beginning to be harvested and controlled by man. Rolling for countless centuries through periods of dark storms and serene sunlight, this huge fluid world will continue to flow on in majestic splendor, impervious to impacts of man and machines.

• Science News Letter, 87:42 January 16, 1965

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