

Future Space Ship May Glide on Electrified Gas

New York, N. Y. (Scientific American Feature) — In contrast to the roaring booster rockets that now put artificial satellites into orbit, the cruising space ship of the future may glide to its cosmic destination on thrust developed by a small jet of electrified gas, according to Gabriel Giannini, head of Giannini Scientific Corporation of California.

A lighter-than-air ship such as a blimp, Dr. Giannini explains, moves itself forward by thrusting a mass of air backward. A space ship, on the other hand, has nothing to push against once it passes the limits of the earth's atmosphere. It has no outside mass to thrust and so must carry some mass for this purpose. It cannot accelerate, that is, alter its motion, unless it ejects a portion of its own substance.

Depends on Velocity

The amount of thrust developed depends not only upon the amount of substance jetted, but on the velocity of the jet. In other words, the propulsive force is proportioned to the rate of mass flow and to the velocity with which the mass is thrown. This fact provides the engine designer with an opportunity to trade mass for velocity when the nature of the voyage indicates a preference in one direction or the other, the compromise posing a choice between large thrust of short duration or low thrust of long duration.

Chemical engines, such as those that launch satellites, eject mass, measured in tons per minute, at velocities upward of 10,000 feet per second for short duration thrusts amounting to millions of pounds. Forces on this scale are essential for blasting multi-ton vehicles into space. But once in orbit the need for great thrust disappears. The vehicle then moves in an almost frictionless environment. Thereafter, sustained thrust of low force may best serve the navigator's objective and dictate an engine of radically differing design.

Several are already on test in the laboratory, Dr. Giannini states. Unlike the chemical engines, in which the energy source and the mass required for propulsion are combined in the fuel, the new engines rely for energy on electric generators and on a light gas, such as hydrogen, for the mass.

Two Problems

"The developers of electrical propulsion systems face two problems," says Dr. Giannini. "One is to develop sources of electrical energy that are sufficiently light; the other is to feed the energy into the propellant in such a way as to provide higher exhaust velocities than are now attainable. The second of these problems has been solved, at least in the laboratory. One method takes advantage of the electrical conductivity of the gas stream that can be produced by an electric arc. Streams of gas can be readily heated to between 20,000 and 30,000 degrees F., to produce proportionately high exhaust velocities.

"As to power sources, the picture is much less clear. Chemical batteries would appear to be out of the question. The process of converting chemical energy into electrical energy and then into energy of motion is not likely to be competitive with the single conversion carried out by chemical rockets.

From Nuclear Sources

"Inevitably, then, the energy will have to come from nuclear sources. Here there are only a few possibilities. One would be a nuclear power plant; a fission reactor driving a turbogenerator. These are heavy installations and would be suitable only for a large vehicle that was blasted free of the earth's gravity by a chemical booster. Alternatively, sunlight, itself a product of nuclear processes, could be substituted for conventional nuclear fuel. Outside the atmosphere sunlight delivers a steady stream of energy amounting to more than a kilowatt per square yard. This could be collected by a light-weight parabolic reflector and focussed on a steam boiler for driving the turbogenerator. Finally, it is possible that sufficient energy could be converted from sunlight directly into electricity by solar batteries."

Until adequate energy sources have been developed, however, electrical propulsion in space must remain speculative, according to Dr. Giannini. "So far as propulsion units themselves are concerned," he declares, "we can already build them to perform beyond the requirements of any space mission presently envisioned."

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