

been in the ocean for long periods were discovered and analyzed. The aromatics are also more water-soluble than other hydrocarbons.

Although he regards the aromatics as the most toxic fractions, Dr. Blumer says all hydrocarbons are suspect and some are unexpectedly nondegradable. Paraffins—straight chain saturated hydrocarbons—degrade scarcely at all in sediments, although they degrade within organisms at rates not yet determined. They are also showing themselves to be unexpectedly toxic.

Hydrocarbons in general tend to concentrate in the fatty tissues of organisms, where they remain virtually unchanged by metabolic processes. By transfer from the fat of one organism to another, they can become more concentrated as they move up the food chain. Mechanisms of toxicity are not wholly understood, but the aromatics have been implicated as carcinogens. The paraffins cause damage through cell narcosis, especially in shrimp larvae and other juvenile organisms.

Olefins—unsaturated—hydrocarbons interfere with ecologic processes which use various chemicals in concentrations as small as one part per million for such functions as attracting predators to their prey

The olefins are generally absent from crude oil, but they are common in gasoline and other petroleum products, as well as in synthetic crude produced from coal or oil shale. "There is still a great mystery about the role that the olefinics play in marine life processes," Dr. Blumer says. "But even if they are nontoxic, they can interfere with these life processes."

Dr. Edward Goldberg of Scripps Institution of Oceanography confirms Dr. Blumer's conclusions. "The chronic buildup of pollutants from petroleum is quite serious," he says. Dr. Goldberg has done research in the transmittal of pesticides in the environment.

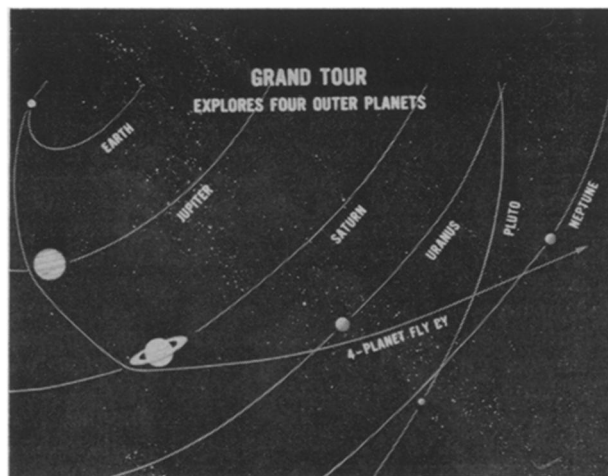
Woods Hole scientists plan further sampling, at various points in the open sea, to learn the extent of pollution farther from shore.

Dr. Blumer's work has concentrated on the more subtle biochemical effects of oil pollution. But the grosser effects have been known for a long time. Petroleum saturates the feathers of aquatic birds, reducing their buoyancy and water resistance and finally killing them.

The Interior Department reported last week that an estimated 10,000 birds had been killed along the shores of Alaska's Kodiak Island as a result of tankers pumping oily ballast out of their tanks into the sea. A sternly worded statement from Hickel indicated that he held this spill to be one that could have been avoided. □

Reaching for the planets

To the outer planets: An earlier version planned to visit four.



NASA

With the first round of a continuing budget battle and the dedication of his Administration to environment, education and fiscal responsibility behind him, President Nixon last week turned to space. His promised space message (SN: 9/20, p. 233) was exactly what the scientists had ordered—not one present but a bundle full, largely unmanned.

The President, in deferring to the "many critical problems here on this planet which make high priority demands on our attention and resources," seemed to be trying to allay criticism of space-budget cuts by announcing that "by no means would we allow our space budget to stagnate."

The biggest plum was the first Presidential confirmation of a grand planetary tour: two unmanned cruises to the outer planets. One, aimed at Jupiter, Saturn and Pluto, is set for 1977. The second, to Jupiter, Uranus and Neptune, will go two years later. Such missions are the rare opportunity of this decade; it will be 180 years before the planets will be aligned again in such a way as to allow one vehicle to swing by each of them.

Scientists had been rather gloomy about the prospects of the grand tour idea. The date had not been mentioned in the National Aeronautics and Space Administration budget announced Jan. 31 by Administrator Dr. Thomas Paine. At that time Paine also inferred that neither the nuclear-powered vehicle NERVA, nor the Saturn 5 rocket, would be able to carry out the mission; the nuclear vehicle will not be flown until 1978, and production of the Saturn 5 rocket has been suspended. Now scheduled for the task is the Titan III-D Centaur-Burner II, which could carry a payload of about 1,600 pounds; the Saturn could carry 9,800 pounds.

Another theme that scientists have

been pushing is greater emphasis on unmanned flights as precursors to manned missions. The President seemed to be going along with this idea, too. In particular, he did not set a firm date for a manned flight to Mars, although he said we will eventually, fly there. Dr. Paine says such a flight could not take place before the late 1980's.

Nevertheless, manned flights are the meat of the space program, and to support his contention that his program is "bold but balanced," the President emphasized the importance of the remaining manned lunar flights, to be completed with Apollo 19, according to NASA plans, by 1974. He also mentioned Skylab—the orbiting workshop of 1972—which will house several three-man crews for periods up to 56 days.

In addition, as his Space Task Group pointed out in its September report, unmanned planetary explorations, such as two planned Mars orbital flights in 1971, the two unmanned spacecraft landings on Mars in 1976, and the Venus-Mercury flyby in 1973, are all precursors of later manned missions.

Another aspect of President Nixon's space program is the much-touted possibility of gains from earth applications. The President went through the catalogue once more: communications, weather forecasting, low-cost space transportation, crop surveys, mineral location and the measuring of water supplies. Much of this work will be done by a variety of earth satellites which Mr. Nixon did not catalogue.

The President also made a traditional gesture to "greater international cooperation in space," a point backed up by Dr. Paine's recent trip to Canada, Japan and Australia to discuss cooperative space projects.