

## The chances of contacting extraterrestrial civilizations seem poor

The possibility of life, and especially intelligent civilizations, on other planets has stimulated many people's imaginations. Science-fiction writers have made it a stock of their trade. Technology is now capable of sending or receiving interstellar messages, and the possibility of intelligent civilizations on other planets now stirs the imaginations of sober scientists as well. In 1971 both a summer study group at the Ames Research Center in California and an international conference at Byurakan in the Armenian Soviet Socialist Republic (SN: 10/2/71, p. 223) recommended that a search be made.

In the Feb. 9 NATURE James C. G. Walker of Yale University studies the possible parameters of such a search and comes to some pessimistic conclusions.

One way to search is entirely passive. Antennas are set up to listen for signals produced by other civilizations. Walker supposes, however, that a more active form of search would be tried: that of sending out a signal in the hope of a reply.

Our present technology could not send out a signal in all directions with the hope of its being heard 100 light-

years away; it would take more than the earth's total energy production to do it. So, Walker concludes that the search would be done by beaming signals toward stars that appear to promise the possibility of inhabited planets.

The chances of getting a reply would depend on the number of habitable planets within a given distance and on whether all or only some of them were occupied by intelligent civilizations. Walker provides estimates of the average distance between communicative civilizations under different assumptions about the fraction of habitable planets that are occupied. If all habitable planets are occupied, the average separation of civilizations is 24 light-years and the probable duration of the search is 1,400 years. If only one planet in a thousand is occupied the separation is 240 light-years and the probable duration of search 14 million years.

Walker concludes that these figures may limit any search for extraterrestrial civilizations to passive listening for signals from a super-civilization, one with a technology advanced far beyond ours and capable of blanketing the galaxy with a recognition signal.

material between the galaxies.

One way out of the dilemma is to look for plausible means of deuterium production that could have been at work during the history of the galaxy. If there were such production, the deuterium injected by it into the interstellar medium would be part of what is now seen. This would lessen the amount attributable to primeval production and in turn permit a more dense universe.

In the Feb. 9 NATURE Fred Hoyle and William A. Fowler of California Institute of Technology propose a method involving energetic outbursts in helium-rich celestial bodies. Bursts of radiation with tremendous energies of  $10^{55}$  or  $10^{56}$  ergs would come out of the centers of such bodies. The helium in the outer portions would be driven by the radiation and form a shock wave proceeding at very high speed. Within the shock the helium would be shaken apart into its constituent neutrons and protons. The protons would then capture neutrons to form deuterium. Free neutrons decay radioactively in a time on the order of 1,000 seconds. Crucial to the operation is that the density in the shock be not so small that the neutrons decay before being captured by protons and yet be small enough that the deuterium formed can get out of the shock wave before it too is shaken apart.

Hoyle and Fowler calculate that such conditions could in fact exist. If the deuterium abundance of 1 in 33,000 is characteristic of the galaxy, then this method could have produced all the deuterium in interstellar space. The deuterium dilemma would be solved. □

## Environment message: A middle path

In the first of his series of State of the Union Messages, President Nixon last week lashed out at what he called the "advocates of defeatism" who take a "doomsday attitude" toward environmental issues. By radio he told the American people to stop "sanctimonious hand-wringing" and in his message to Congress urged them to stick to a "sensible middle ground between the Cassandras and the Pollyannas."

The President's environment program centers on resubmission of 19 bills that died in legislative limbo during the last Congress. These include a \$170 million National Land Use Policy Act, a controversial proposal to establish new Federal requirements and guidelines for strip mining, an incentive tax ("charge") on sulfur oxide polluters, and legislation aimed at providing early identification and protection of endangered species.

Additional, newly submitted legislation includes a drastic reworking of farm subsidies toward an eventual free-market system for agricultural products, revision of the Federal Highway Trust Fund to allow use of these funds for mass transit, and establishment of Federal Wilderness Areas in ecologically restored regions of the eastern United States. Most of the nation's current wilderness areas are in the west.

The President pointed out that Federal spending for protection of the environment and natural resources has increased four-fold during his first term in office, and industrial spending for pollution control increased 50 percent

last year alone. In America, he said, we are "well on the way to making our peace with nature."

Even before the message was released publicly, critics declared the President was not going far enough in providing environmental protection. Rep. John D. Dingell (D-Mich.) released a letter he had sent to Russell E. Train, chairman of the Council on Environmental Quality stating that the mining bill would "appeal to the mining interests, but not to the public." He accused the Administration of ignoring criticism by Environmental Protection Agency head William Ruckelshaus that "Congress will again set aside the Administration's bill if we fail to take a stronger stance." At a White House press briefing, Ruckelshaus denied his advice had gone unheeded. Secretary of Interior Rogers Morton added, "I don't see how this bill could be made much stronger than it is." □

## NAS calls '75 standards technologically feasible

When Congress required automakers to meet strict new pollution standards in their 1975 and 1976 models, it assigned the National Academy of Sciences the job of determining whether or not the standards were technologically feasible in the time allowed. The Committee on Motor Vehicle Emissions of NAS has now released its report and finds that the 1975 standards are "technologically feasible" and that eventual achievement of the 1976 standards is "likely, but may not be attainable on the established schedule."

Automobile manufacturers disagree.