ASTRONAUTICS

Set New Law Principle

When no nation asked permission to send up satellites and no protests were made, a new law principle was established. Space legislation is now needed, Tove Neville reports.

➤ A NEW PRINCIPLE of international law was established when satellites were sent into space without permission from other nations.

No permission was sought by any nation, none was given and no protests were made about the launchings. Such lack of action proves the new principle, Paul G. Dembling, assistant general counsel to the National Aeronautics and Space Administration, told the American Rocket Society meeting in Washington, D. C.

He said no action has yet been taken to define territorial rights in space, but no legal authority believes that territorial rights should apply to space, not even in Russia.

The main question to be answered is: where does air space end and outer space begin. Three types of proposals have been made:

1. Geophysical limit, which would set the troposphere, the ionosphere or similar division, as the limit.
2. Arbitrary limit, set at a certain altitude.
3. Air-breathing limit, above which aircraft requiring atmosphere cannot fly.

Mr. Dembling said that the law must consider socio-economic as well as the physical problems of space flight.

The legal principles regarding liability for damage from space vehicles of any kind are quite well set already, he said. Responsibility for damage, direct or indirect, would fall on the launching nation. Indirect damage from radioactivity would be included under this classification.

Concerning commercial exploitation of space, an entirely new legal field will be opened, Mr. Dembling said. If commercial firms can launch their own satellites, licensing laws must be made. The rates they can charge for their services must be considered. Provisions for national and international control of such use of space must be made.

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ASTRONAUTICS

"See" Earth Three Ways

➤ THE FIRST ASTRONAUT will have three ways of "looking" at the earth as he orbits around it one hundred miles up. Besides direct vision, he will have a periscope and instruments to "see" by.

The astronaut will be able to see only an edge of the earth and black space beyond it when he looks through the window in front of his head.

He will not be able to see the whole earth at any time, but will have a periscope between his knees that shows him a view of the earth beneath him as a circle the size of a grapefruit. This will represent an area 1,800 miles in diameter from horizon to horizon at this altitude, Dr. Robert Voas of the Space Task Group, National Aeronautics and Space Administration, Langley Field, Va., reported.

Dr. Voas described to the American Rocket Society meeting in Washington, D. C., four tasks the astronaut must face in trying to control his Mercury space capsule.

When the capsule separates from the rocket, it is possible that the capsule will tumble, turning end over end. The astronaut has to stop this motion with his instruments and reorient the capsule so it is level with the earth. Next he has to set his gyros so the capsule remains level, without tumbling as it will have a tendency to do. He also has to keep it from oscillating and, lastly, he must be able to fire retrorockets and change the orbit of the capsule to bring it back to earth.

Dr. Voas said that the astronaut has a number of different systems by which he can carry out his tasks. First of all, he has an automatic pilot that, however, will allow the capsule to move only in the forward direction, with the man aboard flying backwards.

If the astronaut wants to fly forward, or any other way, he must use one of his three manual control systems. These systems have different engineering characteristics, Dr. Voas said.

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Astronauts Man Controls

➤ THE ASTRONAUTS have learned to work the controls in the Mercury space capsule while tested in a centrifuge trainer that simulates the conditions under acceleration up to 8 g's, or eight times the earth's gravitational pull. This force will be experienced by the astronaut from rocket propulsion when leaving and returning to earth.

Dr. Robert Voas of the National Aeronautics and Space Administration, Langley Field, Va., reported to the American Rocket Society meeting in Washington, D. C., that the astronauts were trained in two different types of trainers. One type is fixed and a computer comes up with problems for the astronaut who then has to respond as he would when actually in space.

The other type of trainers move. One is a platform on air bearings. The astronaut controls the platform while it moves. Another moving trainer simulator tumbles on a gimble apparatus. In this the astronauts were turned over and over 50 times per minute, and all were taught to handle controls while moving at this speed.

A third moving trainer is the centrifuge simulator, in which it is very difficult to handle controls, Dr. Voas said. The astronauts are now fully trained to go into space, but they will continue the program until the launch, he said.

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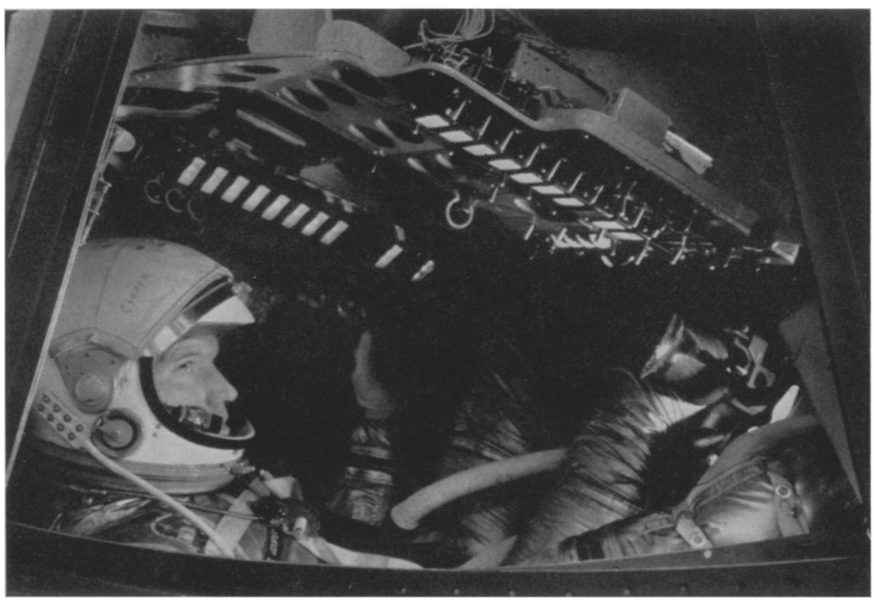
New Rocket Nozzle

➤ MISSILES WILL be lighter and shorter when a new reverse-flow type rocket nozzle



ASTRONAUT COOPER INSIDE THE CENTRIFUGE TRAINER.

is put to use, R. S. Kramer reported for Rocketdyne, a division of North American Aviation, Inc., Canoga Park, Calif., which is producing the nozzle.

Detailed information on this nozzle is still classified, Mr. Kramer said at the American Rocket Society meeting in Washington, D. C. He said that the trend in rocket nozzles has been toward shorter design, going from the bell-shaped nozzles, now used in all missiles, to the spike type, to a combination of the two.

The reverse-flow type will use a new idea in rocket nozzles and will likely be adopted for missiles in the future, he said.

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Rocket Fuel at Half Price

➤ THE LIQUID rocket fuel, hydrazine, can now be produced for less than half the present price.

Aerojet-General Corporation, Azusa, Calif., reported at the American Rocket Society meeting in Washington, D. C., that a nuclear reactor can produce hydrazine from ammonia at about 25¢ per pound. This process is being developed for the U. S. Air Force Air Materiel Command.

Uranium-235, suspended in ammonia, is used for the hydrazine production reactor. Fission fragments of uranium break up ammonia molecules, some of which recombine to form stable hydrazine.

Circulation is continuous with the stream becoming subcritical as it leaves the reactor. A yield of one molecule of hydrazine per 100 electron volts will produce an economical plant.

Experiments have exceeded this yield. Ammonia, hydrazine and uranium are drawn out of the reactor stream. A cyclone separator removes the uranium-235 and feeds it back into the reactor. Hydrazine and ammonia are drawn off for additional processing, and then separated. Fission fragments are removed and the ammonia is fed back into the reactor. The hydrazine is further decontaminated and stored.

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Improve Rocket Thrust

➤ A NEW PRINCIPLE can improve rocket thrust to make it as effective as nuclear fuels would without actually using nuclear fuel.

Donald J. Simkin of Ordtech Corp., Walnut Creek, Calif., chairman of a closed meeting on hybrid rockets at the American Rocket Society in Washington, D. C., told SCIENCE SERVICE that this principle can be applied to any chemical or nuclear engines used in rockets for rocket thrust. Details of the principle, worked out by scientists at Astropower, Inc., Long Beach, Calif, a subsidiary of Douglas Aircraft Corporation, are still secret, he said.

The principle, called HIFOX, will lead to expansion of thermo-dynamic barriers, or improve existing performance limits of rocket engines, when applied.

Mr. Simkin explained that the HIFOX principle operates between nuclear specific impulse (pounds of thrust per pound of propellant per unit time) and the chemical specific impulse.

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MILITARY SCIENCE

Pictures of "Little Boy" Released After 15 Years

See Front Cover

➤ PICTURES of the "little boy" atomic bomb dropped on Hiroshima, Japan, in 1945, and the "fat man" type bomb, detonated over Nagasaki, Japan, have now been released by the Department of Defense.

The "little boy" type bomb, seen on the cover of this week's SCIENCE NEWS LETTER, is 26 inches in diameter and 120 inches long. The first nuclear weapon ever detonated, it weighed about 9,000 pounds and had a yield equivalent to 20,000 tons of high explosives. The "fat man" type bomb is 60 inches in diameter and 128 inches long.

• Science News Letter, 78:404 December 17, 1960

SCIENCE NEWS LETTER

VOL. 78 DECEMBER 17, 1960 NO. 25

Edited by WATSON DAVIS

The Weekly Summary of Current Science, published every Saturday by SCIENCE SERVICE, Inc., 1719 N St., N.W., Washington 6, D. C., NOrth 7-2255. Cable Address: SCIENSERVC.

Subscription rates: 1 yr., $5.50; 2 yrs., $10.00; 3 yrs., $14.50; ten or more copies in one package to one address, 7½ cents per copy per week; single copy, 15 cents, more than six months old, 25 cents. No charge for foreign postage.

Change of address: Three weeks notice is required. When ordering a change please state exactly how magazine is addressed. Your new address should include postal zone number if you have one.

Printed in U.S.A. Second class postage paid at Washington, D. C. Established in mimeograph form March 13, 1922. Title registered as trademark, U. S. and Canadian Patent Offices. Indexed in Reader's Guide to Periodical Literature, Abridged Guide, and the Engineering Index. Member Audit Bureau of Circulation.

SCIENCE SERVICE

The Institution for the Popularization of Science organized 1921 as a non-profit corporation.