NAVY

THE MAGAZINE OF SEA POWER

NOVEMBER 1964 25c

The United States Navy: A Look Ahead to 1980

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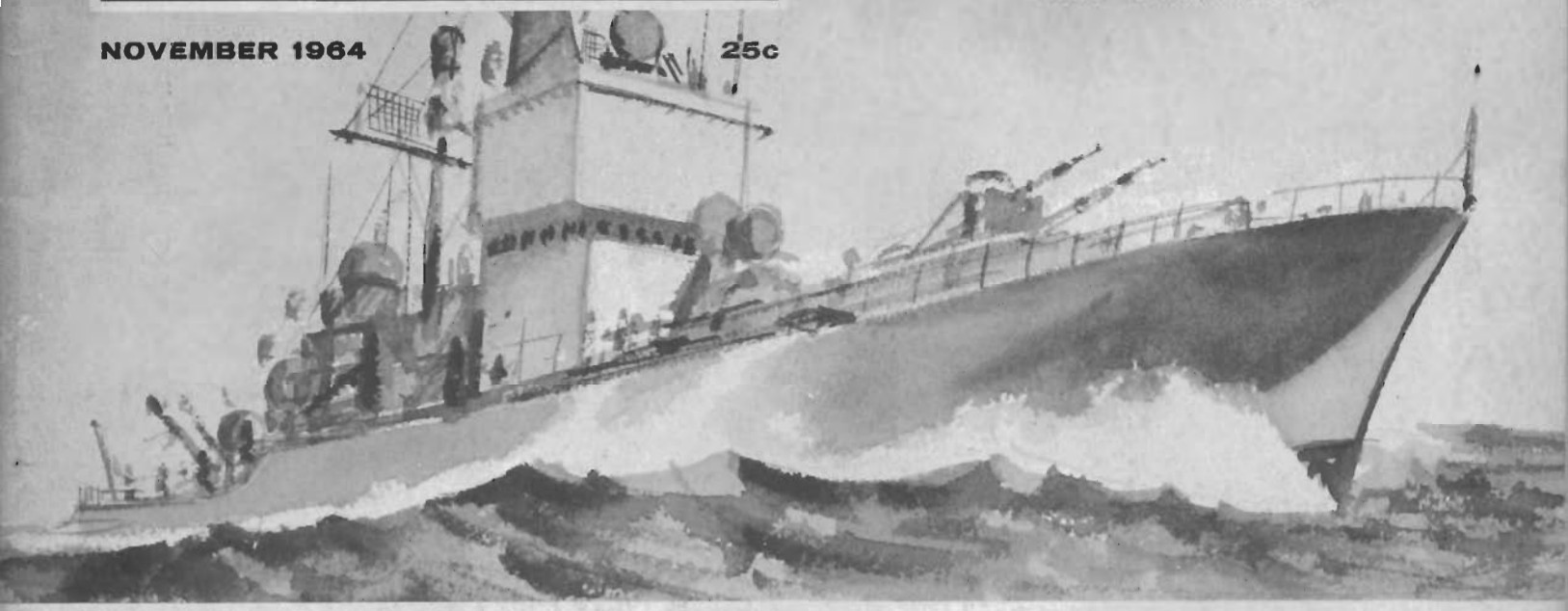

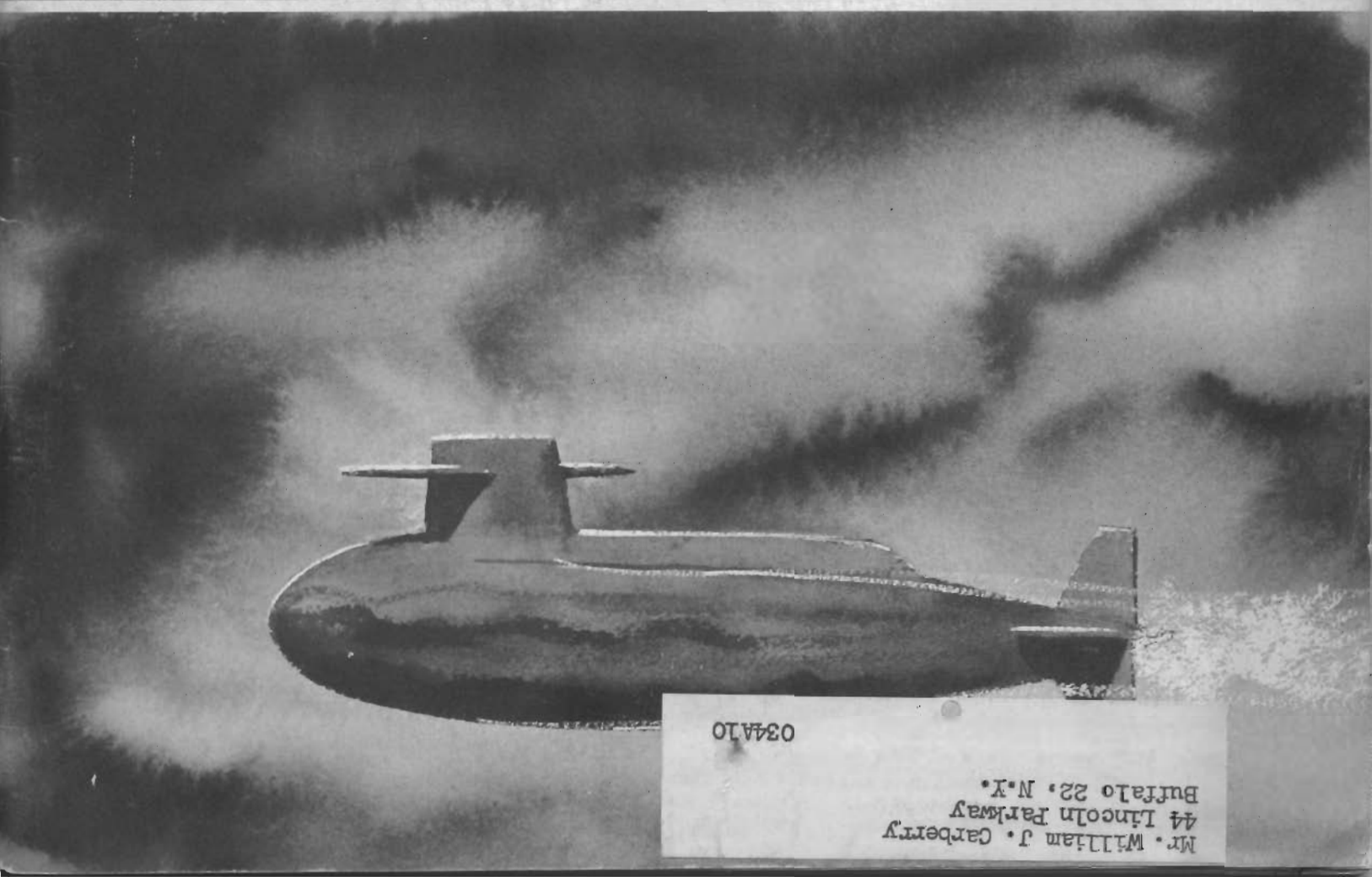

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VOL. 7, NO. 11 NOVEMBER, 1964

The Civilian VOICE of the Navy

Official Publication of THE NAVY LEAGUE of the UNITED STATES

The Civilian ARM of the Navy

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NAVY—The Magazine of Sea Power

Second-Class postage paid at Washington, D. C. Published monthly by the Navy League of the United States, 818 Eighteenth Street, N.W., Washington, D. C. This magazine is classified by the Library of Congress call number: VA-49-N28.

Editorial, Subscription and Advertising Correspondence to Navy League of the U.S., 818 Eighteenth St., N.W., Washington, D. C., 20006, Telephone, 298-9282.

Annual Membership includes one year's subscription.

Subscription $3.00 per year.
Single copies 25c. Special issues 50c.

The Navy League is an independent, civilian organization. Statements contained herein have no official sanction or approval by the Navy Department.

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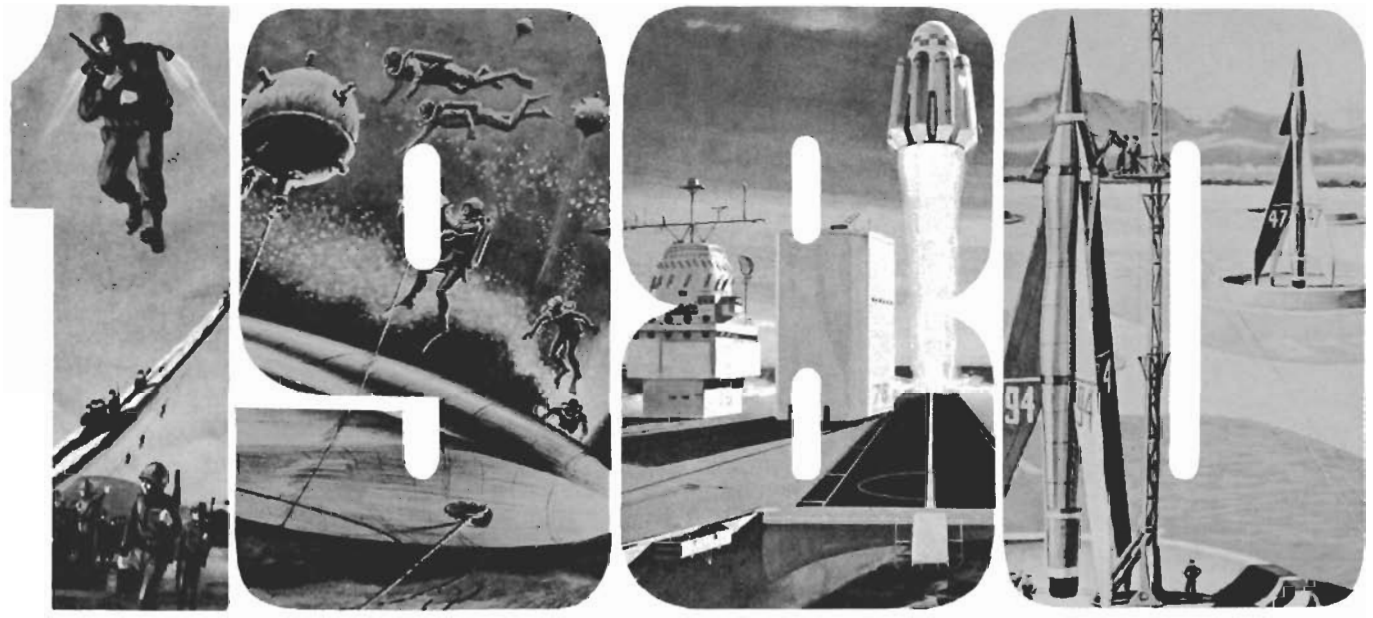
STRIKING POWER OF THE FLEET IN



By ADM CHARLES D. GRIFFIN, USN
Commander-in-Chief, U.S. Naval Forces, Europe

PERHAPS the best way to grasp the idea of how the Navy of tomorrow will operate is to take a hypothetical military problem and put it in a 1980 setting.

Let us assume it is 15 years hence, no major World War involving the wholesale exchange of nuclear weapons has occurred, and that a small nation, torn by internal disorders, faces a threatened take-over by a militant would-be dictator. The incumbent government has called on the United States for assistance and has asked American forces to land to restore order and preserve the status quo.

Growing Nuclear Club

A naval task force, complete with striking and amphibious forces, steams at high speed towards the objective area. In envisioning this task force barrelling-in, it is important to remember that 15 years from now there is a possibility that there will be no nearby overseas bases to "back up" such a landing. This is indicated by the present world-wide growing nationalism and the reluctance of smaller nations to become involved in the cold war struggles of the major powers.

In considering the entire tactical picture of this hypothetical problem the reader must bear in mind that by 1980 many countries may have nuclear military capability, much of which will be seaborne. It is a reasonable assumption the future will see most nations maintaining their nuclear striking forces at sea to minimize the risk of destruction by association with continental bases.

Thus, in executing his mission, the task force commander is virtually self-sufficient and, tactically, must deploy his ships against an ever-present threat of a counter-strike by seaborne forces.

The odds are that our hypothetical commander will be directing operations from a nuclear-powered carrier—a CVA(N).

Our tactician of 1980 will not be pacing the bridge, peering through binoculars, or taking messages in the flag plot, and anxi-

ously scanning his deployment on plastic status boards. Instead his command post will look more like the control panel of a TV studio, and he will be sitting in front of an organ-like console which will house the switches of a battery of computers.

As his task force slices along at better than 40 knots, the commander will know from his computer-operated Naval Tactical Data System all pertinent information on which to predicate decisions. With background information having previously been fed into the NTDS, and with current data on a steady in-put basis, the computer will supply instant information ranging from weather and unit dispositions to recommended weapons to be employed.

Tied to JCS

The information constantly coming up on the commander's Tactical Data System will be appearing concurrently on a similar console at the war room of the Joint Chiefs of Staff. The JCS also will be feeding into the commander's NTDS information about matters outside of his immediate operating cognizance but pertinent to his strike.

The odds are that this commander of the future will be able to talk to the captains of the other units afloat with something like a "scramble vision" device—a communication system which does not disclose a ship's position as signals are bounced off the moon or a satellite. He will also be in continous communication with higher echelons of command.

By the same token all the units in the task force will continuously know their exact position by computer "sightings" on navigation satellites or atomic powered position buoys on the floor of the ocean.

Greater Missile Accuracies

Other than minor refinements this task force, externally, will not look much different from the newer ships that have been launched within the last two years. There will, of course, be operational and technique differences.

A substantial number of the Navy's antisubmarine surface ships are likely to be nuclear powered by the 1980s. Above, the conventionally propelled destroyer escort USS BRONSTEIN, armed with the ASROC missile and guns.

Hydrofoils, as well as air cushion vehicles, hold promise for naval applications. Above the HIGH POINT, the Navy's first operational hydrofoil, is shown during tests off the Washington State coast. The 110-ton craft was built for the Bureau of Ships by the Boeing Company. It is designed to exceed 50 miles an hour.

By 1980 rocketry will be in such an advanced stage of development and with such a high degree of accuracy that aircraft will no longer be the *sole* instrument for direct enemy strikes. Instead, many of the aircraft, shorn of their heavy armament, will be faster, more far ranging, and will play the role of "eyes and ears" for the task force. The commander, with a flick of the switch, will be able to see on a myriad of TV screens the electronic camera playback from each of his airborne units. Other aircraft will have the job of flashing early warning of unidentified aircraft, surface ships, submarines or missiles.

Some of the submarines will carry their weapon packages externally, much as planes do today, and they will come alongside replenishment ships to change their type of armament to conform with the assigned task. The cruisers will have the capability of shooting down satellites.

When it comes time for the landing, troops will be whizzed to the beaches by hydrofoils, hovercraft and helicopters. And it is a pretty safe guess that Marines will be going in with rocket packs

affixed to their backs for individual terrain maneuvering. Frogmen will have preceded the landing troops, utilizing laser equipment for undetected signalling back to the ships.

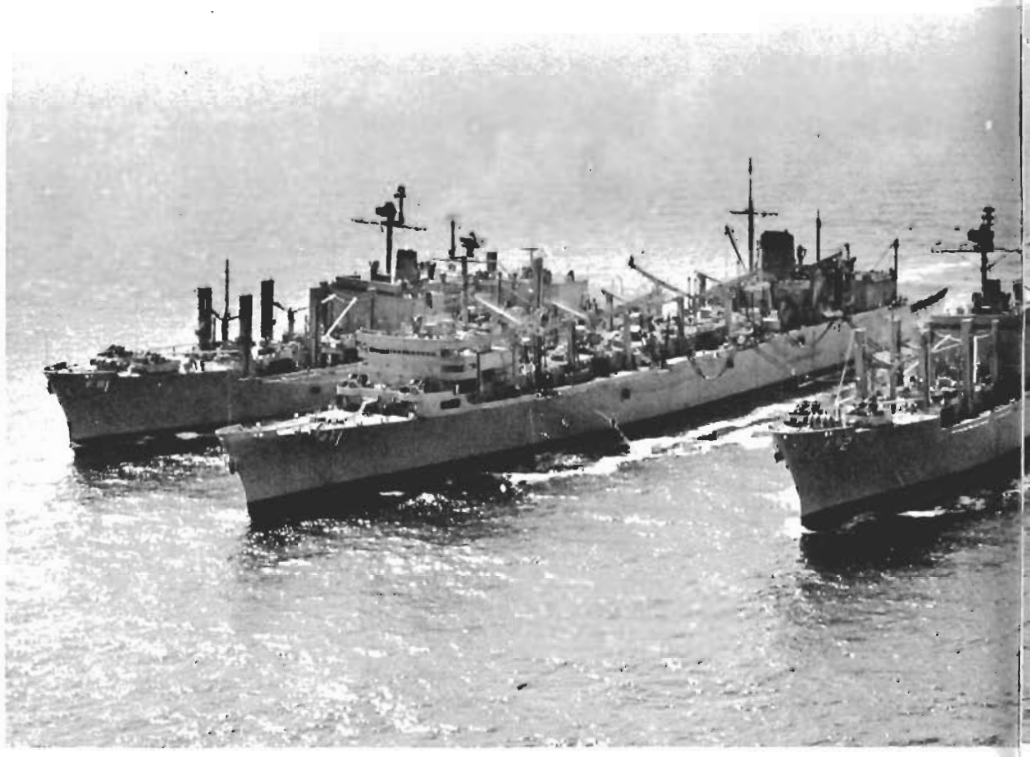
Does this sound a bit like Buck Rogers? Not at all. Nearly everything I have described about this 1980 task force is in various stages of experimental development in the Navy. Some are already operational and many more will be in the fleet within 15 years.

A Matter of Evolution

None of the things I have described for the Navy of the future is revolutionary. All are evolutionary. If proof of this point is required, a look at the Navy today should be convincing. Many ships still operating effectively were planned and constructed 20 or more years ago. It is a reasonable assumption that many units at sea today will still be operational in 1980 and later.

As I look back over my own career in the Navy, spanning more than 41 years, and stop to realize that the old biplane Boeing F4B was the popular carrier fighter when I was training as a naval aviator, and then compare it with the supersonic craft of today, it gives one pause even to hazard guesses about the future. Even so, I think the "family resemblance" of the Navy of the future will be much like its 1965 counterpart. Broadly, the same type of forces will be required. However, as I sought to point out via the illustration of the hypothetical task force, the changes in 1980 will range from the subtle to the dramatic.

When I refer to the "family resemblance" I mean the broad function. It is certainly true that the difference between the guided missile cruiser USS ALBANY of today and the USS CHESTER in which I served in the early 30's is, in many ways, like night and day. Yet the family resemblance—as a type of warship—remains. This is why I stress the evolutionary aspect when trying to forecast tomorrow's Navy.



One of the most perplexing problems which confronts naval planners and decision makers is that of determining what the size and character of our Navy *should be* in the future. Decisions made now with respect to allocation of research funds, weapons systems development and current shipbuilding programs will have a profound influence on the striking power of our fleets in 1980.

Better Than Ever

Thus, the hypothetical task force that I described is not blue sky thinking. These things are coming into being. There are others as well—developments which remain classified information. What it all adds up to is that the Navy will grow steadily in sophistication and deadliness to provide, in 1980, undreamed of naval striking power which will be more flexible, more survivable and more devastating than heretofore.

To ensure that every dollar invested today will still pay dividends 15 years from now, the crystal ball used by naval planners must be of unusually high clarity. Today's decisions and budgetary requests must be directed towards orderly building and research and development programs with specific and local objectives designed to serve both short-term requirements and long-term estimates.

It is, of course, a practical impossibility to look as far into the future as 1980 and determine with complete confidence the size and composition of fleets we will need then—or be able to have.

No one can forecast precisely the direction international political events will take, the military threats we will face, economic trends, or the course and speed of technological progress. There are, however, distinct overall trends and developments which provide good guidelines for our nation's naval requirements of the future. Let me attempt to forecast some of the politico-military environment in which our fleets will operate 15 years from now.

The Communist Factor

Of major influence in shaping the 1980 environment will be the ever-present influence of international communism. In spite of recurrent claims to the contrary and, indeed, intermittent "thaws" in the cold war, world domination re-

Although nuclear propulsion for surface ships will reduce the replenishment-at-sea volume of fuel, there still will be a big need for mobile logistics in the 1980's for food, supplies, spare parts, ammunition and weapons. The 53,000-ton Fast Combat Support Ship USS SACRAMENTO (AOE-1), center, and the two partially automated cargo stores ships USS MARS (AFS-1) and USS SYLVANIA (AFS-2) conduct replenishment-at-sea trials off San Diego.

mains a fundamental objective of international communism.

There is no reason to expect this objective will have been abandoned by 1980, particularly since it has been restated and re-emphasized repeatedly by Communist leaders. We should heed their statements.

Concurrent with the pressure of communism there will be the ever-increasing problem of nationalism in many nations of the world. This is particularly true in Asia, Africa, the Middle East and, to a growing extent, Latin America.

In their efforts to assert their new-found independence and find solutions to their many problems, these nations are reluctant to become involved in the cold war struggles of the major powers, or to be subjected, over a long period of time, to the predominant influences of any foreign power. Thus they are becoming increasingly reluctant to host foreign military bases.

Yet factors at work throughout the world portend greater, and not less, world instability. There will be a continuing requirement for the United States (and its allies) to be able to move quickly into widely separated and remote parts of the globe.

The Threat Will Be There

The population explosion will undoubtedly intensify economic and social problems. It can be expected that established major Communist nations will exploit these conditions to penetrate and subvert. It would seem likely, therefore, that in 1980 there will be continuing unrest, tension and turmoil.

Not to be overlooked is the fact that superimposed on this world of tension and conflict will be a strategic nuclear threat to the United States itself. Although some progress has been made toward the easing of tension between this country and the Soviet Union, as exemplified by the atmospheric

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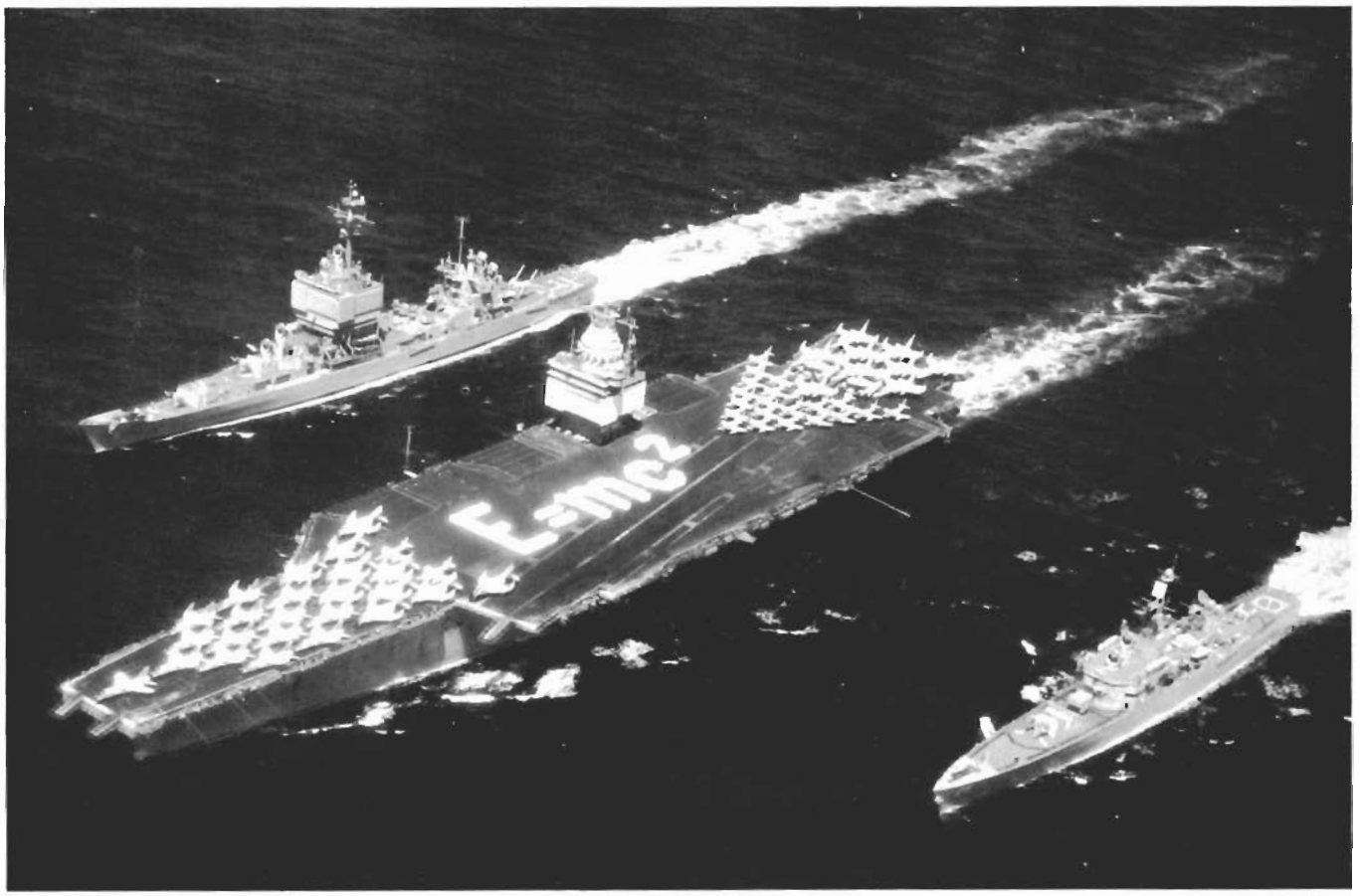


The Navy of 1980 will feature many more nuclear-powered surface ships. Here is the United States' first nuclear task force, composed of the missile cruiser USS LONG BEACH (top), the aircraft carrier USS ENTERPRISE and the missile frigate USS BAINBRIDGE.

not be told without detailing the development of special equipment and techniques, and space does not permit this here. Suffice it to say that the Marine Corps is still developing equipment and techniques that will keep the United States pre-eminent in the art and science of amphibious warfare.

From the foregoing thumbnail history of the Marine Corps it is obvious that the Corps has performed many functions and tasks—only one of which is amphibious operations. It recently fought as part of a land army in Korea. It still has security forces all over the world. Its air elements are even now helping at least one friendly nation defend itself against Communist insurgents. It is training the troops of allied nations.

And so today, in our Birthday month, the Marine Corps stands as a bulkwark for Freedom, the nation's "Force in Readiness". With 189 years of experience behind us, we project our plans into the future, with new weapons, new tactics, but with the same old-fashioned breed of trained Marines—ready *now* to guarantee the freedom of us all.

STRIKING POWER OF THE FLEET IN 1980

Continued from page 15

test ban treaty, it would be foolhardy in the extreme to assume the next 15 years will see the disappearance of a nuclear threat to our own shores. Claims of peaceful coexistence, as Communists define it, is highly deceptive. And by 1980 other nations will have developed nuclear weapons.

What this means is that the Navy of the future will be operating in an environment in which the struggle against communism undoubtedly will be continuing.

Keeping up our guard means that our strategic nuclear forces must be maintained, improved and modernized regularly to deter the U.S.S.R. and any other nation from being tempted to launch nuclear attacks against our homeland.

In doing so we must avoid placing ourselves in the iron maiden of nuclear inflexibility because we must also retain readiness to counter Communist thrusts with operations not necessarily dependent for success on nuclear weapons. Our national security, accordingly, demands that, in addition to adequate and secure nuclear retaliatory power in the strategic sense, we possess forces which can be used with discrimination, restraint and precision.

Bigger Role for Navy

Furthermore, our military posture must be such that we can bring our forces to bear in any area of the world promptly and without major reliance on an extensive overseas base structure. With consideration for the power of modern weapons, it would appear that the bulk of United States Armed Forces should be composed of these so-called "conventional" forces. It goes without saying that we must preserve the national will to use these forces when situations so demand.

It becomes self-evident that the Navy of 1980 will have an increasingly large part to play in achieving the American military posture to face any and all threats. The impelling strategic reasons which already have resulted in moving some of our nuclear missile strength to sea in Polaris submarines will continue.

It is probable that by 1980 technology will permit both the United States and the U.S.S.R. to acquire missiles with a high degree of accuracy at any range at less cost than required to build the hardened land-based missile sites necessary to survive attack by these accurate missiles. If this is the case, an attempt to place major reliance on fixed land-based missile systems with assured survivability would put us in an economic race we could not win. On the other hand, we will still require some fixed and protected installations to provide adequate diversification.

Also, by 1980, the population densities and the complexities of highly industrialized society will argue convincingly for moving most strategic nuclear retaliatory forces from the continental United States to sea to minimize the risk of destruction of cities and industrial facilities by association.

Thus, the Polaris submarine system, favored by its unparalleled virtues of mobility, concealment and survivability, will continue to be of top strategic importance in 1980. Polaris missiles in surface ships, while not providing all the advantages of the submarine system, also will become important as nuclear deterrent/retaliatory forces. Such forces are feasible, relatively economical and necessary for modernization of the Free World's strategic nuclear deterrent forces.

There will be, the Navy hopes, other nuclear-powered aircraft carriers to keep the giant USS ENTERPRISE company by 1980—and perhaps a good deal earlier than that. Above, an F4H Phantom II catapults from the deck of ENTERPRISE.

Importance of Marines

A most important characteristic of our naval forces, and of the attack aircraft carrier and Marine amphibious forces in particular, which will become more valuable and more sought after in the future, is their effectivity throughout the entire spectrum of warfare possibilities—cold, limited and general. Additionally, naval striking forces of the future,

with inherent mobile logistic support, will continue to enable us to project American military power virtually to all troubled areas of the world without regard to foreign bases.

Attack aircraft carriers will continue to be the backbone of our flexible naval power. Exploding technology will increase the potency of this system. In this connection it is important to note that, excluding the Soviet Union, nearly 90 per cent of the remaining area of the world lies within 500 miles of the sea. This is a geographic fact of life which underscores the important role the Navy will continue to play in 1980.

We should expect that by 1980 the flexibility, staying power and self-defense capability of our attack carrier forces will be greatly enhanced by the introduction into the fleets of more nuclear-powered carriers. They will be, in all probability, about the size of the FORRESTAL class, with greatly improved aircraft handling and maintenance facilities, aviation fuel and ammunition capacities, electronics, tactical data handling equipment and sea-keeping qualities.

Faster Weapons for Planes

Speed of embarked aircraft will keep pace with technology. Speed however, for the sake of speed alone will be rejected. It probably will be found, tactically as well as economically, best to tailor airborne *weapons* to the requisite speed and target-seeking characteristics rather than building maximum possible performance in the delivery vehicle.

In addition to interceptor aircraft and reconnaissance planes, special mission aircraft for carrier-based electronic-countermeasures, airborne early warning and counter-insurgency tasks will be required, and their roles in supporting strike warfare, anti-air warfare and anti-submarine warfare will become increasingly important.

Destroyers and cruisers will show steady technological improvements. Point defense anti-air weapons will be favored as opposed to the more expensive and complex area defense systems. We should hope, also, that 1980 will see many of these ships propelled by nuclear power as smaller propulsion plants become feasible.

Amphibious ships and their embarked Marines will continue to be required. Major advances in this area will take the form of increases in ship speed, load carrying capability and techniques for rapidly putting assault troops ashore. More emphasis undoubtedly will be placed on the LPH-type ship with improved helicopters to give increased capabilities for rapid airlift of Marines to "beyond-the-beach" areas. Much higher speed landing craft, such as hydrofoil and hovercraft, will be developed.

Improved Submarines

Nuclear-powered submarines will continue to be an essential part of the 1980 Navy. Their unique capabilities are well known. And within the next 15 years they will be capable of operating at substantially greater depth, at higher underwater speeds and with less noise emission.

The Navy of the future cannot be sketched without mention of our vital anti-submarine forces. For both Navy and Merchant Marine reasons, great research and development effort will be required in the future. We can also expect to reap much benefit as a by-product of space exploration, particularly in the field of super-sensitive instruments. Perhaps a major breakthrough in underwater detection will come from this source permitting greatly improved detection capabilities in aircraft. Even without it, steady progress will continue to be made in "locating" equipment.

Our underway replenishment ships in 1980 will have much higher speed capabilities, both in carrying out replenishments and transit time. They will have lighter and more efficient handling equipment. Some undoubtedly will have today's different types combined into one hull.

But whatever type of ship we discuss, it becomes quite evident that the Navy of 1980 will have a decided family resemblance to its 1965 counterpart. It goes without saying our Navy will keep pace with advancing technology as well as with world environmental trends. The Navy has done so in the past. There is no reason to believe that it will be otherwise in the future.

The Key: Officers and Men

And even if we cannot forecast precisely the direction of international political events in the next 15 years, there are two things we can be *certain* of in 1980—first: that the geography of the earth, three-fourths of which is water, will not be substantially changed, and second: that naval power will depend—just as it does today—mainly on the officers and men who serve in the Navy. The material aspects of our Navy surely will change—but the spirit, the talent, the dedication and high resolve of Navy men must and will remain at a very high level.

COMMANDANT'S BIRTHDAY MESSAGE 10 NOVEMBER 1964

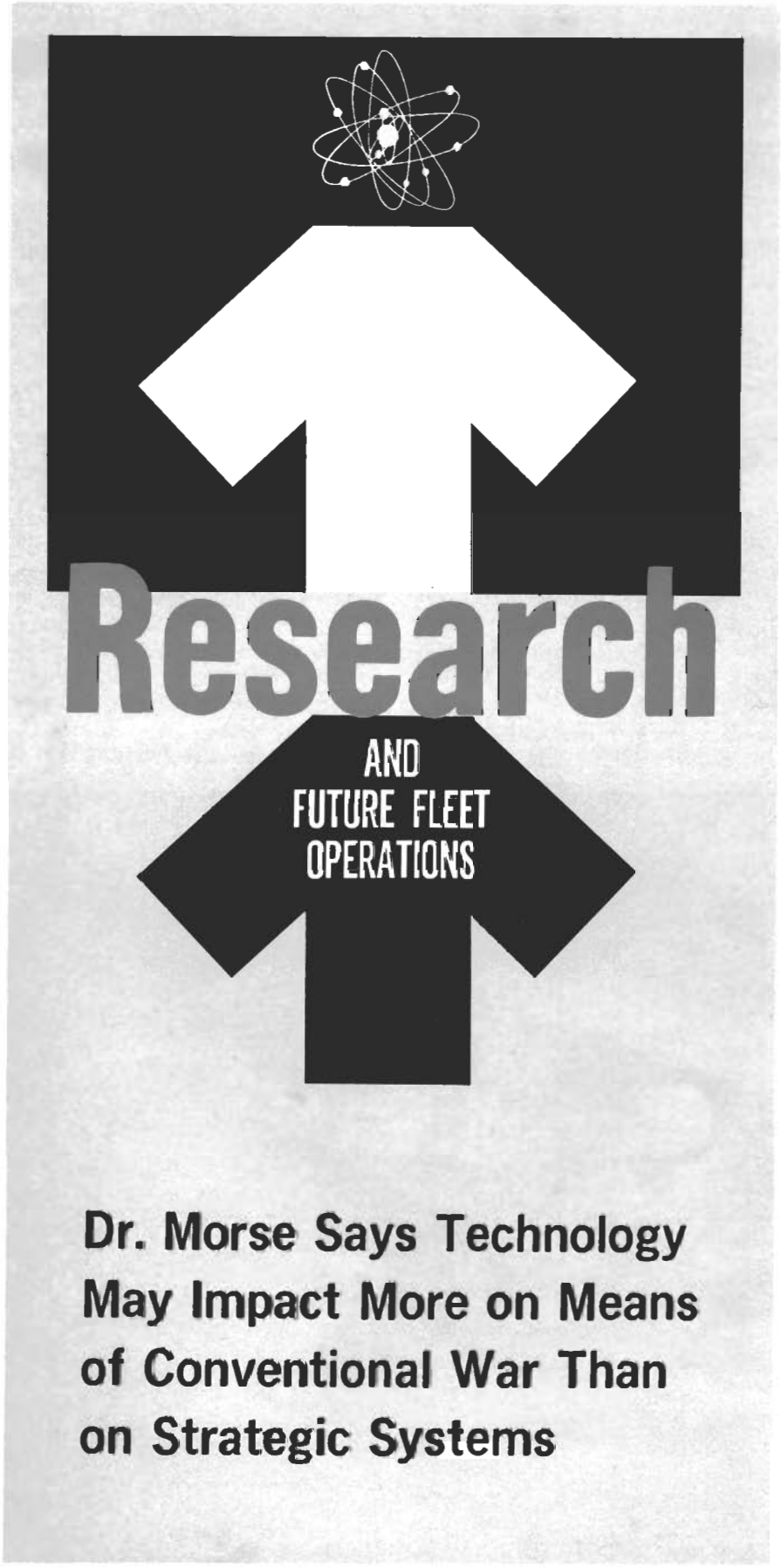
Since 10 November 1775, Marines have served our country faithfully and well, in war and in peace. For nearly two centuries we have fought on far-flung battlefields of the world in the cause of liberty. Today, in Southeast Asia, a new generation of Marines is helping a beleagured people defend their freedom against aggression.

It is fitting that amidst our celebrations we pause a moment to pay tribute to the memory of those Marines who have given their lives in steaming jungles, on the cold waters, and in the vast reaches of the skies in the defense of freedom throughout the years. Let each of us pledge, with deep and reverent resolution, to preserve and maintain those high ideals for which they fought and died.

Today, as in the past, our Nation is most fortunate in having within the Marine Corps men and women who have the high order of personal ability that modern warfare requires, and the ability to percieve a national goal of such paramount importance that they voluntarily undertake duties in which the long hours, the family separations, the risks, and the uncertainties far exceed the material rewards. Throughout the years, Marines have fostered these traditions of courage, loyalty, honor and devotion to duty—qualities which have made uncommon valor a common virtue.

To all who bear the name Marine, and to all Marine families, I extend my warmest congratulations and very best wishes on the 189th birthday of our beloved Corps.

WALLACE M. GREENE, JR.
General, U. S. Marine Corps
Commandant of the Marine Corps



Dr. Morse Says Technology May Impact More on Means of Conventional War Than on Strategic Systems

By DR. ROBERT W. MORSE

Assistant Secretary of the Navy
For Research and Development

AMERICANS now in their forties are watching the emergence of the third Navy within their lifetime. Oil, which replaced coal, is now being replaced by nuclear fuels. Missile armaments are making inroads on attack aircraft, just as the latter did two decades ago on naval gunnery. All this has occurred in as tightly scheduled a cycle as the engineering and economic lifetimes of ships permit. It is, therefore, only natural to expect that the Navy which we now know will evolve into quite a different one by the early 1980's.

The many of us responsible for research and development in the Navy face a growing and substantial challenge. Not only must we direct a rapidly accelerating technology to fit this future Navy for the requirements which are already recognized, but in the longer view we must use new technology creatively in order to give our Navy—and hence our Nation—the means by which to retain strategic initiative at sea.

It's Up to Us

In the generation ahead, the United States will be the foremost naval power. The shaping of modern science for the fulfillment of our unique advantage depends on our initiative alone. No longer can we measure advance by comparison with other navies—having the "best" Navy is no longer sufficient. And we must be imaginative enough not to pass up our most important strategic advantages. Technology, therefore, not only must serve old ends, but it must also create the means by which naval power can find new projections.

To understand the problem of predicting future developments, we must make a distinction between the types of technology which affect the Navy's operation. First, there is that technology which is a steady evolutionary improvement of what is now in being,

such as the development of the submarine. Then there is that type of technology which seems to indicate the possibility of rapid progress and radical change in some specific area such as weaponry or communications. Finally, there is the unusual coincidence of several advances leading to a qualitative change in naval power—as happened with aircraft carriers or with the POLARIS submarines.

It is impossible to make any kind of prediction on the more dramatic effects of technology; once perceived—which may be difficult—they suddenly affect us. In the first case, however, involving principally the performance of the known combatant types as determined by development in naval architecture and marine engineering, one can foresee the direction of growth with better accuracy. Even these foreseeable capabilities, however, must be considered merely as options which research and development can place at our disposal against the day when requirements should demand (and economics permit) that we avail ourselves of them.

Deeper and Deeper

Particularly illuminating to the present discussion is the matter of increased operational depth for submarines which might ultimately have to replace the recently designed SSN an SSBN types. This is not a trivial matter for there are many, including myself, who foresee the full exploitation of the three dimensions of the ocean as inevitable to the progress of naval power.

Signs of the future can thus be found in our exploration of the deep ocean. Consider progress in current research and exploratory engineering commitments to deep diving vehicles, the first of which was Professor Piccard's bathyscaph TRIESTE. Its pressure hull is a heavy steel sphere which is attached to a buoyant or flotation upper hull in which external and internal pressures are equalized. As such, it is merely a deep sea elevator. A major step towards

DR. ROBERT W. MORSE

giving such a vehicle horizontal mobility has been taken in the recently completed ALVIN, whose pressure sphere is contained inside the buoyant hull. Capable of accommodating two men, this vehicle has been specifically designed for oceanographic research purposes, possesses a range of 30 miles, allows for a maximum future speed of six knots, and has a normal cruising endurance of eight hours at a speed of two-and-one-half knots. Its operating depth, however, is limited to about 6,000 feet as compared to the 35,800-foot dive achieved by TRIESTE.

The next step forward is a two-man deep submergence vehicle. The design of such a submarine is now being completed for the Bureau of Ships. This will be a work vehicle to be used both for oceanographic research and special tasks, such as inspecting bottom contours or installing and recovering components in the deep ocean. Like ALVIN, the vehicle will have a two-man pressure sphere contained in a teardrop-shaped hull, but new materials will be tested. The seven-foot diameter sphere will probably be constructed of either titanium or a special Martensitic steel alloy that is age hardened. The outside flotation hull is expected to be of aluminum with a length of 45 feet, more than twice the length of ALVIN, and a diameter of 10 feet.

How quickly the fleet's surface warships are given nuclear power depends a good deal on the man shown below and his organization. He is Vice Admiral H. G. Rickover, USN (Ret.), head of the program to develop smaller and more powerful reactors. The President, Congress and the Secretary of Defense all play important roles, too, as far as the command decision and financing are concerned.

The DOLPHIN

A deep diving submarine now under construction which is of more conventional design is DOLPHIN (AGSS-555). This is a test vehicle designed to collect data needed to design the deep diving operational submarines of the future. A vast amount of information in a number of areas is needed before engineers can even begin seriously to plan or design such submarines. The DOLPHIN, for example, will provide experimental development of hull structure by using more plastic parts than any previous submarine. It will also contribute to knowledge on the problems of sonar and weapons systems functioning at depths far deeper than presently attained.

It is through the pursuit of programs of the kind just described, together with work on the underlying problems of hull materials, configurations, and fabrication processes, as well as on appropriate propulsion plants, that over the long haul the Navy will attain the option of building submarines

Although it looks like a stranded boat, this 12-ton vehicle is actually skimming along on the land after an over-the-water trip from Montauk, Long Island during tests last summer. The craft is a ground-effects machine, a vehicle supported by a three-foot-high cushion of air generated by the downdraft of two of its four gas turbine engines. Republic Aerospace is conducting tests of the 24-passenger craft for the Navy. The vehicle was designed by Vickers, England. During tests it glided over water, sand dunes, sand bars, rocky beach, mud flats and marshes with equal ease. It could have many naval uses in the future.

.The nuclear-powered attack submarine USS PLUNGER at sea. The new submarines of the Eighties are expected to be able to dive much deeper than PLUNGER.

having depth capabilities five to ten times better than present ones. Such work—slow, expensive, and incremental—is all necessary if we can hope to move into the third dimension of the seas in the future. The idea may be radical, but the technology is not.

A somewhat foreshortened time scale of technological advance is encountered when examining the changing cycle of weapons of the future. Here research and development can be characterized as permitting increased flexibility and precision in the kind of attacks to be mounted. To the extent that the spectrum needs broadening in the coming decade, this will happen more at the lower end of limited severity rather than at the upper end of massive damage. This comment applies both to conventional and nuclear weapons. *Indeed, technological advance in the next decade may well have more impact on the means of conventional warfare than on strategic systems.* With respect to nuclear delivery systems, we can expect that accuracy of fire control and guidance, propulsion packages of higher efficiency and smaller cost, and warheads of greater efficiency will occupy a central position. Flexibility in means of delivery which must go with such weapons systems contiues to provide ample room for innovations.

Hydrofoils

New types of surface ships may play a role in the Navy of 1980, although it is not too apparent now what forms they will take. Today, we are exploring design and performance of hydrofoil and hydroskimmer craft, and the direction in which these developments will go depends principally on the results of long-range research and development programs involving a series of test vehicles of increasing size. A 25-ton research hydrofoil, equipped with a turbojet engine and designed to be the world's fastest hydrofoil, was completed in 1963. Construction is nearing completion on a 300-ton hydrofoil research ship (AG (EH)) which will have radar, sonar, variable depth sonar, torpedo tubes, and ample space for testing various ASW systems.

The first hydroskimmer or air cushion machine to be built for the Navy is the 22-ton SKMR-1. This aluminum-hulled craft, which has surpassed its design speed of more than 80 miles an hour, was the first large air cushion vehicle built in this country. The Navy will use SKMR-1 to study the practicability of air cushion vehicles for use in such military operations as amphibious landings, high speed patrols, mine countermeasures work, and ASW, as well as to formulate design criteria for larger vehicles.

I should emphasize that both hydrofoils and hydroskimmers will have to be evaluated against other types of vehicles such as airplanes, helicopters, conventional ships and submarines. They will have to demonstrate overriding advantages over these other types in important operations to warrant their additional cost.

One of the capabilities which the future Navy must have is the rapid collecting and processing of in-

telligence. The word "intelligence" is used in the broad sense of information on the operational environment as well as surveillance and reconnaissance. The innovational process here is currently most rapid and most dynamic. Even though the performance ranges of our future Navy may not differ radically from those of the current fleet, the future Navy can be expected to be greatly advanced in its awareness of just exactly when, where, and how to apply its physical resources best.

Oceanic Data Stations

First of all, we are now rapidly increasing our knowledge of how the ocean environment affects naval operations. We are moving decisively so that we can correctly anticipate oceanographic conditions so as to maximize the success of any naval mission. As one example of our advancing techniques, we have recently started testing the experimental prototype of a telemetering oceanographic buoy, or oceanic data station. This instrument, able to collect oceanographic data down to a depth of 22,000 feet while on station unattended for one year, can transmit its data on command over a distance of 3,000 miles.

Eventually it is anticipated that a large network of these oceanic data stations, broadcasting four times a day, will be positioned throughout the major seas of the world. This oceanic data service will provide a vast amount of knowledge on the air-sea interactions, ocean currents, and the onset of hurricanes, to give but a few examples. It will also provide data for the Navy's Anti-Submarine Warfare Environment Prediction System (ASWEPS).

In the second area related to surveillance and reconnaissance, very important innovations in the use of electromagnetic and acoustic signals are being made which will rapidly increase our capabilities in a host of military devices. These, in turn, will be backed up by data processing equipment which helps in sharpening the precision and reducing the time delays in naval actions.

There are also comparable advances in command and control mechanisms. Integrated control is rapidly being achieved in individual combat vehicles through the research achieved under such programs as the Joint Army-Navy Aircraft Instrumentation Research program (JANAIR), where the objective is to achieve a simplified and unified cockpit display, and a related program known as Submarine Integrated Control (SUBIC). Involved are techniques for collecting data from all subsystems, such as ship's control, propulsion, surveillance, and communications, and for analytically selecting the best configurations for accomplishment of the intended mission.

Presentation in unified displays allows greatly reduced delays in decisions and choices of action on the part of officers in command. Finally, integration of the communications circuits which weave the individual Navy units into the broad pattern of national military deployment, will permit increasing flexibility and quickness of response to evolving strategic situations.

Concern for Trends

In summary, it may be said that one objective of Navy research is to provide a variety of technical realities on which the Navy can call to meet future contingencies. At the same time, there is the equally urgent need for learning better to anticipate these contingencies and for developing those systems which will, in fact, be adequate to meet them.

Along with our constant improvement of naval technology, we must have a continuing concern for anticipating strategic trends, clarifying tactical situations, and determining the optimum choices open to us. The technical age into which we are emerging provides more choices than our economic and human resources can pursue. We must, therefore, choose our paths with a shrewd balance of discipline and imagination.