

by the human life. (Of course, the earth to which he would return would be many many years older than the earth he left.)

Because there are so many ifs about outer space, and mostly because life in outer space has only been assumed and never contacted, the formulations of metalaw are still elementary.

Assumptions of Metalaw

But certain assumptions underpinning the laws can be made. According to Mr. Haley, these are:

1. Extraterrestrial beings are made up of the same elementary stuff as we humans are.

2. These beings are composed of many atoms and they can feel, move about and think.

3. Each of these beings has a "zone of sensitivity" and outside this zone activity by humans or others has no effect.

Some of the rules which follow from these assumptions are:

1. Landing on a planet where life is assumed must wait until it has been determined that injuries to that planet will not result.

2. Landing on a planet must be by invitation only.

3. Decontamination before landing on a foreign planet must be followed by decontamination before return to earth.

BIOLOGY

Need Clean Spaceships

➤ **UNMANNED SPACE SHIPS** to Mars must not carry even a harmless organism. They must be far more germfree than the cleanest of hospitals.

The chances of landing one single organism on Mars must be less than one in 10,000 or even less than one in a million if astronomers make further discoveries about the environment of Mars before the proposed 1964 and 1966 Mariners take off.

L. B. Hall, on loan to the National Aeronautics and Space Administration from the U.S. Public Health Service, told *SCIENCE SERVICE* that he plans to change much of the sterilization technique on spaceships to methods of killing staphylococcal infections in hospitals. This means the use of dry heat.

Protection from earth organisms is necessary, not only for possible life on Mars, but to protect the health of people on earth later.

Harmless bacteria could mutate and be brought back to earth to play havoc with the public health.

Spacecraft to Mars is so designed that all its parts can still function after being subjected to intense dry heat sterilization.

"The only method we know of for reliable sterilization of interior masses such as plastics, vacuum tubes and transistors in Mariner B and C is dry heat," Mr. Hall said. Although sterilization of spacecraft surfaces can be done in other ways, the final sterilization, which must take place at Cape Canaveral just before flight, also should be dry heat.

He said the parts that cannot withstand the intense 145-degree Centigrade (293 degrees Fahrenheit) heat necessary for flight

4. Communications lines must be left intact by efforts to establish and maintain contact with foreign planetary systems.

How these interplanetary and intergalactic rules will be formulated and upheld is a problem, considering the trouble we have with international and interstate relations.

But Mr. Haley is optimistic.

"After 500 years we finally executed a treaty on the high seas. After 4,000 years we have a consular treaty." A space treaty is "possible."

Possible U.N. Regulations

The United Nations is currently proposing to lay the guidelines for space activity. Passage of this proposal seems assured.

Someday, Mr. Haley believes, the United Nations may have jurisdiction over man's dealings with extraterrestrial beings. "If it can't do that then it has lost its purpose."

In the final analysis, Mr. Haley admits the impatient may think that formulating metalaw is like trying to make rules for a relationship with an amoeba. But if we are going to spread the crimes of mankind throughout the universe, he believes "it would be better to deprive mankind of the opportunity to explore the cosmos or indeed to leave the planet earth."

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sterilization will be sterilized by other methods—surface parts can be sterilized with ethylene oxide and inserted into the spacecraft by sterile means. A man in a sterile plastic suit with air and exhaust hoses, who has been immersed in germicides, could do part of the sterilization.

Mariner C, which will be a fly-by, could make the trip to Mars in 1964, according to present estimates. Mariner B, however, probably cannot take off before 1966, since it will consist of a small landing capsule for life detection purposes as well as a fly-by.

Mr. Hall told the Association of Military Surgeons that "lunar landers" will be flown with low levels of microbiological contamination. This is because moon probes already have been designed and some are in the process of being built without heat-resistant parts.

The chances of earth organisms spreading and surviving on the moon are very low, scientists believe. In trying to maintain planet quarantine, however, every precaution is being taken.

"From the biological point of view," Mr. Hall explained, "we are more concerned with keeping spores off the spacecraft than vegetation cells. The vegetative cells will largely die by themselves over a comparatively short period of time, but spores are extremely hard to kill, and might survive for years under normal conditions."

A spore is the reproductive cell of specific lower organisms such as the tetanus germ. It is covered by a thick shell and survives great heat and cold, making it difficult to destroy.

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