The docking trainer was built by McDonnell Aircraft Corporation for the Manned Spacecraft Center. Actual docking in space will not take place until the sixth Gemini shot late this year. Only two have been launched so far, both successful but both unmanned.

Of course, the high point in the drama of man's first lunar voyage will be the actual landing on the moon. There is a great deal to be learned about the surface of the moon that directly affects the landing, such as the amount of weight that the surface will support. It is not even certain that there will be a large enough spot of level ground for a landing.

Nevertheless, experiments are underway to seek techniques for the lunar landing itself. Bell Aerosystems in Buffalo, N. Y., has developed two spidery-looking research vehicles, to be held aloft by large fans. Test pilots, or "astronauts," will practice landing them on four extendable legs similar to those that will be on the Lunar Excursion Module, the actual moon vehicle.

### Weight Remains a Problem

Finally, although much of the lunar flight will be made under reduced gravity, weight will still be a problem. A part of the trip will be made while escaping the full force of earth's gravitational pull. Manned orbiting satellites will need to create their own gravity. To reproduce these conditions, the scientists trying to anticipate problems in space have turned to the centrifuge.

One large centrifuge will whirl a 40-foot room with four passengers around a 150-foot circle for periods up to a month. North American Aviation is building it to examine the effects of long periods in artificial gravity.

NASA is also building itself a huge centrifuge, at its Manned Spaceflight Center. In a 170-foot-diameter circular building, three stories high, payloads up to 3,000 pounds will be subjected to as much as 30 times the force of gravity. In a 12-foot chamber, representing controls and accommodations in the Apollo spacecraft, three astronauts will perform their expected space duties under artificial acceleration, while being monitored by NASA doctors for respiration, body temperature, heart activity and blood pressure.

These centrifuges, isolation booths, and other strange and elaborate devices are just a few of the many pieces of special equipment that man hopes will tell him more about a place to which he has never been. Experiments have been undertaken in places ranging from the bottom of the ocean (which simulates low gravity) to a rocket-powered vibration machine. Testing will go on in many forms. The toughest test for man in space, however, will still be—when he gets there.

• Science News Letter, 87:154 March 6, 1965

SPACE

# Launch Pad Poison

➤ WARNING TO ROCKET scientists of the future: do not stand downwind from the launching pad.

Poisonous exhaust gases from some of the super-fuels now being developed for both civilian and military rockets could be a major safety hazard during launches, cautions Dr. Kenneth D. Johnson of the Atlantic Research Corporation, Alexandria, Va.

Two of the most powerful but most dangerous of such fuels, elementary fluorine and metallic beryllium, are so far being used only in upper-stage rockets, which are not fired until they are safely away from the launch area. However, future military plans might require "convertible" systems in which upper and lower stages could be interchanged.

In such systems, said Dr. Johnson, the advantage of increased thrust would have to be weighed against the problem of toxic exhaust fumes.

The Atlas is one first-stage rocket that could benefit greatly from fluorine as a fuel. Scientists at General Dynamics Corporation, San Diego, Calif., estimate that they could increase the booster's payload 88% by using a fuel mixture containing 30% liquid fluorine.

Dr. Johnson said that the U.S. Air Force's Blue Scout rocket, which comes in four different versions made from five different rocket stages, is a convertible system similar to the one he envisioned, although it does not use toxic-exhaust fuels.

In order to make it easier to compare the advantages and disadvantages of fluorine, beryllium and similar fuels, Dr. Johnson developed a mathematical way to predict the area that the exhaust gases would cover, as well as the concentration of the gases and the length of time before they would disperse.

This knowledge would help to determine such factors as the cost of protecting personnel stationed at various points. It might turn out that the extra thrust in the first-stage rocket just was not worth it.

Dr. Johnson reported his study at a meeting of the American Institute of Aeronautics in Washington, D. C.

• Science News Letter, 87:155 March 6, 1965

SPACE

## Space Mirrors Help Astronauts Fix Straps

➤ ASTRONAUTS in the two-man Gemini space capsules will spend part of their time in space looking at themselves in mirrors—but not for vanity's sake.

In a fully pressurized spacesuit, an astronaut cannot see to adjust the array of straps and clamps securing him in his seat. Special mirrors mounted inside his space capsule, similar to the rear-view mirror on a car, will enable him to see what he's doing, even under full pressurization.

Liberty Mirror Co., Brackenridge, Pa., is making the shatter-proof mirrors from an evaporated-aluminum coating sandwiched between two pieces of glass.

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