

both ends of Long Island Sound, creating the largest fresh water reservoir in the nation.

A **three-ship Canadian** "navy" is fighting water pollution in the Great Lakes by checking the industrial, domestic and surface pollution from Ontario and their effects on the Lakes.

New kinds of spectrographic analysis and other advanced methods for quickly detecting polluting chemicals and bacteria were reported.

The oceans can no longer take all man-made wastes such as crude oil, radioactive elements, heavy metals and chlorinated hydrocarbons, warned a 54-nation Intergovernmental Oceanographic Commission sponsored by UNESCO.

A **500-foot deep well**, first of a series, is being installed to pump about 400 gallons of fresh water per minute into sands near the southern coast of Long

Island to keep salty ocean water from moving in.

Cessation of plans for the immense, expensive Rampart Dam proposed for the Yukon River in central Alaska, was urged after 16 months of study by a six-man team commissioned by the Natural Resources of America.

Scientists continued to make strides in combatting insect pests with biological factors instead of harmful chemicals, including use of natural enemies of insects such as bacteria, viruses and protozoa; use of high-energy gamma rays, infrared and other powerful radiating waves; and energy waves such as sound, light and heat.

Plants such as grapes, beans and spinach are being cultivated to be less sensitive to air pollution.

Forest genetics experts are breeding pine seedlings that grow faster, resist

disease, and produce more and better pulpwood.

The Sequoia redwoods, *Sequoia sempervirens*, some of the world's oldest trees, were centers of bitter fights between conservationists and lumber and highway interested people.

Yielding under pressure from President Johnson and an aroused public, California lumber companies agreed to stop cutting "park quality" redwood trees within the confines of a proposed Redwood National Park.

The bald eagle, symbol of America, was given better protection in federal refuges, where one square mile around each nesting tree is now closed off.

A **mother Southern Right whale** and her calf were sighted and driven out of Sydney Harbor, on the New South Wales coast. The two are perhaps the last survivors of a species.

SPACE

On the Way to the Moon

by Jonathan Eberhart

The space story in a nutshell was: U.S. astronauts did, Soviet cosmonauts didn't, and the moon had more oglers than Sophia Loren.



Eberhart

The next chapter of the space story in a nutshell will be: What next?

Though a manned moon landing is still some two years off, most of the work has been done already. The

huge space companies, many of which have grown almost from nothing solely because of an address by President Kennedy declaring the moon to be a national goal, are turning to other things, diverting their vast engineering and scientific teams to more earthly problems such as pollution and medicine.

It is taking man a decade to tool up for going to the moon. If he is going to Mars, those preparations may take even longer. While trying to make such a monumental decision so far in advance, NASA is finding itself stuck for ways to sustain its more than \$5 billion budget.

Though the Space Age is moving so fast that a lot of hardware is far behind the state of the art by the time it is built, NASA's biggest hope to

plug the economic dike is the Apollo extension system, a plan to use Apollo-style hardware for a range of projects including space stations, moon flights and other missions.

A series of mishaps during the past year, mostly involving Apollo testing, have caused considerable delays and shufflings in the early flight schedule, but NASA doggedly maintains that the manned lunar landing will take place on time. It can still happen, but the program is now so tight that there's barely enough "padding time" left to bite your nails.

During the year:

The only men in space were Americans, riding five Gemini spacecraft. Each flight had its spacewalk, some finally got some docking practice, and the net result was that although a lot was gained toward the Apollo flight to the moon, working in space turned out to be a lot harder than previously imagined.

The moon was scouted like never before in 1966, especially by two spacecraft that first settled gently down in a blast of retrofire, then sent back to earth the first pictures ever taken from the lunar surface. The Russians were first with Luna 9, the Americans followed four months later with Surveyor 1, which amazed even its inventors by surviving for months instead of for only a single two-week lunar "day."

Luna 10 was launched in April into orbit around the moon, equipped not with cameras but with a gamma ray spectrometer to analyze the lunar rocks. Next was the U.S. Lunar Orbiter 1, which took the first U.S. pictures of the far side of the moon, followed by Luna 11 from the Soviet Union, weighing more than four times as much as the U.S. spacecraft, then Luna 12, and Lunar Orbiter 2, which obtained the high resolution photos its predecessor missed.

Three satellites were launched for the Environmental Science Services Administration, the first two forming a global storm patrol, and the third being the first Tiros-type satellite to carry two advanced vidicon camera systems, each capable of complete daily coverage of the world's weather.

The years-behind-schedule Orbiting Astronomical Observatory finally got off the ground, only to have its battery fail after two days in orbit. Two months later, however, the Orbiting Geophysical Observatory, OGO-3, did everything just right and set to work with all 21 of its experiments going.

The second Nimbus weather satellite, largest meteorological satellite ever launched, was lofted perfectly, photographing everything from tropical storms to nighttime clouds.

At least 27 of the Soviet Cosmos catch-all satellite series were launched this year, notably including No. 110,

which carried two dogs and gave rise to rumors about severe medical trouble with human cosmonauts in space; and No. 122, a weather satellite whose launch was witnessed by possibly the first foreigner ever to visit the Soviet space complex at Baikonur—President de Gaulle of France.

The third French satellite, D1A, was successfully launched early in the year, and has been returning geodetic survey data from its rather sharply inclined (34 degrees) orbit.

A Russian spacecraft apparently col-

lided with Venus (or landed on it) on March 1. Whether the flight was a successful planet probe or an unsuccessful flyby was debated, but initial concern was over whether the Soviets had sterilized the vehicle (they had) so that it would not contaminate the planet with earthly bacteria.

Applications for positions in the second group of U.S. scientist-astronauts were requested by the National Aeronautics and Space Administration and are due Jan. 8, 1967.

A new rash of UFO sightings

prompted two Federal investigations, several books, and resulted in the Air Force's becoming completely fed up with carrying responsibility for the whole thing and dumping same on the University of Colorado.

On the good side, television viewers saw the first live coverage of recovery from space this year, beginning with Gemini 9. On the other hand, an accident during an unauthorized publicity photo flight cost the lives of two pilots and one of the country's two \$600 million B-70 superplanes.

ENGINEERING/TECHNOLOGY

Road to Glory?

Basic research, a miracle phrase that once could open any door, including those of government coffers, is in for a rough time.

On the other hand, unbasic science, better known as technology, has acquired a rooting section that is spreading all through the government into such keys spots as Congress, the Defense Department and the National Bureau of Standards.

Combined with plans to soup up the mind-bogglingly antiquated U.S. patent system, this new view should see the greatest surge in technology and engineering since before all the basic research noise began in 1959. Many federal agencies are already studying NASA's technology-boosting plan of offering royalty-free use of all its inventions, followed, if that fails to bring the engineers out of the woodwork, by royalty-free exclusive rights.

Not all research, of course, is directly speeded or impeded by government funding traffic. To a large extent, technology breeds technology. The huge supersonic transport project, for example, has caused the competing manufacturers to develop almost an entirely new branch of metallurgy, since there have been practically no existing techniques for fabricating the mostly-titanium aircraft.

This year in technology:

A reading machine for the blind translates writing into tactile vibrations received through the fingertips.

Patients will be less exposed to X-ray radiation because of a new machine, designed with its radiation source housed seven inches farther from the person than in present designs. The machine which also gives better pictures is the first since 1923 in which the components inside the X-ray head have been rearranged.

The use of inorganic solvents lacking light atoms such as hydrogen was the basis for a new type of liquid laser with a high energy output.

Ground glass was made into a lubricant suitable for aerospace applications and automatic weapons.

A photographic system that takes black-and-white pictures and then shows them in color was revealed.

A new microscope was developed that can either superimpose one image on top of another or rapidly alternate images.

An F-104 Starfighter capable of traveling at twice the speed of sound took off without using a runway, receiving extra thrust from a solid-fuel booster rocket mounted beneath the fuselage.

The first four-inch superconducting linear atom smasher section was successfully operated.

Troops were successfully landed on treetops from helicopters.

A computer language called FASE for "Fundamentally Analyzable Simplified English" was devised that will be useful in automatic information retrieval.

A laser powered by the sun was successfully tested.

Automated libraries capable of supplying information and selected book passages on the television screen with a simple telephone call were predicted.

A proposed system will make broadcast of television programs directly to homes from satellites possible.

The "tuning" of a tiny pin-headed sized integrated circuit was made possible by a new kind of transistor containing a fine gold whisker only one-tenth the diameter of human hair.

Liquid methane was proposed as a

possible fuel for supersonic transport planes.

The first electrically scanned laser system made possible tracking rockets during launch more precisely than with radar.

A test was being made of a computer-based registry for chemical compounds that would provide a comprehensive file of about 40,000 chemical substances of special interest to the Food and Drug Administration and the National Library of Medicine.

The theory that flame can be used to amplify sound was verified by the production of a system that intensifies a human voice to many times that possible with the electrodynamic loudspeaker.

A new method of desalting seawater placed in operation depends on the energy of chemical reactions for its power.

A battery-operated electric car that is plugged in for recharging while parked was seen as a future means of transportation with the development of a new type of battery that offers 15 times the energy density of current batteries of the same size.

A "telepuppet," or robot, that could take the place of man and perform chores in space while controlled by radio waves from earth was deemed possible with the instruments and technology available.

Synthetic pictures of the ground, clouds and other objects on earth were generated by a tiny computer onto a television screen.

Rings for storing accelerated protons are being built both at CERN (28 Bev) and at Academic City in Siberia (25 Bev). Finishing touches were being put on the Soviet 70 Bev atom smasher scheduled to go into operation during 1967.