Technology Notes

OPTICS

Billion-watt Twin-beam Laser

A twin-beam laser at the Army Electronics Command in Ft. Monmouth, N.J., produces light pulses with peak power of one billion watts, using five synthetic ruby crystals in a row.

Designed for atmospheric and meteorological research, the laser has an output of 100 joules, believed to be five times greater than any other ruby device of its type. Its five crystals are mounted on a 14-foot beam called an optical rail. In front of the fourth crystal is a prism to divide the beam, a necessity because after three crystals the beam is so powerful that it might damage the remaining two. It passes through the final crystals in twin pulses, in-phase, lasting one 100-billionth of a second.

The twin-beam laser was built for the Army by Korad Corp., Santa Monica, Calif., a division of Union Carbide Corp.

SPACE PROPULSION

Breakthrough for Gas-core Rockets

If they can ever be built, gas-core nuclear rocket engines will be by far the most efficient known, with the possible exception of fusion rockets, for which designs do not even exist yet. Engine researchers, however, have been stymied for more than a decade by a seemingly insurmountable obstacle: a nuclear rocket with a gas-core reactor must eject large quantities of its fuel with the propellant. This is a hazard, as well as a costly waste.

Now a discovery has been made in fluid mechanics that could make such an engine feasible.

Dr. C. C. Chang, head of the department of space science and applied mechanics at The Catholic University of America in Washington, D.C., has detected an unsuspected toroidal (doughnut-shaped) vortex within the flow pattern in the cavity of a simulated gas-core nuclear rocket. The vortex, which has never been encountered before, according to Dr. Chang, moves relatively slowly compared to the main vortex flow, and thus interacts with it very little. In an actual gas-core nuclear rocket, such a recirculation zone would act to prevent the gaseous nuclear fuel from mixing with the gaseous propellant and being carried out the exit nozzle with the thrust.

The zone appears so efficient, Dr. Chang says, that it could actually act as a fuel reservoir. An injected flow of propellant, instead of spiralling directly toward the gaseous fuel core and carrying it away, would detour around the walls to reach the exhaust core.

The best indication of how well fuel confinement would work in a gas-core nuclear rocket is found by comparing the residence time of the fuel—the length of time it stays in the engine cavity—with that of the propellant. Previous investigators have reported residence times for the fuel no greater than five times that of the propellant—an appallingly inefficient ratio. Dr. Chang's research team, including Drs. S. W. Chi and C. M. Chen, both of Catholic University, achieved ratios as high as 240 to one, a 4,800 percent improvement. This is "much better than expected," Dr. Chang says, and could even provide enough margin to permit increasing the volume of fuel by sacrificing some of the residence time ratio. The size of the zone can be enlarged, the researchers found, by changing the contour of the end wall of the cavity.

In their experiments, part of a continuing program supported by the National Aeronautics and Space Administration, the scientists used a transparent cylindrical cavity mockup, with helium substituting for the hydrogen propellant and Freon representing the nuclear fuel. The discovery of the recirculation zone was reported at a Washington propulsion conference held by the American Institute of Aeronautics and Astronautics.

AVIATION

Flameout Spotter Restarts Jets

A safety device for jet aircraft that automatically relights engines in flight if a flameout occurs has been developed by the Bendix Corp., Sidney, N.Y.

Flameout occurs when some condition, such as the orientation of the plane, air turbulence or icing, disrupts the proper fuel-to-air ratio and momentarily deprives the engine of sufficient air to burn the fuel. The Bendix device is triggered when a flameout causes the pressure within the unit to drop. A switch energizes the engine's ignition system, and keeps it on until pressure is restored.

At present, the ignition system is kept on continuously so that in the event of a flameout the engine can be restarted immediately with the throttle. The new system would greatly prolong the life of ignition components, says Bendix, because they would only be used briefly when and if needed.

The Navy's F-8 Crusader, a Mach-1.8 jet, will be the first aircraft to have the system installed. The company says it can be used with all existing turbojet and turboprop planes.

WEAPONRY

Radiation Spots Ammunition

Test ammunition or duds lost from sight in mud, snow, jungle or swamp can now be located by instruments which detect a tiny radioactive tag developed at the Army's Picatinny Arsenal, Dover, N.J.

A one-millicurie wafer of scandium 46 with a half-life of 85 days is secured to projectiles before firing. The tag is half an inch in diameter and less than .015 inch thick. The detection instruments can spot the tag more than 30 feet away if it is under a foot of vegetation and water, or 100 feet away if it is on the surface.

Since development of the recovery technique, engineers at the arsenal report 100 percent retrieval of the tagged items. They estimate that as much as 50 percent of munitions scheduled for firing in various environments could be lost if only visual location methods were used.