engineering sciences

MISSILE NOSECONES

Ammonia-gas cooling

Ballistic-missile interceptors like the very high acceleration Sprint, developed for the Safeguard ABM system, glow white-hot at peak velocity in the atmosphere. Martin Marietta engineers in the Sprint program believe that such vehicles are now operating at close to the outer limit of ablative coatings used as an inactive cooling mechanism.

They are proposing active control of nosecone temperatures through the injection of ammonia gas into the boundary layer medium. This, they say, will cool the walls and both dilute and react with oxygen in the layer to limit the erosive oxidation of hot surface materials. Water has been considered, but the necessary subsystems are more elaborate and the contribution of more oxygen into the boundary layer is undesirable. Ammonia, however, can be stored as a liquefied gas, requires no positive expulsion device and has both high specific heat and high heat of dissociation.

LOW POLLUTION AUTOS

An external-combustion engine . . .

While American auto manufacturers crank out reports "proving" the unacceptability of engines other than their internal-combustion types, Japan's Nissan Motor Co. has signed an agreement with Kinetics Corp. of Sarasota, Fla., for delivery of a halocarbon-steam engine for test and possible future use in the 1972 or 1973 Datsun line of small cars. The new external-combustion engine, developed by Kinetics' Wallace L. Minto, uses a kerosene-heated boiler containing the Union Carbide fluorocarbon Ucon-113 as the working fluid. Similar designs in the past have run into trouble because of the instability of working fluids at high temperatures, but Kinetics says its engine-operating temperature is about 300 degrees F. and the fluorocarbon will perform well to at least 450 degrees F.

Minto says research to date shows very low emissions from the engine: no unburned hydrocarbons, less than one part per million of carbon monoxide and 0.01 part per million of nitrogen oxides.

Detractors seem unconvinced. They note that the boiler and condenser are too large and they question the safety margin between the engine working temperature and the fluorocarbon breakdown temperature. It was for these reasons, reportedly, that both Ford Motor Co. and Lear Motors Corp. decided not to use the Kinetics engine at this stage of its development. Despite these views, Nissan will test a model early next year and plans to obtain the first production engines a year later.

LOW POLLUTION AUTOS

. . . and a super battery

Not to be outdone in the quest for a nonpolluting vehicle, Tokyo Shibaura Electric Co. (Toshiba) and Yuasa Battery Co. have announced joint development of a sodium-sulfur hot battery. Operating at 570 degrees F., it has an output of 150 watt-hours per kilogram at a three-hour discharge rate—sufficient for powering a one-ton electric car at up to 60 miles an hour for 150 miles on a single electric charge, or three times the energy capability of lead-acid batteries.

The power supply employs sodium as the negative electrode and electro-conductive sulfur for the positive side; separation is by means of beta-alumina ceramic, a solid electrolyte through which sodium ions will flow, the developers say. Advantages, they claim, include a capability for fast or slow discharge, a better than 100-cycle life expectancy, no generation of gases and the relative abundance of sodium and sulfur.

Investment cost to a user for the present model would probably be excessive. However, the firms claim that the first mass-produced batteries, to be available in 1976, will be vastly improved. These will have an output of 300 watt-hours per kilogram and a 1,000-cycle lifetime. This, they assert, would permit 425 miles of travel on a single charge.

REMOTE CONTROL

Guided chutes for strandees

Someday victims marooned by accident or natural disaster may be rapidly resupplied from the air with radio-guided parachutes. Such a system is in advanced development by engineers at the Rocket and Recovery Systems Division of the Atomic Energy Commission's Sandia Laboratories in Albuquerque, N.M.

An operator on the ground or in an aircraft follows the course of the chute from a small television screen and manipulates control flaps in the chute in much the same manner that radio-controlled model planes are flown. A gyro-stabilized video camera is installed on the parachute's payload. Uncontrolled parachutes typically miss an intended target center by about 150 feet for every 1,000 feet of descent, AEC engineers estimate. With radio control, the error is reduced to only seven feet per 1,000.

WIND SENSOR

To measure a breath

Of great interest to tactical military forces is the determination of weather change and forecasting on a short-term basis for a small area, called micrometeorology. But a need exists for better instruments such as wind-current measuring devices, which have been limited in sensitivity to velocities of five miles an hour or higher. However, by using air flow directly as the energy source in a fluidic sensor the Office of Naval Research believes it soon will be able to determine air movements down to 0.1 foot per second. Also, response to velocity changes will be immediate because the fluidic sensor has no moving parts. Conventional anemometers are inertia-limited; response is poor to low speed air movement.

Under development by Bowles Fluidics Corp., Silver Spring, Md., the prototype device employs identical crossed tubular components through which a constant air stream is maintained. Any external air flow impinges on the internal air jets causing a pressure change that is sensed by one of a pair of very sensitive pressure transducers. Coverage is throughout a full 360-degree field, ONR researchers report. Delivery of the first engineering model will be made early next year.