OCEANOGRAPHY

Ocean Deserts Enriched

Reactors may be used to stir up deep water nutrients to enrich barren sea areas. Microscopic plants can grow and in turn support larger fish.

NUCLEAR REACTORS may be used to make ocean deserts fertile by stirring up deep-water nutrients.

The green pastures of the open seas, areas with abundant life, are limited to those areas where a natural vertical circulation plows up nutrients from the deep waters to the sunlit surface waters, where plant and animal life can flourish.

These nutrients, largely dissolved minerals, foster the growth of phytoplankton, floating and usually microscopic plants. The phytoplankton, in turn, support animal life from minute zooplankton, or floating animal life, to the larger fish men harvest for food.

Many surface areas of the ocean lack this nutrient supply. Not fed by vertical currents, and thus not having the benefit of their fertilizing process, these ocean deserts cannot support much animal life.

The Committee on Oceanography of the National Academy of Sciences-National Research Council in Washington, has recommended in a recent report that a three-stage approach be made towards turning some of these deserts into fertile ocean.

The first stage involves developing proposals for artificially inducing upwelling and determining the feasibility of the proposals. The second stage is a period of detailed engineering development of the promising proposals. The third stage would include pilot-scale trials of devices that are developed.

One of the suggested methods for stirring up deep-water nutrients where no natural upwelling occurs is to place a nuclear reactor at a sufficient depth in the water and make it produce enough heat to cause a large quantity of water to be forced up by convection.

Another possible method might be some form of mechanical agitation. Richard Vetter, executive secretary of the Committee, told SCIENCE SERVICE of one such technique.

It would involve anchoring a floating chain in the Florida Current between Florida and Cuba. To the links of this chain would be attached huge metal flaps. As the deep-ocean currents caused the bottom flaps to "wave," the subsequent movement would be carried along the whole length of the chain, even up to the stiller, shallower areas.

Such a system would create a vertical turbulence to disturb or interact with the laminar movement of the deep currents. Because the Florida Current is a part of the Gulf Stream, Mr. Vetter said, a mechanical device like this might help in fertilizing many ocean desert areas throughout the North Atlantic.

A third possible technique, Mr. Vetter said, was to lower a long plastic pipe into the ocean so that one end was near the bottom and the other near the surface. Because deep water is always colder and sometimes less salty than surface water, the denser deep water could be pumped upwards through the tube, be gradually heated by the water outside the tube, and thereby made less dense. Once pumps had started such a system, the water would continue to flow by itself, provided the deep water and the surface water maintained this relationship.

These are three of the possibilities to be tested in the feasibility phase of the Committee's recommendation for making fertile seas out of ocean deserts. The recommended budget calls for a $1,410,000 outlay within the next ten years.

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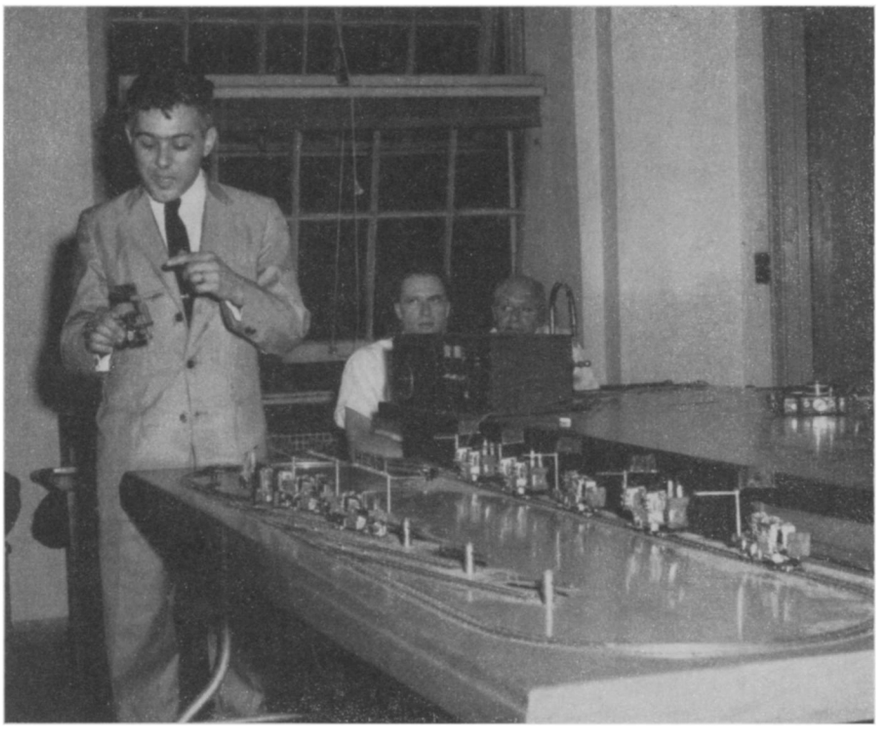

REPRODUCING MACHINE—Prof. Homer Jacobson of Brooklyn College's department of chemistry, demonstrates for the first time publicly a working model of a non-living self-reproducing device. RSD I, as the device is named, contains a two-part "organism" that can assemble copies of itself from a supply of its own parts. The operator of RSD I must start the "reproductive" process.

PHYSICS

Atomic Clock Designed To Prove Relativity

See Front Cover

A 30-POUND atomic clock that will neither gain nor lose one second in a thousand years and "ticks" 24 billion times a second is being developed for a satellite by Hughes Aircraft Company, Culver City, Calif., under a $200,000 contract from the National Aeronautics and Space Administration.

Dr. Harold Lyons, Hughes scientist and inventor of the first atomic clock, is shown in the photograph on the cover of this week's SCIENCE NEWS LETTER examining the tubular heart of the clock. The tube will house the stream of ammonia molecules that generates a highly stable current.

Orbited by a space satellite, the clock would transmit rapid oscillations to be compared with time shown by another maser type clock on earth, thereby giving Einstein's general theory of relativity a very searching check. Dr. Lyons said the Hughes-proposed clock also could measure precisely the geometric shape of the earth, investigate whether space is the same in all directions and recheck Einstein's special law of relativity, from which the famous "twin paradox" concept is derived.

The satellite clock's primary purpose will be to check Einstein's proposition that a clock running in a gravitational field far above the earth's surface would apparently run fast relative to a clock on earth.

(The twin paradox may be explained as follows: If a twin could be launched with the clock in its orbit around the earth, he would return younger than his brother who stayed at home on earth. If he could travel 20 years at near enough to the speed of light, or 186,000 miles per second, he would find the earth much more than 20 years older upon his return.)

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