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Benedict P. Kuehne

Guy A. Messick

Kathleen M. O'Donnell

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THE OCEANS

BENEDICT P. KUEHNE)
 GUY A. MESSICK) *
 KATHLEEN M. O'DONNELL)

LAW OF THE SEA CONFERENCE

The Third United Nations Conference on the Law of the Sea resumed in New York City on March 16, 1976. As of this writing, the Conference is still in the "private negotiation" stage, and consequently no results have been made public. The outcome of the Conference will be covered in the October issue of the *Lawyer of the Americas*.

In a speech given in April, the U.S. Secretary of State stressed the importance the United States places on the conclusion of a comprehensive Law of the Sea treaty this year. The Secretary felt that the three major unresolved issues were the encouragement of marine scientific research, the compulsory and impartial settlement of disputes, and the creation of an international regime for the exploitation of deep-sea resources. He reaffirmed the U.S. position on deep-sea beds, as reported in 8 *Law. Am.* 187 (1976), supporting the creation of a deep-sea bed authority with limited powers.

FISHERIES

United States

President Ford has signed the Fisheries Conservation and Management Act of 1976. The law extends the exclusive fishing zone of the United States to 200 miles, effective March 1, 1977. The Act is a compromise version of the respective House and Senate bills which was worked out in joint conference. Under the Act, Congress has veto power

*J. D. Candidates, University of Miami School of Law.

over fishery agreements negotiated by the Secretary of State. Congress must exercise its veto by joint resolution within sixty days from receipt of the text of the agreement, or it is waived.

All anadromous species of fish, such as salmon, which are spawned in the fresh or estuarine waters of the United States are claimed as being under exclusive U.S. control *throughout their migratory range*; except when these species enter a foreign State's exclusive fishing zone or territorial sea to the extent these zones are recognized by the United States.

The United States also claims exclusive control over "[a]ll continental shelf fishery resources of the United States beyond the fishery conservation zone." The effect of this claim is unclear. Under the 1958 Convention on the Continental Shelf, States have exclusive control over the living resources of the continental shelf which, "at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil." The extent of the continental shelf is defined by the 1958 Convention as being adjacent submarine areas to a depth of 200 meters or "beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas." The Committee's comments on the new U.S. law do not make clear whether "Continental Shelf fishery resources" are to be limited to the traditional creatures of the continental shelf or are to be expanded to all fish species in the waters above the shelf. In addition, the problems connected with the open-ended definition of the shelf are not resolved, leaving the extent of the U.S. fishery claim extremely vague.

The law creates eight regional management councils to set fishing regulations and quotas within their respective regions. The optimum yield of each species will be established, as well as the projected U.S. catch. If said catch is less than the optimum yield, each council, subject to the Secretary of State's approval, may allocate quotas to foreign fishing vessels. Present and historical fishing practices, dependence on the fishery, economics of the fishery, and other factors will be considered in determining priorities in allocating quotas among foreign States wishing to fish in the zone. A permit will be required of all foreign fishing in the zone after March 1, 1977. Where the species is not utilized at all by U.S. fishermen, the necessity of a permit for foreign fishermen is left up to the individual councils. Non-fishing vessels will not be required to obtain permits while in the fishery conservation zone.

The United States will not recognize a foreign State's fishery conservation zone beyond the State's territorial sea to the extent such sea is recognized by the U.S. if such State: (1) fails to consider traditional fishing activity of the U.S.; (2) fails to accept the management of highly migratory species by international fishery agreements, regardless of whether the State is a party thereto; or (3) imposes on U.S. fishing vessels any conditions or regulations which are unrelated to fishery conservation and management.

The law also authorizes the Secretary of the Treasury to prohibit the importation of fish and fish products from a foreign State which, in the Secretary of State's opinion: (1) is unable to reach a fishery agreement with the U.S. due to the bad faith of the foreign State; (2) does not allow U.S. vessels to fish for migratory species in accordance with applicable international fishery agreements, whether or not the State is a party thereto; (3) does not comply with international fishery agreements concerning U.S. fishing of species claimed by the foreign State; or (4) illegally seizes U.S. fishing vessels.

Enforcement of U.S. fishing regulations will be carried out by the Coast Guard. The Coast Guard will allocate its air and ship patrols according to the level of fishing activity. Areas off New England and Alaska are heavily fished and thus will be routinely patrolled. Patrolling will be augmented by use of observation satellites and the requirement that foreign fishing vessels entering U.S. waters be equipped with electronic identity devices called transponders. The Coast Guard estimates additional costs to be more than \$24 million. Once caught, offenders will face civil penalties (up to \$25,000), civil forfeitures, and criminal penalties (up to \$100,000 and one year imprisonment).

The state of Alaska has made a request to resume management of nine species of marine mammals. There has been a moratorium on the taking of marine mammals in Alaska since 1972. Fishermen claim the marine mammal population has increased to the point where it now poses serious competition for the standing stock of finfish in the eastern Bering Sea and Aleutian area. In 1975, about 5.8 million metric tons of finfish were taken from the eastern Bering Sea and Aleutian area. Commercial fishermen accounted for 2.3 million metric tons or about 14% of the estimated standing stock of finfish while marine mammals took 3.5 million metric tons or about 20% of the stock.

The proposed management plan sets upper limits on the number of marine mammals which can be taken annually and bars certain methods

of taking. The species affected would be polar bear, sea otter, northern (stellar) sea lion, Pacific walrus, harbor seal, ringed seal, ribbon seal, bearded seal and beluga whale. Alaskan officials say the plan will lessen the rate of fish reduction thereby increasing economic benefits to the fishing industry.

The U.S. Marine Mammals Protection Act of 1972 is getting its first test in the Federal courts. The United States Attorney for the Southern District of Florida filed criminal charges against two men who allegedly captured twenty-one dolphins in Bahamian territorial waters and on the high seas, and sold them for a profit to European and Canadian tourist attractions. The Act forbids any American citizen from taking or killing marine mammals in any location without a permit. Last year, an estimated 100,000 marine mammals were killed incident to the taking of tuna. The outcome of this case will certainly be of considerable interest to both environmentalists and the tuna industry.

Mexico

Mexico has enacted a constitutional provision which gives a statutory basis to President Echeverría's declaration of a 200-mile exclusive economic zone. Mexico claims control over all the removable resources, both living and non-living, within the zone. Exclusive conservation and inspection jurisdiction is also claimed. Foreign fishermen are required to obtain Mexico's authorization to fish in the zone.

Mexico wishes to expand its tuna industry and has expressed great displeasure with the amount of tuna taken by the highly mechanized United States tuna fleet stationed in San Diego. It estimates that 20% of the total tuna catch of 200,000 tons in 1974 was taken within its present 200-mile exclusive economic zone. Yet Mexico's catch was only 22,000 tons.

In order to expand its entire fishing industry, some thirty fishing schools have been opened to train present and future fishermen. The fishery school system graduated its first 1,200 professional fishermen this year. To facilitate instruction, twenty coastal fishing boats have been placed in service as floating classrooms. These fifty-foot boats were built in Cuba.

The planned addition of 289 new vessels to its fleet will enable Mexico to achieve an annual catch of 500,000 tons this year. The catch just five years ago was 254,000 tons. Fish exports continue to increase while fish

imports continue to decrease. Fish exports in 1975, estimated at \$120 million are up 50% from 1970. Fish imports in 1975, at \$16 million are down from \$21.6 million in 1970.

Cuba

Cuba is rapidly expanding its fishing industry to help meet the food demands of its growing population and to create needed foreign exchange. It hopes to increase its per capita consumption of fish from twelve kilograms at present to nineteen kilograms by 1980. Cuba must now import about 20% of its fish consumption with nearly all of its catch consumed domestically. The exportation of shrimp, tuna and the very lucrative lobster create needed foreign exchange. Cuba claims that it ranks with South Africa and Australia as one of the top three lobster exporting countries in the world.

In 1974, Cuban fishermen caught 165,000 tons of fish, seven and a half times the 1958 catch of about 22,000 tons. Unlike the 1958 catch, a significant amount of the 1974 catch was outside Cuba's coastal waters. In fact, 95,000 tons of fish were caught off the Pacific Coast of South America, the West Coast of Africa, the East Coast of the United States and Canada, the Gulf of Mexico and Central America.

Cuba's Fishing Institute predicts a catch of 400,000 tons by 1980. Cuban scientists estimate that the maximum sustainable yield for Cuban coastal waters is 80,000 tons. If the prediction is correct, 320,000 tons of fish will have to be brought in from areas outside Cuba's coastal waters, representing an increase of 225,000 tons from the present long distance fishing yield. A dramatic expansion of the entire fishing effort is required to meet this goal.

Cuba's long distance fishing fleet now has about fifty trawlers and tuna boats plus two shrimp fleets that fish the Gulf of Mexico and the north coast of South America. There are twenty-six trawlers on order from Spain and sixteen purse seiners on order from Peru. The fishing grounds will be expanded when Cuban vessels move into European and Pacific Northwest waters next year. The country is developing its manpower and shore facilities to meet this seagoing effort. In 1974, about 35,000 Cubans were employed in the fishing industry, about 16,000 of them sea-going. The Advanced Fishing School has been opened in Havana to train future sea-going officers for the fishing fleet. The four-year school graduated 154 students this year. The school's Director expects to graduate 200 in 1977.

Cuba's largest receiving and refrigeration facility is the fishing port in Havana. The port has a 21,000 ton refrigeration capacity and was built with Soviet credits. One of the contractual conditions is that Soviet vessels in the area are to be repaired there. Another fishing port is under construction on the southern coast in Cienfuegos, with an expected 5,000 ton refrigeration capacity. To handle the huge processing needs, Cuba has purchased a \$42 million processing plant from Italy. The plant should be in production by 1978 with a capacity of 200 million cans annually.

The fishing industry suffered a set-back recently when the Bahamas refused to discuss the possibility of Cubans fishing in Bahamian waters or on its continental shelf. The Bahamas, which excluded United States fishermen from taking the spiny lobster from the Bahamian continental shelf, is remaining steadfast in prohibiting exploitation of its marine resources by foreign fishing vessels.

In a tragic incident on April 6, 1976 a Cuban fishing boat was machine-gunned and sunk by an unidentified boat. The incident took place off Cay Sal Bank, about fifty miles off the Cuban coast; one man was killed. The four survivors were picked up by a Norwegian freighter en route from Jamaica to Miami and disembarked at the latter's port, but later returned to Cuba. The United States Federal Bureau of Investigation took preliminary jurisdiction of the matter. The attacking vessel has not yet been identified, but because of the possibility of violation of the U.S. Neutrality Act, an investigation has begun.

The attack appears to have been politically motivated with anti-Castro extremists claiming responsibility. Cuba's fishing fleet was once widely suspected of furthering Castro-sponsored revolutions in Latin America.

Iceland

Tension in Iceland's "cod war" with Great Britain continues to mount; the stakes are high. Iceland's fishing industry is the cornerstone of its economy, but it is also claimed that the exclusion of British fishermen from Icelandic waters would result in the loss of 20,000 jobs, one fifth of Britain's fishing industry. The British have voluntarily reduced their catch off Iceland three times since 1972 and have offered further reductions as part of a long-term agreement but Iceland insists on immediate and full control over fishing within its self-proclaimed 200-mile fishing zone.

According to Iceland's embassy in the United States, the British fleet within Iceland's 200-mile fishing zone is composed of twenty-five to fifty

trawlers, two tugs, two other support vessels and six frigates. In a recent incident, a British frigate trailed twenty-five British trawlers fishing in a closed cod conservation zone about fifty miles off Iceland. An Icelandic cutter confronted the frigate but the frigate's superior size enabled it to force the cutter back to within twelve miles off shore, the internationally recognized exclusive fishing zone limit. According to Iceland, the frigate rammed the cutter at least four times in driving it out of the area.

Earlier in the year Icelandic fishermen blocked United States military personnel from entering radar and communication stations in Iceland. The two-hour protest blocked the entrance to a U.S. manned NATO base which monitors Soviet naval and air movements in the North Atlantic. The fishermen hoped the protest would encourage the United States and NATO to pressure Great Britain to withdraw its warships and trawlers from Iceland's fishing zone.

POLLUTION

The case of the *Garbis* oil spill (8 *Law. Am.* 194, 1976), has been dismissed for lack of jurisdiction. The *Garbis* was accused of spilling oil off the Florida Keys in July, 1975. When judicial proceedings were initiated against the ship and her master, the *Garbis* was believed to have been within the twelve-mile limit of the United States. It has now been shown that the spill occurred when the ship was outside the twelve-mile zone. The United States has jurisdiction only up to twelve miles off its coasts to prosecute foreign vessels discharging oil (33 U.S.C. §1161).

The U. S. National Wildlife Federation has initiated a suit against the United States Army Corps of Engineers and the Environmental Protection Agency (E.P.A.) to curb the ocean dumping of dredged material by the Corps of Engineers. The Federation, the largest private conservation group in the United States with about one million members, has charged that the policies and standards of the Corps of Engineers and the E.P.A. violate both the Marine Protection, Research, and Sanctuaries Act of 1972 and the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. The Federation claims that the defendants have not considered the effects of dumping on health and the environment, as required by law, particularly as to materials containing toxic metals such as mercury, cadmium and arsenic. The suit also seeks to compel the defendants to promulgate ocean dumping criteria which comply with the U. S. law and the international convention.

The extensive safeguards to protect against an oil blowout are especially timely in light of recent studies showing oil spills to be a serious peril to the climate. Scientific studies show that oil spills on Arctic Ocean ice could conceivably create changes in the earth's climate. Experiments reveal that ice contaminated with oil melted very rapidly while adjacent non-contaminated ice remained intact. Given the interrelationship between the Arctic Ocean and climatic conditions in the Northern Hemisphere, the possibility that oil spills might destroy ocean ice becomes very important. Large oil spills could significantly alter the heat budget of the Arctic, thus endangering more than just the environment of nearby areas.

OFFSHORE OIL

The offshore petroleum issue may be one of the focal points of the 1976 Third Law of the Sea Conference in New York. The petroleum question demands particular attention because of the vast amount of wealth at stake. Reasonable estimates are that at least as much ultimately recoverable oil lies under the seas as on land. At present, roughly one-sixth of the total world production comes from offshore drilling. The question, then, of who has the right to explore and exploit this treasure and to share in its benefits is a decisive issue in the Third Law of the Sea Conference.

The United States Department of the Interior appears determined to push ahead with its offshore oil and gas leasing program. The Secretary of the Interior is viewing the oil exploration and development off Alaska and in the Gulf of Mexico as the nation's best hope for significant increases in oil and gas production. The Department is in its third year of the accelerated leasing program on the outer continental shelf. The goal is to lease at least 5 million acres to the oil companies for exploration. To date, little more than 3 million acres have been leased. Criticism of the program continues to mount, however. Congress is considering a number of bills calling for amendment of the leasing system, and tighter controls on exploration and production. Environmental groups, slowed down in their battle against widespread leasing by several losses in the courts, have vowed to keep litigating the issues. With much of the leasing off the west coast completed, efforts are being concentrated on the planned development of three areas off the Atlantic coast. Lease auctions tentatively scheduled for later in the year have already been challenged in suits pending before the district courts.

Meanwhile, the State of Alaska is distressed over the Secretary's decision to lease offshore tracts in the northern Gulf of Alaska. The state's Commissioner of Natural Resources has announced that the State will probably sue the Interior Department for failing to fully consider the ramifications of its actions. Although federal officials have twice postponed the sale, it is believed that the Gulf of Alaska holds the greatest potential of all of the frontier areas on the East, West, and Alaskan coasts that will be opened for drilling. While oil companies are pleased with the decision to lease, possible threats to the environment are of paramount concern to Alaskan officials and private environmental groups. The proposed action is important in that the Interior's decision, if upheld, could be a precedent sounding an end to much of the litigation dealing with offshore sales.

Canada is investing heavily in its search for oil beneath the Beaufort Sea. Drilling is expected to begin in early August, but would have to stop by September 15, in order to move in a relief well before the ice comes. The Beaufort drilling has been opposed by environmental concerns, which prompted Canadian authorities to fund \$50 million to cover cleanup and damage payments to Alaskans and Canadians in the event of a well blow-out.

The widespread effects of the Mideast Oil Embargo has spurred the exploration for alternative sources of oil. The prospects of finding oil and gas under the Atlantic Ocean appear promising from the results of a test well drilled three miles deep in the Baltimore Canyon. Core samplings indicate that the area under the continental shelf from Maine to Florida may contain as much as two to four billion barrels of oil and from five to fourteen trillion cubic feet of gas. The next step is to drill actual wells in the area to substantiate the test results. A 344-foot semisubmersible drilling rig is being used to obtain the geological information upon which further development is based. The giant semisubmersible rig is able to withstand extreme weather conditions while drilling to great depths. The rigs are also intended to act as a home for workers during the exploratory drilling.

The need to handle Middle East crude oil, has led two United States companies to seek approval for building offshore mooring stations. Seadock, Inc. has submitted plans to construct a \$650 million "super port" capable of unloading 2.5 million barrels of crude oil a day, twenty-five miles south of Freeport, Texas. Louisiana Offshore Oil Port, Inc. submitted the second application, calling for a \$350 million facility twenty

miles south of Grand Isle, Louisiana, capable of unloading 1.4 million barrels a day. The deep-water mooring stations, or superports, consist of an above-water pumping station resting on the ocean floor. Buoys, anchored to the bottom, would radiate from the platform. A supertanker would moor to a buoy, unloading its cargo of crude through hoses connected to the platform. A large underwater pipeline would then transfer the oil to onshore storage facilities. Except for Puget Sound near Seattle, United States ports are neither big enough nor deep enough to handle fully loaded tankers with a cargo capacity greater than 100,000 tons. The present applications for the super ports were filed under the Deep Water Port Act of 1974, which calls for environmental impact statements and public hearings before any license will be issued. The first proposed superport in the United States was planned for Delaware Bay in the early 1960's, but environmental concern over oil spills caused cancellation of the project. Those same environmental feelings are causing concern to officials of Florida who feel that they should be involved in any plans for the new superports because of the adjacency and crucial interests of the state. Under the Deep Water Port Act, an adjacent coastal state has the authority to seek delay in the construction of the facilities until its environmental concerns have been safeguarded.

Because of the hardships endured by workers on offshore oil platforms, Phillips Petroleum Corp. is making plans to build a floating hotel to be used as a rest and recuperation center for weary oilmen. It will be a five-story structure built on a platform anchored to the seabed 600 feet below the surface. Phillips expects to have it built, in position, and accepting reservations for its 106 rooms by the middle of next year. The first facility is to be positioned in the North Sea oil fields, but more are expected to be built for other areas.

A \$65,000 Survival System, a standard piece of lifesaving equipment on most oil rigs, became a floating coffin for thirteen oil workers after it was launched off an oil-drilling platform that was sinking in the storm-swept Gulf of Mexico. The domed fiberglass lifeboat, which looks like a flying saucer, is a sophisticated floating environment capable of sustaining twenty-eight men for five days. The floating device apparently capsized after overturning in fifteen-foot seas.

SHIPPING

The Caribbean Multinational Shipping Company (NAMUCAR), the shipping consortium formed last year by Mexico, Cuba, Nicaragua, Ja-

maica, Venezuela, Panama, and Costa Rica, has begun operations. The group, headquartered in San Jose, Costa Rica, is operating one chartered vessel but plans to put a second vessel in service in the near future. Eventually, the group plans to acquire its own ships. NAMUCAR's objective is to monopolize the Caribbean shipping routes; thus, its plan is to include as many countries as possible within the group. Approaches are being made to Guyana, the Dominican Republic, and Colombia. If other member countries follow the lead of Costa Rica, company personnel will receive such benefits as diplomatic privileges, while NAMUCAR itself will gain special options to carry a fixed percentage of goods to and from member ports. This favored relation between members and NAMUCAR is of special concern to Colombia. Coffee growers in that country are concerned over the fate of the Great Colombian shipping fleet which some growers feel is better equipped to handle inter-Caribbean shipping services than NAMUCAR.

Meanwhile, in the United States, the Ford administration is looking for ways to overhaul operation of the nation's merchant marine. Of particular concern to a maritime task force are the so-called "conference system" and the controls the Federal Maritime Commission (FMC) has over "dual rates"—situations wherein steamship companies charge a higher rate for freight shipped in one direction than another. Proponents and opponents of the present maritime system, involved in studying the proposed overhaul, have a complicated task ahead of them. Shipping has been the subject of very few intensive studies, largely because it is difficult to obtain information on operations, revenues, tonnage, and costs of foreign flag vessels. The developing United States position on the merchant marine is certain to have a significant impact on world maritime shipping.

SALVAGE

The Soviet trawler *Samarga* ran aground off Kayak Island in the Gulf of Alaska while attempting to maneuver close to one of the two four-mile landing areas on the island. These cargo transfer areas are open to the Soviets by the terms of treaties between the United States and the Soviet Union. A conflict arose over which nation would be allowed to salvage the ship, the Soviets or the Americans. U. S. law requires all salvage in U. S. waters be done by Americans unless the Americans do not have adequate gear on hand. The Americans, namely Crowley Maritime, the West Coast's biggest tug company, have sufficient capabilities

to float the trawler but are reluctant to act without a salvage contract. The Soviets do not want the expense of a large salvage contract but they also do not want to create an international incident by pulling the trawler off with their own tugs. The United States Coast Guard could also refloat the ship but its regulations forbid such action when civilian equipment capable of doing the job is at hand. The trawler's fuel oil, about 100,000 gallons, has been pumped into barges to prevent a major oil spill while the dilemma is being resolved.

RESEARCH AND DEVELOPMENT

Cayman Trough Exploration

Scientists continue to gather data about one of the little-known areas of the world, the ocean floor. Three research vessels from the Woods Hole Oceanographic Institution have embarked on a voyage that will carry a half dozen scientists into part of the Cayman Trough. The focus of the three vessels, the Knorr, the deep-diving submersible Alvin, and the mother ship, the catamaran Lulu, is directed at an area where two plates of the earth's surface are thought to be sliding laterally relative to one another. The north side of the trough is believed to be the edge of a vast plate that includes all the western half of the North Atlantic as well as the North American continent. It is moving west, away from the Atlantic ridge. Of special interest to the divers is a north-south feature on a 50-mile wide stretch of trough floor, that runs east and west. This is suspected of being a miniature counterpart of the mid-Atlantic ridge where the sea floor is being pulled apart and the resulting volcanic activity has generated a closely spaced series of north-south ridges.

The scientific operation is a successor to the 1974 French-American Mid-Ocean Undersea Study, better known by its acronym as Project FAMOUS. Using the three vessels, scientists are able to engage in direct observation of the earth's surface. The goals of this project include an understanding of the Caribbean area. Already, specimens of volcanic glass have been analyzed. The rocks being hauled to the surface, once examined by geologists, may add to the present knowledge about earthquakes, and lead to a better understanding of how the earth evolved.

Oil company geologists with the Atlantic-Richfield company announced plans at a meeting in March to drill in the northeast section of the Bering Sea to test a theory that sediments in the basins behind the Aleutians meet the requirements for oil accumulation. The meeting was held to

memorialize the late Dr. Maurice Ewing's achievements and research, which laid the foundation for the theory of plate tectonics. According to this theory, the earth's surface is divided into rigid plates that are in constant motion, relative to one another. The focus of the meeting was on island arcs such as the Aleutians, Japan, the Kuriles, and the Marianas, the trenches in front of them where the sea floor begins its descent into the earth, and the basins behind each arc. A major puzzle has been the amount of heat flowing up through the floors of many of these basins (the Caribbean is a notable exception). This heat flow is of special interest because it may "cook" organic material in the sediments of these basins hot enough to produce oil. Huge sediment filled basins have been found north of the Aleutians, formed when sediment is scraped from the descending plate. These basins are being tested by oil prospectors. By acoustic probing, oil prospectors on a moving ship can map structures to depths of several miles beneath the sea floor and thereby trace the oceanic plate as it descends under the Aleutians. The back arc basins, like the Sea of Japan, are rich mineral zones. One explanation for this formation is that hot, molten material rises over the descending plate and spreads near the surface, forming a basin and pushing the island arcs away from the mainland. Where, as in South America, the descent is under a continent, the rising material will create a plateau, such as the Altiplano of Bolivia, or the Andes.

Deep Wells to Aid Oil Exploration

To aid in the search for petroleum reserves, the U. S. Geological Survey announced that it has finished drilling the deepest hole ever made in America's Atlantic outer continental shelf. Drilled into the floor of the Baltimore Canyon Trough, the 16,000 foot well will enable scientists to analyze the geologic formations to determine the likelihood of oil reserves. Plans are underway to drill a 17,000 foot well into the floor of the Georges Bank off the coast of New England.

A maritime satellite system (Marisat) is beginning to open up a new era in communications for ships at sea. The project, consisting of three orbital satellites, will provide instantaneous ship-to-shore communications almost anywhere in the world. The first Marisat spacecraft, already in orbit and positioned high over the Equator, supplies immediate telephone and data relays anywhere in the Atlantic Ocean and Persian Gulf. The second Marisat is to be placed over the Pacific Ocean later this year, and the third, a European-built spacecraft, should be in operation over the Indian Ocean in early 1977.

The American spacecraft, built by Hughes Aircraft Company, are designed for a lifetime of five years. The satellites are equipped to operate at three frequencies — an ultra high frequency assigned for the U. S. Navy's exclusive use, and two very high frequencies for commercial use. To use the system, ships and shore facilities are fitted with a four-foot diameter antenna, along with a specially designed receiver-transmitter. It is estimated that the potential market for the Marisat system includes at least 4,500 ships. The system could revolutionize maritime communications were the shipowners to adopt it.

The Radio Corporation of America, supported by U.S. government funds, has developed a sailing robot, which is designed for electronic intelligence gathering and submarine detection. SKAMP (State Keeping and Mobile Platform) uses air foils and rudders activated by computer monitored radio signals to maintain, and alter its station. The robot moves at a speed of four knots and runs for a year at a time. It can be made invisible to radar scanners because it does not have a metal superstructure. SKAMP will operate normally, except in winds of more than seventy knots, when it will close up and ride out the storm and then return to operation. Other possible uses of SKAMP include monitoring the weather and ocean currents and serving as a radio relay station and navigational aid.

Explorations have begun in southern Chile with an eye towards establishing a major salmon fishing ground in the southern Pacific. Several types of salmon may be introduced; crab-eating salmon in Chilean waters and krill-eating salmon near Antarctica. Salmon are not found naturally in the Southern Hemisphere because all the stream beds for spawning were covered in the "recent" ice ages by glaciers, and salmon in the Northern Hemisphere find tropical waters too warm to cross. There are few sites for a salmon fishery in the Southern Hemisphere. Some possibilities are the French Antarctic Islands (Kerguelen), the Falkland Islands, and the Argentinian portion of Tierra del Feugo. Conditions are believed to be most favorable in southern Chile. Scientists, with the cooperation of the Chilean navy, are looking for places in southern Chile with conditions similar to Norwegian fiords and where cold ocean currents flow south rather than north. Sites will also be sought for chum and pink salmon, which roam over thousands of miles of ocean, and for coho and chinook salmon, which stay longer in fresh water. Scientists feel that the salmon fishery, if established could add considerably to the world's supplies of protein.

One developing area of research and experimentation in the adaptation of ocean resources for man's needs is seaweed farming. Red seaweed is a rich source of carragen, which is a natural industrial gum used as a stabilizer and suspending agent in foods, cosmetics, pharmaceuticals and textiles. This colorless, tasteless, natural additive keeps ingredients in ice cream, chocolate milk, paint, tooth paste, etc. from separating. Marine Colloids, Inc., a firm which produces refined seaweed extractives, has attempted to supplement diminishing natural supplies of red seaweed by sponsoring research in the Florida Keys and seaweed farms in the Philippines, Indonesia, Mexico, Venezuela, Central Africa, and the west coast of the United States. The seaweed farms in the Philippines cultivate *Euchema*, a type of red seaweed. These farms are actively encouraged by the government, and scientific support has been provided by the University of Philippines, the University of Hawaii, Marine Colloids, Inc. and the United States Sea Grant Program. *Euchema* is planted off the bottom on nets to reduce loss of the crop to predators, chiefly sea urchins. The nylon nets are attached to mangrove stakes placed in a lagoon. A 200 net installation holds 25,400 plants and is called a module. The plants are tied to each intersection of the mesh of the net. An acre of seaweed farmed in the Philippines can yield at least forty metric tons of wet seaweed a year, equal to 5.3 dry tons. Each dry ton is worth \$225 to the harvester and requires an initial capital investment per acre of only \$40-\$50 and \$35-\$50 each year thereafter. Marine Colloids has promised to buy all their production. Seaweed farming industry seems to be well established in the Philippines. It is hoped that the industry can be introduced in the Florida Keys but there may be too many logistic problems. The small amounts of seaweed "grown" in the Keys are used to provide data for large-scale harvesting at Marine Colloids' sea farms.