

NASA

It crawls, it flies, it carries your luggage and it pulls you out of ditches.

Getting Along on the Moon

... And leave the driving, rolling, hopping, walking, crawling and flying to us.

Someday, possibly in five years but probably in 15 or 20, when Mercury and Gemini space capsules have been outmoded all the way back to about Wright Brothers status, astronauts are going to stop hoofing it across the surface of the moon and take a ride instead. Obviously they're not going to be driving anything that looks like your new Detroit compact, but some of the ideas that have been proposed—seriously, by educated, down-to-earth scientists—would make some science fiction authors gape in wonder.

Take this week's cover, for example. Bounding along in such a glorified pogo stick would be nerve-racking at best, but Dr. Howard Seifert of United Technology Center says that if the kangaroo, jack rabbit, grasshopper and flea can do it, "it would seem reasonable that matter and energy could be combined by man to create an efficient hopping transportation system on the moon."

The pogo stick on Dr. Seifert's mind hops when the weight of its two globes—one containing men and the other carrying their equipment—compresses a cushion of gas in the central pole. As the gas expands again, driving the spheres up the column, the resulting force lifts the entire device off the

ground and the end of the pole swings forward to the next "step."

The hopper has its drawbacks, of course. One is that visibility is so poor that the driver must use a bombsight-type device to see where the vehicle's foot is coming down. If the area looks too rough, he can change course somewhat by firing small directional rockets. And then there's gravity. The weird form of locomotion would have its passengers alternating between three seconds of normal earth weight (six times their usual weight on the moon) and 12 seconds of weightlessness in every jump. Dr. Seifert, who doubles as a Stanford University professor and is a past president of the American Rocket Society, feels that people who can handle surfboards, trampolines, horses and amusement park rides would be right at home.

There are other moonmobiles that are just as bizarre, yet they all have certain things in common. They must enable the puny earthman to take his environment with him, and protect him from extreme temperatures and vacuum. They must—at least so far—be designed "blind," with no first-hand knowledge of how good a road the moon's surface will make, except for the photographs from the Surveyor

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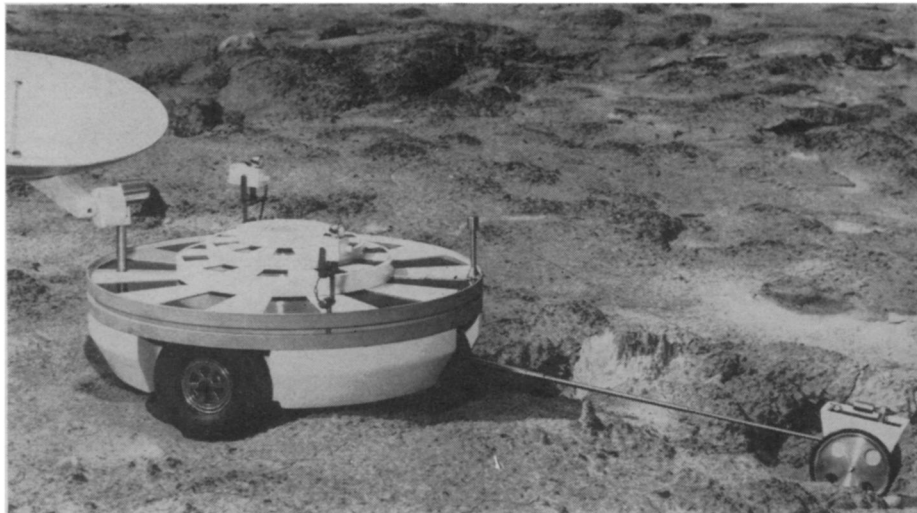
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and Lunar Orbiter spacecraft. A simple task such as changing a tire could become a death sentence on the moon, so breakdowns must be virtually eliminated. In fact, because rescue missions

sharply. Their real peak was in the early years of this decade, when advanced concept engineers let their imaginations run wild. Yet the need for a moonmobile of some kind is coming



Westinghouse

Safety tip for moon explorers: take an extra foot to scout ahead.

will be just about out of the question, even the simplest moon truck will have to be as foolproof as a manned spacecraft.

Simplicity is often a safety feature in itself. One of the simplest proposed moonmobiles is a one-man flying platform that is basically nothing but a rocket motor, a tiny platform above it to stand on and a lawnmower-type handle that the operator grips for stability and directional control. Suggested about two and a half years ago by

ever closer with the approach of the National Aeronautics and Space Administration's plans for post-Apollo lunar exploration. As deputy NASA chief Robert Seamans Jr., has pointed out, fiscal 1968 will be "the first real post-Apollo budget."

Still, many of the early designs are worth noting, and some will undoubtedly contribute ideas to whatever kind of vehicle finally sets foot on the moon. One such design, proposed seven months before Cosmonaut Yuri Gagarin



Space General

Bodyless moonmobile is just bare bones; lets you hang on for dear life.

North American Aviation, the platform is no more complicated than the Bell rocket belt, which by now is such old hat that it has been flown even on television commercials.

As the actual landing of the first men on the moon has drawn nearer, it has occupied most of the space industry's attention, and the number of new designs for moonmobiles has fallen off

made the world's first manned spaceflight, was a huge moon crawler concocted by Northrop Corp. and combining features from a number of different kinds of lunar hardware. The crawler had three pairs of treads for moving across the ground, a rocket engine for short hops over rough terrain, a large crane for use in handling cargo or rescuing personnel from the bottoms

of crevasses, and enough cabin space for a complete scientific research laboratory.

Another approach was suggested by Space-General Corp., who asked, why have a cabin at all? Instead, they designed a moonmobile that was little more than a chassis, engine and wheels. The crew of two would wear space-suits connected by thick umbilical cables to a large oxygen tank mounted on the chassis. To travel on, the crewmen would simply hang themselves up on hooks on the vehicle, like clothes on a hook, and drive off.

Even unmanned vehicles have something to offer. A remote-control Lunar Roving Vehicle proposed by Westinghouse in 1963 embodied an extendable foot that would feel ahead for dangerous fissures or other hazards. Though the device was intended to seek out landing sites for a subsequent manned mission, it could certainly be adapted as a safety measure for manned lunar trucks.

Moonmobiles have been designed around many ideas besides conventional wheels and treads. Now being evaluated by NASA is a vehicle with huge wheels having flexible spiral spokes that can cushion shocks and roll over even large boulders. Giant balloon tires 16 feet in diameter have been proposed by Goodyear, while the MOLAB, a mobile laboratory that got as close as any to acceptance when it was studied jointly for NASA by General Motors and Boeing, would be made in two sections with a flexible joint like a truck and trailer. The coupling would enable one section to ride up over an object while the other kept traction on the ground.

A wide variety of power sources have also been suggested, ranging from fuel cells similar to those used on Apollo to nuclear generators (which would probably be too heavy in a manned moonmobile because of the necessary shielding). Solar cells are a strong contender, but without the blanket of atmosphere enjoyed by the earth, micrometeoroid damage could become a problem to broad panels on long stays. NASA is presently investigating new kinds of solar cells that are more resistant to both micrometeoroid punctures and cosmic radiation. The latter is a danger because every puncture breaks another of the cell's molecular "connections," finally rendering it useless.

Lunar bases with crews of 10 or 20 men may not become a reality before 1985, but with any exploratory mission that is to get outside its own backyard, some kind of vehicle will be needed. Whether it walks, runs, rolls, hops, flies or jitterbugs, it will certainly look like nothing on earth.

Films of the Week

Listing for readers' information of new 16mm and 8mm films on science, engineering, medicine and agriculture for professional, student and general audiences. For further information on purchase, rental or free loan, write to distributor listed.

BOLD NEW APPROACH. 16mm, b&w, sound, 62 min. Deals with the Comprehensive Community Health Centers concept, showing the spectrum of services that are available to help troubled people of all ages with their emotional problems. Stresses continuity of care within the community. Dramatized. Audience: Mental health professionals, co-operating agencies, high school students, general public. Purchase \$150 or rent \$15/day from Mental Health Film Board, 164 E. 38th St., New York, N.Y. 10016.

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INDIAN BOY OF THE SOUTHWEST. 16mm, color and b&w, sound, 15 min. Toboya, a Hopi Indian boy from the southwestern desert in the United States, tells about his life, the food he eats, his family, and his school. Audience: Upper elementary, junior, senior high. Purchase color \$160 and b&w \$85 from Film Associates, 11539 Santa Monica Blvd., Los Angeles, Cal. 90025.

MARVELS OF THE HIVE. 16mm, color, sound, 20 min. Complete documentary on the life cycle of the honey bee, with emphasis on the complex behavior patterns that make up the instinctive activities of bees. Audience: Upper elementary and junior high. Purchase \$170 or rental \$10 from Contemporary Films, 267 W. 25th St., New York, N.Y. 10001.

MORE AND LESS. 16mm, color, sound, 10 min. Illustrates the meaning of equality and inequality in numbers. Shows how we can sometimes match objects from two sets, and other times, objects are left over. Gives special symbols for these relationships. Audience: primary, elementary beginning math students. Purchase \$125 from Film Associates, 11539 Santa Monica Blvd., Los Angeles, Cal. 90025.

NO MAN EXPENDABLE. 16mm, color, sound, 28 min. Shows the activities of the U.S. Air Force's Aerospace Rescue and Recovery Service, including actual rescues of downed airmen picked up by helicopters deep in hostile territory in Vietnam. Audience: general. Loan from Public Relations Department, Sikorsky Aircraft, Stratford, Conn.

NO TIME FOR UGLINESS. 16mm, color, sound, 30 min. Most cities are built haphazardly, growing rapidly in some sections, deteriorating in others. Suggests how knowledgeable and demanding citizens can influence the development of cities. Audience: colleges, adult groups. Free loan from Sterling Movies Inc., 43 West 61st St., New York, N.Y. 10023. (Produced from American Institute of Architects.)

OPERABLE HEART DISEASE IN INFANCY -K-1260. 16mm, b&w, sound, 18 min. (TV film recording). Current trends in operable heart disease during early childhood compared to the state of the art 10-15 years ago; and current surgical techniques, the heart-lung machine and their relationship to improved surgical results and low mortality rate. Audience: professional biomedical personnel. Free loan from Public Health Service Audiovisual Facility, Atlanta, Ga. 30333.

PADDLE-TO-THE-SEA. 16mm, color, sound 28 min. The journey of a toy canoe carved by an Indian boy as it travels from Lake Superior past busy ships, over the Niagara cataract, and on toward the Atlantic. Audience: Junior science K-8. Purchase \$260 from National Board of Canada, 680 Fifth Ave., New York, N.Y. 10019.

THE PARTICLE OF DIFFERENCE. 16mm, color, sound, 14 min. Shows how herbicides can be literally tailor-made to form the droplet size that will give effective drift control and effective weed and brush control for aerial and ground applications. Audience: interested specialists. Loan information from local sales offices of Agricultural Chemical Department of Hercules, or from Phenoxy Herbicides Sales Office, Agricultural Chemicals, Hercules Inc., Wilmington, Del. 19899.

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