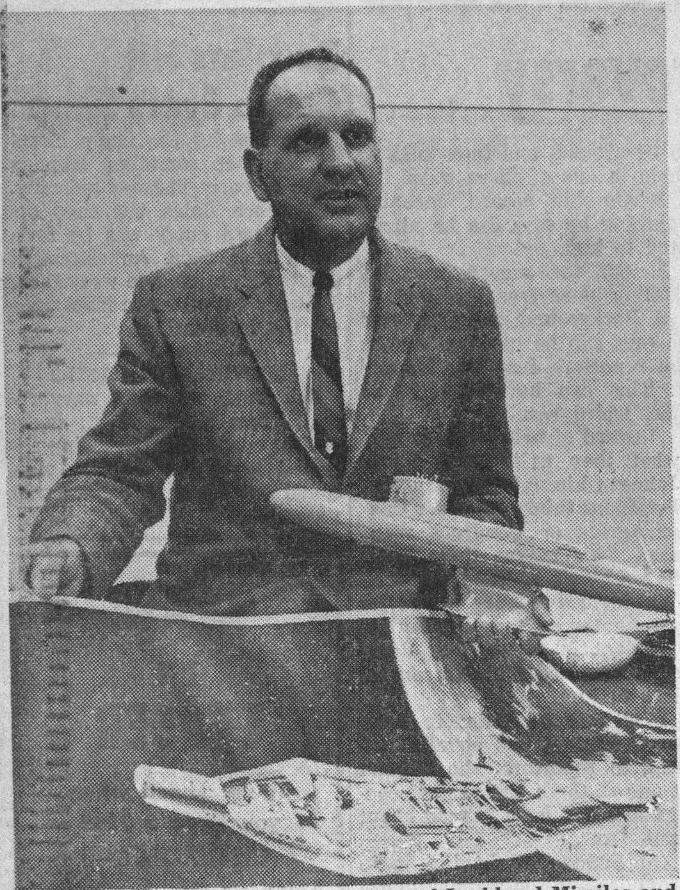
Business K-L

Lockheed Research Links Outer Space, Under Sea



A model of a nuclear submarine and a manned orbiting laboratory concept symbolize for a Lockheed scientist the similar problems faced by "aquanauts" and astronauts. Dr. J. A. Kraft, assistant manager of Lockheed Missiles and Space company's bioastronautics laboratory in Sunnyvale, points out that plans for keeping man in space can draw heavily from experience in maintaining man under the sea.

There's more mileage in the research dollar today because of the direct parallels between strange worlds of the astronauts and the "aquanauts", a top scientist at Lockheed Missiles and Space company in Sunnyvale said today.

Dr. J. A. Kraft, assistant manager of Lockheed's bioastronautics organization, discussed the similarity of problems — both biomedical and mechanical — scientists must solve in exploring outer space and the "inner space" of the ocean's depths.

"Because of this similiarity," Dr. Kraft said, "we have in the ocean a readily available laboratory environment. In it we can investigate the more significant problems common to both.

"In many ways they are opposite sides of the same coin," Dr. Kraft said.

Both astronauts and aquanauts face the same basic problems, he continued. One is the change in the pressures in which they must live and work. In the case of aquanauts, the problems center around bringing man from the multi-atmospheric pressures of extreme depths to the normal pressures of the earth's surface.

For the astronauts, he said, a major problem is finding ways to permit man to function in the relatively lower pressure of the space capsule, and from there move into the vacuum of outer space itself.

Other biomedical problems common to man-in-space and man-in-sea include dysbarism (various gases trapped in the body), oxygen toxicity, and trace contamination.

Sometimes there can be too much of a good thing, Dr. Kraft said, referring to oxygen toxicity. While oxygen is the basic and vital element in the air we breathe, it may be hazardous to breathe pure oxygen for extended periods of time under abnormal pressures. Furthermore, the tolerance varies with individuals.

The trace contamination problem involves minute quantities of solids, liquids or gases present in air systems which might become toxic in higher concentrations. These include body waste elements from materials used in equipment, and even the spacecraft or seacraft walls themselves.

As prime contractor for the navy's Polaris missile system, Lockheed scientists have studied this problem as it exists in submarines submerged for long periods of time.

Spacemen and underwater explorers also face the common danger of anoxia (deprivation of oxygen). "Just as you can drown in water, you also can suffocate in a space cabin or seacraft if foreign particles are ingested in sufficient amounts to hamper normal respiratory functions," said Dr. Kraft.

Astronauts venturing outside spacecraft in pressure suits must carry their own artificial atmosphere and pressure with them—just as an aquanaut, emerging from an undersea craft at a depth of 1000 feet, must take life supporting environment with him.

Dr. Kraft and his team also are concerned with psychological phenomena.

Their studies include such hazards as reaction to complete isolation. This reaction can readily be attained in the ocean depths, and can assist researchers in psychologically conditioning man for extended life in space.

This feeling of "aloneness" which an individual experiences is called the "breakaway phenomenon." It can produce either a feeling of depression or euphoria (an unreal feeling of well-being or power).

In the environment of space, or under water, man can become disoriented and literally not know which way is up or down. In both sea and space, there is also a torquing problem arising from lack of a firm or fixed point, against which man can brace himself to use many types of tools. Such as anchor point is needed to exert force or leverage.

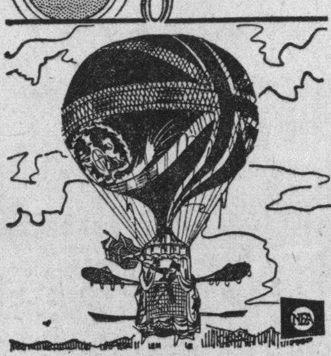
Among those assisting Dr. Kraft and members of his team are George Lander, project leader of the man-in-sea program; and Andre Galerne, French authority on underwater diving operations, and a consultant to Lockheed.

Dr. Kraft reports to Dr. William M. Helvey, manager of bioastronautics, and nationally known for his reasearch in this field.

A partial listing of problems being tackled shows that the work involves practically every aspect of living—clothing, foods, illumination, fire hazard and other safety measures, replenishment and supply, and environmental forecasts. A very important consideration is the selection, training and conditioning of explorers for either inner or outer space.

"In the future, we will undoubtedly see development of special underwater research and training facilities," Dr. Kraft said.

matter of fact



Human flight was made possible in 1783 by the invention of the free balloon. The first flight, a distance of six miles across Paris, was made by two Frenchmen with the use of inflated hot air. Hydrogen gas was soon substituted for air. By 1804, an altitude of more than 23,000 feet was reached by two French chemists.