

to the editor

Spacecraft reliability

I would like to take exception to your article discussing NASA's reliability policy (SN: 6/19/71, p. 416). In the article you state, "NASA policy has been to continue using non-redundant systems in unmanned spacecraft." This statement is misleading since it implies that a single component or item failure can cause mission failure. Almost all items in the presently designed unmanned spacecraft have redundant back-up at the circuit, assembly or subsystem level and all items with higher failure potential have redundancy sufficient to meet mission requirements. Secondly, employing sophisticated redundancy at the circuit, assembly and subsystem level offers much higher reliability than can be achieved by using redundant systems.

John M. Legg
Santa Clara, Calif.

Copernicus' system

Regarding the cover of the June 19, 1971, issue, I submit that the map of the planetary system could not have been drawn by Copernicus in 1566 as you state.

The map shows the four Galilean satellites of Jupiter whose existence was

first reported in *Sidereus Nuncius* in 1610 by Galileo. It also shows five moons of Saturn, the discovery of which occurred much later than Jupiter's four moons.

I would guess that the map was drawn sometime around 1700 and obviously not by Copernicus since he died in 1543.

Dale S. Cunningham
Assistant Professor
Department of Physics
Miami-Dade Junior College
Miami, Fla.

(It was Copernicus' system, but not his map. It was drawn later. The map published by Copernicus is similar, but does not show the satellites.—Ed.)

Alcohol as fuel

The suggestion in William Lynn's letter that alcohol would be a "nonpolluting fuel" (SN: 6/26/71, p. 432) may be misleading. Any of the alcohol compounds, or for that matter hydrogen, used in an internal-combustion engine or gas turbine would still produce oxides of nitrogen and other undesirable compounds associated with contemporary vehicles. The internal-combustion engine can be viewed as a

high-pressure chemical reactor. It has propelled pollution-free vehicles using gaseous hydrogen and oxygen (stored in cryogenic tanks), but that is not an economically practical solution.

It is not the fuel but the engine that is the key factor in vehicle pollution. Alcohol, methane and unleaded gasoline are essentially pollution-free except for CO₂ when used in an external-combustion engine—Stirling cycle, steam engine, etc. Alcohol, however, does have some advantages as a fuel. It may be widely used after the turn of the century when economically accessible reserves of natural gas and oil are depleted. Alcohol can be economically produced from a variety of wood and farm crops.

P.S. I have admired your excellent reporting on all aspects of the environment, and have been a reader for the past 30 years.

Robert W. Prehoda
Chemist
North Hollywood, Calif.

Address communications to Editor,
Science News, 1719 N Street, N.W.
Washington, D. C. 20036

films OF THE WEEK

INVISIBLE FORCE OR DIRECTION. 16mm, color, sound, 21 min. Explores the concept of magnetic forces and the use of these forces to determine direction with a magnetic compass. Traces the gradual refinement and perfection of the magnetic compass, and shows the manufacture and testing of a modern version with emphasis on the intricacies of design and balance in this scientific instrument. The history of the compass, including the use of the Chinese lodestone, is briefly outlined. Explains the difference between the geographic and magnetic north pole, and scenes filmed at the magnetic north pole show directional disorientation. The use of the compass as a directional tool on land and its application on a map are explained. Audience: Scouts, campers, hikers, aviators, hunters and orienteering enthusiasts. Purchase \$275 or rental \$15 from International Film Bureau, Dept. SN, 332 S. Michigan Ave., Chicago, Ill. 60604.

A MOWING LESSON FOR CHARLIE. 16mm, color, sound, 8½ min. Charles has bought himself a new power lawn mower. His experiences in learning to treat the new machine as a cooperative laborsaving tool rather than as a challenging adversary highlight the general rules of safety in the use of power lawn mowers. Charlie learns that the mower can be devastating if it is not treated with respect. He learns to remove small objects from the lawn before mowing, to shut off the mower and disconnect the sparkplug before cleaning out a clogged discharge chute or making other adjustments. He sees why it is necessary to avoid mowing near people and for his own protection, how to mow on slopes and other techniques de-

veloped for safer operation. Audience: power lawn mower users. Rental information from Audiovisual Center, Dept. SN, University of Iowa, Division of Extension and University Services, Iowa City, Iowa 52240.

NOT ME. 16mm, b&w, sound, 51 min. A starkly realistic dramatization of the youthful drug scene. Chronicles the tortuous journey of a 13-year-old drug addict. Paul is a healthy, out-going child from the inner city, subject to the problems and pressures of an increasingly complex and depersonalized society. Restless, curious, searching for self-identity, the boy is led to experiment along new avenues of experience. He quickly goes from "snorting" to "skinning" to "mainlining" heroin. His health deteriorates and he loses all self control. He is an addict, the thing he always believed others would become, but "not me." Film offers no solutions, but shows how the elements of home, environment, acquaintances and psychological needs combined to bring about the needless ending of a young life. Audience: junior high through adult. Purchase or rental information from McGraw-Hill Films, Dept. SN, 330 W. 42nd St., New York, N.Y. 10036.

PRACTICING MATHEMATICAL SKILLS. 16mm, color, sound, 18 min. Shows how the effectiveness of drill and practice is highly dependent on when it is used and how it is presented. Illustrates suitable materials, use of a computer terminal, techniques for promoting interest and ways of identifying appropriate items for drill. Audience: teachers, student teachers. Purchase \$61.75 or rental \$10 from National Audiovisual Center, Dept. SN, National Archives and Records Service, Washington, D.C. 20409.

A CHANGING CULTURE. 16mm, color, sound, 17 min. To what extent are changes in family patterns, values and other elements of culture related to changes in technology? Using Eskimos of Nunivak Island in the Bering Sea, this film examines such changes as they have occurred in the lifetime of the present generation. Defined from the points of view of both older and younger members of the village, changes in mobility, rising expectations, increasing education and marked changes in values are seen partly as products of technological advances. Audience: elementary, junior, senior high school. Purchase \$235 or rental \$15 from BFA Educational Media, Dept. SN, 2211 Michigan Ave., Santa Monica, Calif. 90404.

OPERATIONS WITH WHOLE NUMBERS. 16mm, color, sound, 22 min. Explores procedures for interrelating addition and subtraction. Shows materials, methods and strategies which are particularly effective. Attention is focused on the use of multiple techniques for improving instruction in multiplication. Emphasizes algorithms which have been particularly effective. Stresses the use of materials. Audience: teachers, student teachers. Purchase \$78.25 or rental \$10 from National Audiovisual Center, Dept. SN, National Archives and Records Service, Washington, D.C. 20409.

Listing is 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.