SPACE

Planned for Space Risks

➤ THE HAZARDS of the first United States space trip gave U. S. Navy Cmdr. Alan B. Shepard Jr. some apprehensions that he met by considering how each difficulty could be licked if it occurred.

This was revealed in a pre-flight psychiatric interview with the astronaut, the National Aeronautics and Space Administration reported at a Conference on Medical Results of the First U. S. Manned Suborbital Space Flight in Washington, D. C.

The astronaut looked at his flight as a difficult task. Although he was confident, he could not be sure of success. However, he was more concerned about performing well than about external dangers.

The medical data from the first U. S. space flight show that Cmdr. Shepard lost exactly three pounds from a few hours before the trip until three hours after the rescue. However, only minor changes were observed in body functions before and after the space trip.

During the flight itself, Cmdr. Shepard's pulse increased. At lift-off signal it was 126 and climbed during the launch to 138. During the weightless part of the flight the pulse rate decreased to 108 beats a minute. The highest pulse rate during re-entry was 132.

The respiration rate of the astronaut was between 15 and 20 breaths per minute during countdown. A peak rate of 40 occurred during the launch period, declined to 20 near the end of the weightless flight phase and rose to 30 during re-entry. On descent it fluctuated between 20 and 25 breaths per minute.

The astronaut reported no difficulties during the flight but at the time of maximum aerodynamic pressures, at Mach number 1.0, vibration was so severe the pilot stated he had some difficulty seeing for about 15 seconds.

Cmdr. Shepard reported that for future flights the vibration problem will be avoided by providing more foam rubber for the head support of the astronaut's couch. Later space capsules will also have picture windows for observation purposes.

He said the centrifuge, the procedures trainer, and testing with the Mercury spacecraft at the launching area provided the most valuable aids during the training period before the space flight. Comdr. Shepard described his flight in detail and showed the film taken aboard the rocket during the flight.

Dr. Robert B. Voas of the NASA Space Task Group reported the astronaut had carried out his tasks of checking the instruments he was assigned to do. This is indicated by the pattern his eyes follow on the film.

The Conference was co-sponsored by the National Institutes of Health and the National Academy of Sciences.

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SPACE

Moon Rocket Described

➤ THE NOVA space rocket that will carry man to the moon, as projected in President Kennedy's extraordinary Congressional message, is expected to be half as tall as the Washington Monument, or about 275 feet.

Boosters for this space vehicle will be a cluster of liquid fuel engines or a cluster of large solid propellant engines, each having a thrust of 1,500,000 pounds. The Nova will be thirty to fifty times as powerful as the Atlas booster that is scheduled to carry man into orbit around the earth at the end of this year.

The Nova will consist of a three-stage rocket with the Apollo space capsule on top for the lunar landing. The Apollo can as yet only be described in general terms since it is still on the drawing boards, George M. Low, chief of the National Aeronautics and Space Administration's manned space flight program, reported.

He told the First National Conference on Peaceful Uses of Space in Tulsa, Okla., that the craft will be very compact in order to make it as light as possible and help ease its return into the atmosphere when the moon travelers return to earth.

It is also certain at this time that the capsule will be made up of various "building blocks," or modules, each of which is used for a certain part of the flight.

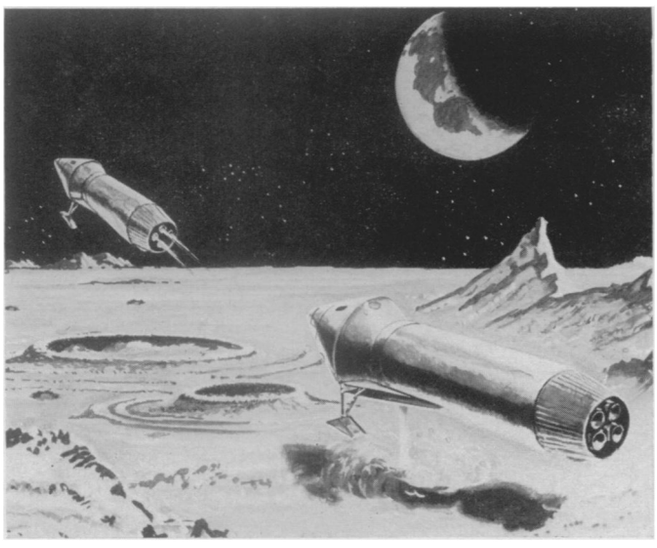
The first of these building blocks is the "command center module" that will house the crew of three during launch and re-entry. It will also serve as a flight control center for the rest of the trip.

The second module is a propulsion unit that will be used as a take-off stage from the moon. This unit will also be used on earlier flights of the Apollo capsule, namely in earth-orbital flights, possibly by 1965, and in a trip around the moon without landing between 1967 and 1969.

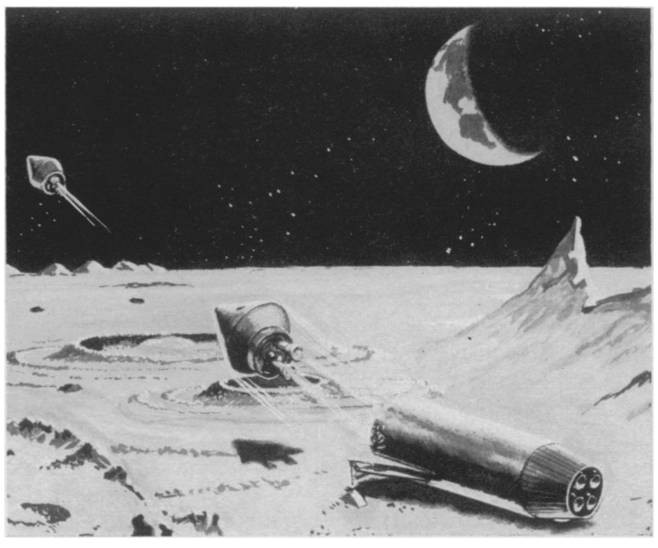
In orbital flights this unit will be used for emergency conditions and for maneuvering in orbit. For the circumlunar trip the propulsion unit will return the space craft to earth from any point of the planned route.

For the trip around the moon, this versatile propulsion unit will provide mid-course guidance corrections. It can also place the capsule in orbit around the moon and send the capsule out of orbit and return it toward earth.

The third building block of the Apollo is a propulsion stage that will slow down the space craft as it approaches the moon and set it "gently" down on the surface. A horizontal landing on the moon is now



Lunar Landing



Lunar Take-off

pictured, but vertical landings are also possible.

An additional part of the capsule is a laboratory for earth-orbiting trips. However, of all the Apollo modules, only the command center can re-enter the earth's atmosphere and be recovered.

The actual landing on the moon will be made at a site surveyed earlier by an unmanned spacecraft. This is necessary in order to learn if there are any obstacles in the landing area and to get information about the landing surface. A moon-landing gear cannot be designed before the composition and hardness of the lunar landing surface is known.

The take-off from the moon after landing will be a difficult operation done by only three men, in contrast to the hundreds of experts on the launching pad on earth. All the equipment for take-off must be prepared, erected and checked out.

The propulsion system for the lunar take-off must be the most reliable part of the Apollo capsule. The time of take-off must be precisely planned and the guidance equipment must work perfectly for starting the capsule on the right path for its return to earth.

On trips to the moon the most serious radiation problem that threatens man will be from solar flares. Some giant solar flares send out particles of such energy and intensity that shielding against them would weigh too much to be practical.

Fortunately, flares may possibly be predicted several days in advance and flights avoided when they occur. In the past ten years, only seven giant flares were observed. Many answers about the radiation problems are still lacking, but much of this information is anticipated from scientific satellites and space probes.

During the flight to the moon, the space pilot will help maneuver the capsule.

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PHYSICS

Atom Blasts for Research

➤ IF THE NUCLEAR test ban talks now stalled at Geneva fail completely, United States scientists are brimful of ideas for purely scientific research using nuclear explosions.

They see the nuclear blasts as "uniquely necessary" for many experiments in basic research. The decision concerning whether their proposals will be accepted depends on a "difficult mixture" of scientific, economic and political arguments.

One of the suggested experiments for nuclear blasts would be the creation of elements heavier than 103, the heaviest man-made element now known. Element 106, for instance, might last for many years, compared to the fleeting part of a second that element 103 exists.

The "Scientific Applications of Nuclear Explosions," or SANE, is more limited than Project Plowshare, the Atomic Energy Commission's project concerning all peaceful uses of nuclear explosions, particularly those of economic importance such as excavating harbors or moving mountains.

Nuclear explosions are of interest to the research scientist chiefly as uniquely intense sources of neutrons (electrically neutral particles of matter, one of the building blocks of the universe), neutrinos (elusive atomic "ghost" particles that interact very rarely with matter), plasmas (gas clouds), high temperatures, gamma rays, X-rays, light, shock and radioactive isotopes. The explosions also have the capacity to transform large quantities of elements through neutron reactions.

Radioactive contamination could be kept at a very low level by conducting the nuclear blasts underground, Dr. George A. Cowan of the Los Alamos Scientific Laboratory, N. M., reports in Science, 133:1739, 1961. He suggests that some of the nuclear explosions now in the planning stage for purposes of improving seismic detection or in connection with Plowshare programs can also be used for purely scientific measurements.

Dr. Cowan states it should be possible to avoid charges of evading test ban agreements when conducting such explosions by making the tests open to all. This would increase "opportunities for cooperative research on an international scale."

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MILITARY SCIENCE

Gas-Germ Warfare Defense

➤ DESPITE growing public awareness and expanded military research, the United States has a long way to go before defenses against chemical and biological warfare are adequate.

Army officials made this clear in testimony before a House appropriations subcommittee considering Department of Defense budget proposals for the next fiscal year.

Maj. Gen. Marshall Stubbs, chief chemical officer, said a detection and warning system is essential for such attacks, "just as radar gives advance warning of oncoming missiles and planes."

The Army has a chemical agent detector kit, effective at short ranges, and is adding to its knowledge of toxic agents as new ones become known. But an actual chemical attack probably would be with "odorless, colorless and tasteless clouds," which must be detected at a distance before troops are reached and overpowered, Gen. Stubbs said.

Biological attack offers problems even more difficult. A single aircraft could release enough material to cover "several hundred to several thousand square miles." The organisms are odorless, tasteless and invisible to human eyes.

Fast, accurate identification of biological attacks is considered "technically impossible" by many scientists, Gen. Stubbs said. But recent laboratory devices show "considerable promise" for automatically detecting biological aerosols—suspensions of fine biological particles in air or gas. A contract for industrial development has been awarded.

Masks and protective clothing have been developed to protect the respiratory system and the skin against biological and chemical agents. Col. Dan Crozier, chief medical consultant for the Surgeon General's office, said the Army has "effective vaccines against many of the diseases which are potential biological weapons," and is making rapid progress on others.

Disease casualties, he said, may have two to ten days between exposure and illness. But lethal gas casualties in chemical warfare may have only "a matter of seconds and minutes" for treatment. He believes a vast educational program is needed to make the public aware of treatment methods.

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MILITARY SCIENCE

Long-Range System For Spotting Submarines

➤ A SONAR SYSTEM for detecting and tracking enemy submarines long before they reach United States shores is being developed by the U. S. Navy.

The system uses a roving sound transmitter, packed on a ship, earphones on the ocean floor, and relay stations spotted along the ocean waters. The sonar system is part of the Office of Naval Research's Project Artemis.

The submarines are detected when sound waves sent through the water by the transmitter bounce off the submarine. By measuring the time the waves take to travel back, the distance to the submarine can be determined. The exact range of the anti-submarine system is still undisclosed by the U. S. Navy.

The sound transmitter, or transducer, which is five stories high and weighs hundreds of tons, will be carried on a former Navy tanker, the USNS Mission Capistrano. The ship is equipped to raise and lower the transmitter into the water and also provide power for its operation.

The U. S. Navy has already built a relay tower, called Argus Island, on top of an extinct underwater volcano off the Bermuda coast. The man-made island, sticking nearly 100 feet above the ocean surface, will relay sound waves picked up by hydrophones scattered along the ocean floor.

Columbia University's Hudson Laboratories, the prime contractor of Project Artemis, is working with nearly 30 university, Governmental and industrial scientific groups in carrying out the program.

The ship is scheduled to operate in waters stretching from Cape Hatteras to Bermuda.

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