ASTRONAUTS ENDANGERED

Solar flares still unpredictable

Astronauts have a rendezvous with the moon before 1970—but they also have, if they make the timetable, a rendezvous with potentially fatal radiation from an angry sun.

They will land during the maximum period of solar flares, immense disturbances on the sun that fling out X-rays and cosmic rays in deadly profusion. An astronaut walking the lunar surface could be killed in the storm which would pour radiation through his unprotected body. (Within the space ship, however, he should be safe because of its metal shielding, as he would be safe in earth's shielding atmosphere.)

Dr. Harold Zirin

Time lapse photos of a solar flare.

All that is possible now is the detection of a flare, and a warning that solar particles are on the way—an alert of little more than an hour or so.

Scientists believe they will eventually be able to predict the coming of individual solar flares—but apparently they will develop this ability too late to warn this decade's astronauts.

Dr. Harold Zirin, astrophysics professor with Mt. Wilson and Palomar Observatories, is working in that direction. He estimates that it will be five years before man can truly predict the coming of a solar flare. Such flares not only endanger astronauts, they black out short-wave radio communications on earth, and cause auroras.

Already, however, Dr. Zirin sees certain clues, or precursors, to the coming of flares. It is a base on which an early warning system may some day be built.

Solar flares, which are associated with sunspots, were first detected in 1855. They are invisible in ordinary light, yet when viewed by instruments sensitive to the extreme ultraviolet, these great outbursts of energy provide dramatic evidence that the sun has a seething surface that erupts unpredictably.

A flare covering only a one-thousandth of the solar surface emits more ultraviolet light than all the rest of the sun put together. The total energy release in a flare over all wavelengths equals the output of the entire sun in the same time—some 3.9×10^{33} ergs in a second.

New knowledge about solar flares is coming from time-lapse motion pictures combined with special filters that show the sun's activity in the light of one narrow wavelength, such as hydrogen alpha in the ultraviolet. These pictures make up one of Dr. Zirin's precursors.

Recent observations indicate that flares frequently occur in regions of the sun having a steep magnetic field gradient and that they are most common in very complex sunspot groups with intertwined regions of different polarity, another set of precursors.

These conditions are now known to precede flares; the question is how closely are they linked to flares and what forecasts can be built out of their detection.

All that is known now is that when these great outbursts of energy occur, regions tens of thousands of miles across brighten simultaneously in a matter of seconds and great clouds of matter are thrown out at tremendous speeds.

Also, at the moment of most rapid brightening, energetic pulses of X-rays are emitted. These are what change earth's ionosphere, resulting in the fade or black-out of radio signals. Swarms of energetic cosmic rays are also hurled into space at the same time.

MILITARY VS. CIVILIAN

Language, money and the nuclear navy

Language is misleading. The advocates of a nuclear navy and the spokesman for official Defense Department policy both speak in the name of national defense. But the worlds they live in seem galaxies apart.

Last week the nuclear view held the spotlight. In testimony released by the Joint Atomic Energy Committee, nuclear navyman Hyman G. Rickover, with strong Congressional endorsement, made it clear he thinks the U.S. is penny-pinching itself into second place.

The crux of the discussion is the place of nuclear power in navy vessels. Admiral Rickover, and most of the navy, think combat surface vessels should be driven by the nuclear reactors that have given atomic submarines fantastic range and flexibility and have proved successful in the few surface ships so powered. The cost-conscious Defense Department feels the job—protecting the nation—can be done with cheaper conventional power.

Nuclear submarines are accepted as far superior to the diesel types that fought World War II. But the Defense Department wants to taper off submarine construction; Admiral Rickover, looking at the Soviet drive to build up its submarine fleet, thinks the U.S. should undertake a similar effort to keep its lead and remain top sea dog.

Admiral Rickover discounts completely the oft-repeated argument that the nuclear stalemate has made development of new weapons unnecessary. Many times in the past, he contends, advancing technology has made seemingly invincible weapons obsolete, as the World War II Maginot Line experience showed.

The controversy over submarines has a central role in the question of deterrence because Polaris-carrying nuclear subs are a major branch of the U.S. deterrent force.

There is evidence that the Soviet submarine fleet, outside of its own missile force, is aimed at canceling out the Polaris deterrent with attack submarines. The idea of sending a sub to hunt another sub has intrigued navy men for years; such a capability if developed by an enemy could make the U.S. underwater nuclear deterrent as useless and dangerous as was the Maginot Line.

For this reason, Admiral Rickover is pushing development of new attack submarines that would counterbalance the Soviet force. Although the requirements of such a weapons system are not talked about, they presumably include a new type of nuclear power plant that Ad-