USED IN NUCLEAR, NON-NUCLEAR EXPERIMENTS

Hydrogen Rules Rocket Division Roost

EDITOR'S NOTE: This is the ninth in a series of articles by staff writer Rita Tessmann on research programs being conducted in the Register area. It is also the last of a five-part series on the National Aeronautics and Space Administration's Plum Brook Station.

Liquid hydrogen is a capricious lady that rules the roost in the Rocket Division of the National Aeronautics and Space Administration (NASA) Plum Brook Station.

WHEN SHE GETS together with fluorine, it's automatically an explosive situation. They are used together to provide thrust for rockets being considered for future use.

Liquid Hydrogen is also to be used in nuclear rockets. A nuclear reactor in the rocket will provide the heat that sets off the hydrogen thrust.

AS A RESULT, hydrogen is used in most of the Plum Brook Rocket Research Facilities experiments. These experiments are aimed at development and perfection of both nuclear and non-nuclear rockets.

"Almost anything we do with hydrogen is applicable to both," observed Glen Hennings, Rocket Division chief, as he explained the work of his division.

To be a liquid, hydrogen must be very cold —about 423 degrees below zero Farenheit. This, in itself, presents many problems to the researchers.

EVERYTHING containing liquid hydrogen must be well insulated against even normal atmospheric temperatures or the liquid will boil and become hydrogen gas.

Both liquid hydrogen and hydrogen gas are extremely combustible . . . to put it mildly. Vacuum jackets surround even the hoses through which liquid hydrogen flows.

Special pumps must be developed to transfer liquid hydrogen. They must move the liquid at a high rate of speed. Research is conducted to measure and improve their efficiency.

ONE PUMP is capable of emptying a liquid hydrogen trailer, larger in size than a large gasoline transport, in one minute. It pumps at a rate of about 200 gallons per second, Hennings said.

In space, hydrogen will be used with a nuclear reactor for short thrusts, sometimes, to steer a space vehicle. This means tests mut be conducted to make sure a nuclear rocket can be depended on to start and stop and start again.

All this must be done in the extreme cold of space.

ANOTHER HEAT - VERSUS-COLD problem that rocket researchers are learning to control involves the use of liquid hydrogen as the most desirable nuclear fuel.

Since a reactor's main output is heat, a fuel is needed for thrust energy in a rocket. This thrust is obtained by passing liquid hydrogen, which is about 423 degrees below zero Farenheit, over the intense reactor heat.

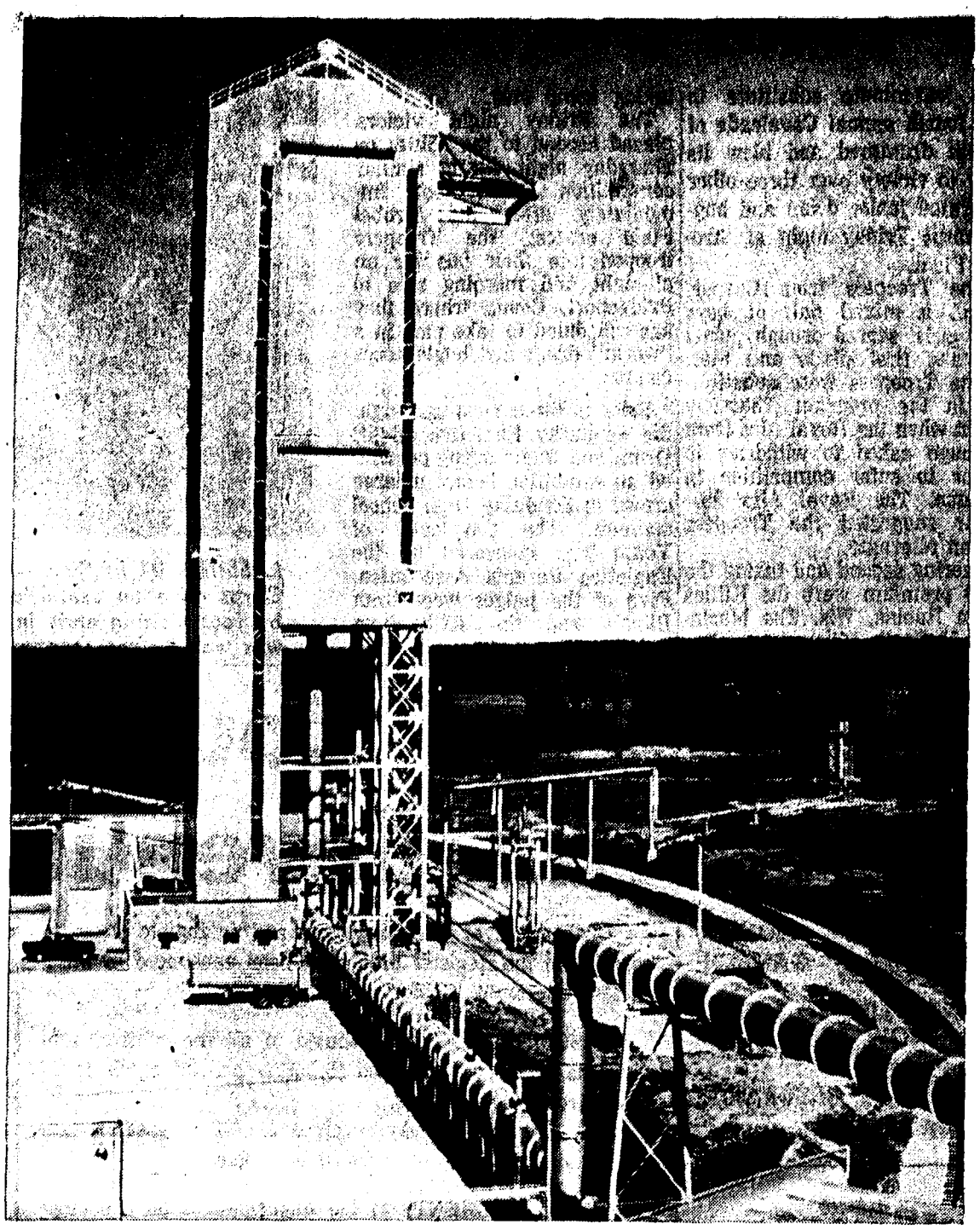
The extremely rapid expansion of the heated hydrogen provides the rocket thrust.

In the Plum Brook Rocket Division experiments, engineers must find how to keep the liquid hydrogen cold until it is needed. If it heats too soon, it will boil, turn back into a gas and vapor-lock the pumps.

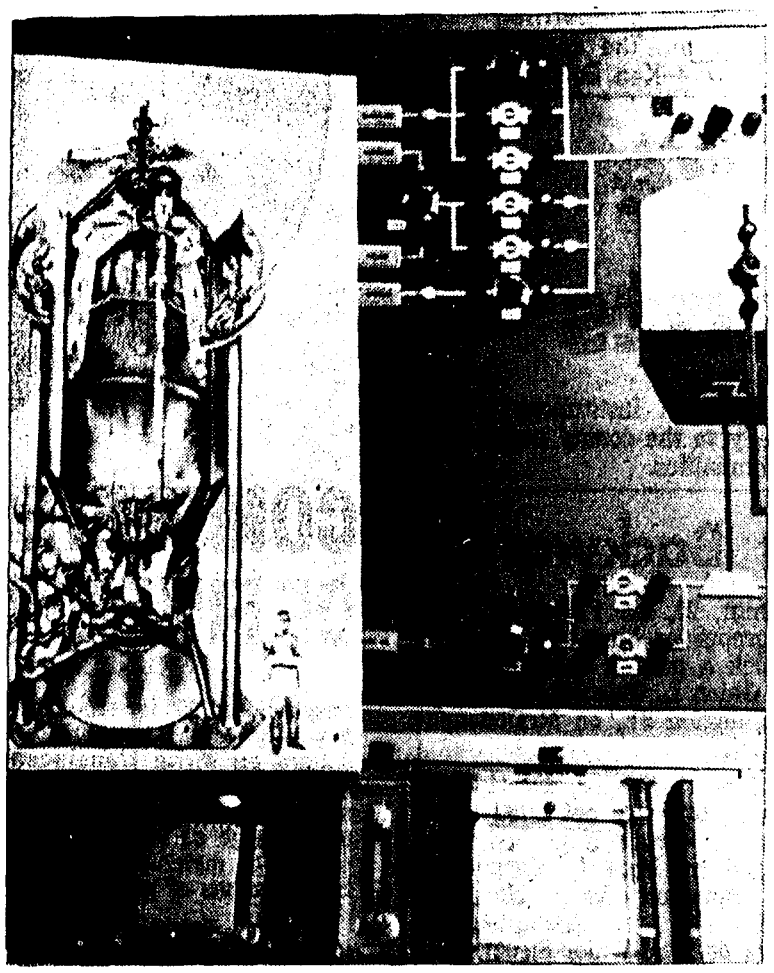
OTHER ROCKET components — even nozzles — are being tested to make sure they will withstand the intense heat and cold they will encounter in space travel.

Plum Brook experiments are conducted under direction and surveillance from NASA's Lewis Research Center in Cleveland.

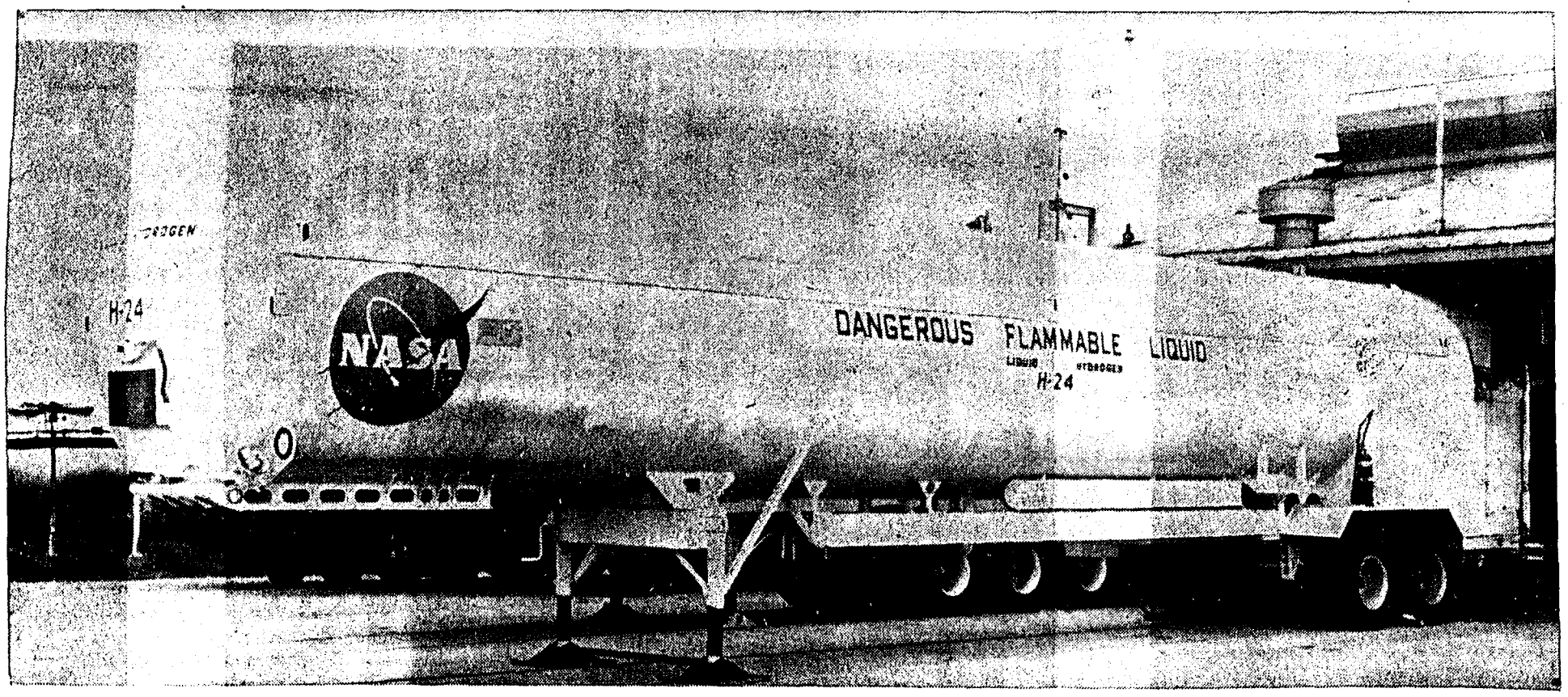
The extensiveness of these experiments are based on a belief by Lewis Director Dr. Abe Silverstein that expensive space hardware should be thoroughly proven in ground tests so that each project need have only one attempt in space. . . a successful one, explained Hennings.



NUCLEAR ROCKET DYNAMICS AND CONTROL FACILITY is near completion at NASA's Plum Brook Station. It is 200 feet high and cost an estimated $3.5 million. Designated B-3 Site, this facility will be used for non-nuclear tests of various components of large nuclear rocket engines such as will be needed for interplanetary travel. (Register Photos—Rita Tessmann)



LIQUID HYDROGEN TEST TANK is shown in a cut-away drawing to guide personnel who operate it by remote control. The control panel is in H Site, the Central Control Building. The tank, located at C Site, is used for testing a liquid hydrogen boiling fluids pump.



HUGE TRANSPORT TRAILER—This is a huge liquid hydrogen transport trailer shown at the pump test area at the NASA Plum Brook facility. Pumps are tested in fluid transport "loops" at this site. (Official NASA Plum Brook Station Photograph)

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