

OCEANOGRAPHY

Conquering Inner Space—Oceans

A new U. S. emphasis in exploring and solving the secrets of the oceans promises to yield many benefits for mankind, Vincent Marteka reports.

See Front Cover

► THE OCEANS blanket nearly three quarters of the globe, yet scientists still know less about the oceans than the moon.

Although a bathyscaph has bumped bottom in the deepest part of the ocean and oil-well drilling rigs now dot the offshore shallows, scientists still know very little about the huge area between the ocean's edge and the deepest portion.

U. S. scientists are now trying to plug this gap by planning extensive programs to chart the huge ocean expanses, plumb the ocean depths and sample the ocean bottoms. Their purpose: to push back the long-ignored oceanographic frontiers, solidify the defense of U. S. shores, and extract the wealth of minerals and food from the oceans.

Teeming fish life and untold mineral wealth lie waiting in the ocean depths for man's use, as shown in the picture on the cover of this week's SCIENCE NEWS LETTER.

A man standing on Mars would see the earth as a watery planet with the continents floating like islands on a salty sea. Yet man still thinks of the earth as land.

The ocean bottom lying underneath 1.5 billion tons of water is a huge uncharted tract seldom touched by man's probing instruments. Although oceanographic surveys have discovered major mountain ranges, deep ocean trenches and isolated mountains, only two percent of the ocean bottom is adequately charted. Much of it was mapped during the International Geophysical Year.

Most of the underwater mapping has been limited to the continental shelf, an underwater lip of land skirting the continents.

The swirling currents and teeming sea life of the ocean depths still pose a large mystery to oceanographers. Last year Swiss scientist Jacques Piccard plunged in a bathyscaph nearly seven miles into the deepest part of the Pacific Ocean and found, to the surprise of scientists, that fish could live at such depths.

Influence Climate

The extensive oceans also greatly influence the earth's climate. The oceans store huge quantities of heat, acting as a huge heat engine that drives the circulation of the atmosphere. By learning more about the relationship between the oceans and the atmosphere, man may one day control his climate.

With the threat of Russian nuclear-powered submarines slipping through outmoded U. S. defenses, scientists must develop sophisticated instruments that can

"see" the enemy subs, and also chart "road-maps" of the ocean bottoms for U. S. submarines. The U. S. Navy, realizing the military importance of making the seas transparent, recently announced a 10-year, \$1 billion oceanography program to build more oceanographic ships and to learn more about the "shape and nature" of the oceans.

By conducting oceanographic research, scientists can find currents and layers that either muffle, stop or conduct sound waves from sonar instruments.

One of the most promising sonar systems, Artemis, evolved from oceanographic research. The system, currently being tested at sea, uses huge ship-borne sound-makers lowered to depths where sound travels best. The sound waves would bounce off submarines trespassing a vast network, and the waves would be picked up by underwater phones and radioed to shore.

With the crowding of land by a skyrocketing population, man may soon count on the sea for food. About one-tenth of the food consumed in the United States comes from the oceans. Besides this, some 2½ billion pounds of fish used as animal feed and oil indirectly benefit humans.

To Increase Harvest

In order to increase the potential harvest, more studies are needed not only on the whereabouts and movement of fish, but also the distribution of water temperature, salt content and the fish's food supply.

"Until such studies mature, man must be hunters rather than farmers, searching out the game and capturing them, rather than raising them as done on land," Dr. Harris B. Stewart, chief oceanographer of the U. S. Coast and Geodetic Survey, told SCIENCE SERVICE.

The ocean bottom and the waters themselves hold rich storehouses of minerals. Since the oceans first formed a few billion years ago, the mineral resources of the land have been eroded and washed into the seas by rivers. Huge chunks of rich manganese-cobalt-iron "ore," some as large as grapefruits, are strewn along many ocean bottoms. Some scientists believe they are the work of microscopic organisms that can concentrate these minerals in an unknown manner.

Although the oceans are looked upon as a possible cure-all for many of the world's future problems, care must be exercised as to the proper use of this expanse of no-man's land. Past history has taught how man abuses his resources by stripping the forests, indiscriminately using up the mineral resources and polluting lakes and

streams. Already, the oceans are being used as a dumping spot for the radioactive wastes of the nuclear age. Scientists must first learn more about the silent ways of ocean currents, for they could spread the contamination and curtail the use of the oceans for thousands of years.

The new emphasis on oceanography has captured the imagination of layman and scientist alike. Scientists predict that oceans in the near future will be criss-crossed with defensive, meteorological and oceanographic networks. Automatic weather stations bobbing on the surface will constantly chart the changing sub-surface currents, temperatures and salinity, so that "weather maps" can be issued for underwater travelers. Remote-controlled robots housing a TV "eye" will pick up samples of the ocean floor while nuclear-powered "pods" filled with passengers or commercial goods glide by on the way to distant ports.

In the shallower basins, sea "farms" will



RECORD LAMP—This five-foot-long lamp is believed the largest mercury-fluorescent lamp in the country. Four inches in diameter, it produces as much light as 400 household bulbs and is intended for large-area floodlighting.

be growing shellfish, fish and "ores" with methods gleaned from oceanographic research.

The United States has already made a big step in this direction. The U. S. Navy, along with its anti-submarine systems, now route ships through ocean lanes where waves offer the least resistance. The U. S. Weather Bureau has an experimental floating weather station that once hinted when Hurricane Diana was brewing off the coast.

Scripps Institution of Oceanography scientists have a remote-controlled "robot" patrolling the Pacific Coast fringes, while scientists from Project Mohole have already penetrated the once-mysterious volcanic layer underlying the soft ocean bottom sediments.

MEDICINE

Acids Linked to Immunity

► VIROLOGISTS have a new dimension to use following discovery that free viral nucleic acids are infectious.

Dr. Roger M. Herriott, professor of biochemistry in the Johns Hopkins University School of Hygiene and Public Health, focuses attention on properties of viral nucleic acids that may lie behind the reasons for permanent immunity.

The resistance of infectious nucleic acids to antibodies, Dr. Herriott reports in *Science*: 134, 256, 1961, may explain some conditions that are at present baffling.

The infective nature of viral nucleic acids (the stuff of life) was discovered first in plant viruses and then demonstrated for poliomyelitis and a variety of diseases.

The scientist points out that after recovery from certain virus-caused diseases such as polio or yellow fever, individuals are permanently immune to the agent.

"To account for this," Dr. Herriott says, "it has sometimes been thought that perhaps

These feats have been matched by Woods Hole Oceanographic Institution scientists who are planning to string a line of unmanned monitored buoys from Cape Cod to Bermuda to continuously collect oceanographic data.

The sign that oceanography came of age was reflected in President Kennedy's 1961 budget request to Congress for \$97,000,000—nearly double the amount spent on oceanography last year. Bills pending before Congress would give President Kennedy's program a further push.

"Knowledge of the oceans is more than a matter of curiosity. Our very survival may hinge on it," the President declared in a special message to Congress.

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in these cases there is a very low level infection maintaining a stimulus for antibody formation."

The infectious nucleic acid provides a model for maintaining an infection in the presence of antibodies, he says. "Released nucleic acid would infect a few susceptible cells and maintain the infection. The larger range of cell hosts for the nucleic acid may be particularly important in this connection."

Summarizing, Dr. Herriott says, "Viral nucleic acids have been found to be infectious for tissues and animals, yet are nonantigenic and resistant to antibodies against whole virus."

"The release from infected tissues of even a small proportion of total virus as free nucleic acid could, in an otherwise immune individual, lead to a low level of infection which would, perhaps, explain permanent immunity."

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PSYCHOLOGY

"Climbers" Prone to Illness

► "NONHAZARDOUS" occupations can be dangerous for men who work their way up.

Eighty-four out of 139 young men between the ages of 22 and 32 who had attained managerial positions showed more illness than 55 co-workers who stepped into the same kind of job right out of college.

Dr. William N. Christensen and Lawrence E. Hinkle Jr., both of the departments of medicine and psychiatry, New York Hospital-Cornell Medical Center, reported in the *Journal of the American Medical Association*, 177:247, 1961, that the men who had worked their way up displayed both acute and chronic symptoms, including signs indicating eventual high blood pressure and hardening of the arteries.

The physicians tested diet and smoking habits, hereditary factors and social back-

ground among other points to show that illness is caused by complex biological interactions taking place between man and his environment.

The men who were sick more often were sons or grandsons of immigrants. Their fathers had been skilled and unskilled laborers. They had grown up in modest to substandard neighborhoods in low-income families where the fathers generally had a grammar-school education or less.

As a result their climb up the ladder of success was full of challenges, threats, demands and other factors of a domestic and financial nature. The place they gained at the top was unfamiliar to them.

The college graduates, with few exceptions, were fourth-generation Americans, the sons of managers and other types of white-collar workers who had acquired at least a high-school education and often

more. They had grown up in families of middle to high income, in medium to substantial neighborhoods, the researchers found.

This meant that the college men were living and working in a social environment with which they had a lifetime familiarity.

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PHYSICS

Ancient Principle Might Have Saved Capsule

► THE SPACE-AGE capsule lost after the U. S. second successful manned space shot probably might have been saved by applying a scientific principle advanced more than 2,000 years ago by the Greek philosopher, Archimedes.

According to Archimedes' principle, the Liberty Bell 7 capsule, even flooded with water, would weigh less in water than it did in air, due to the buoyant effect of water. By releasing more cable and letting the capsule sink a few feet below the ocean surface, the rescuing helicopter probably could have held on until help arrived.

During actual rescue operations, the capsule was cut loose from a hovering helicopter when its motor overheated as it was trying to lift the capsule.

Archimedes noted that lighter, or less dense, material is more buoyant in water than heavier materials. Scientists now wonder whether the vacuum-packed instrument packages, the padded fiber-glass space seat, and other lightweight materials within the capsule could have helped lessen the average density of the submerged metal capsule, making it much more buoyant or lighter than in air.

National Aeronautics and Space Administration scientists are meanwhile keeping silent as to the exact materials contained in the Liberty Bell 7 capsule.

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PHYSICS

Solid Matter Viewed Directly by X-Rays

► A METHOD for direct visual observation of the interior of solid materials, such as metals, was reported to the American Crystallographic Association in Boulder, Colo.

Drs. G. W. Goetze and Abraham Taylor of Westinghouse Electric Corporation, Pittsburgh, said the system is an improved method of X-ray diffraction—a means for observing the patterns formed by passing X-rays through a crystal. The diffraction pattern of a material is its "fingerprint," a positive identification of the nature of the material and the alignment of its crystals.

In the new system, the diffraction pattern strikes a photosensitive surface, from which an identical pattern of electrons is released. The electrons in turn strike an amplifying surface, the emission of which excites a photosensitive output surface, creating a visible image some 100 times larger than the original. Greater magnifications are possible with larger and more powerful X-ray sources.

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