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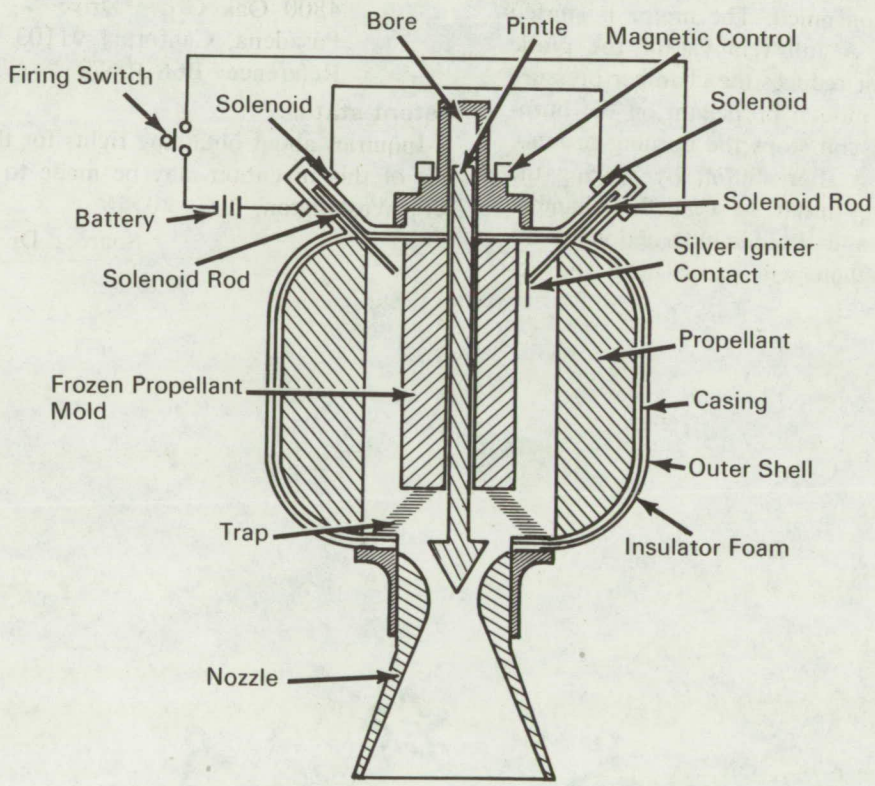
# NASA TECH BRIEF



## "Cold" Solid Propellant Motor Has Stop–Restart Capability




**The problem:**

To develop a solid propellant rocket that can be kept and fired at low temperatures in launch vehicles or spacecraft. The solid propellant rocket motor must be capable of developing a specific impulse comparable to that of liquid propellant motors; can be started, stopped, and restarted; and can be stored in space without solar radiation causing hot spots on the motor casing.

**The solution:**

A motor prepared from any of the following:

(1) frozen liquid monopropellants (e.g., hydrazine, hydrogen peroxide, and nitromethane) with or without additives to form a better grain;

(2) a mixture of a liquid propellant with a powdered solid fuel or oxidizer (e.g., a hydrocarbon liquid with ammonium perchlorate, $H_2O_2$-98% with $BeH_2$, etc.) frozen and kept at low temperatures;

(continued overleaf)

(3) a mixture of solid oxidizer and liquid fuel binder which is unstable at room temperatures but very stable and rubbery below the freezing point.

The motor with a pintle and a grain of $H_2O_2$ provides stop–restart capability. A heat conducting outer shell prevents hot spots on the motor casing from solar radiation.

**How it's done:**

The motor casing houses the propellant which is molded into the casing. A bore extends longitudinally through the frozen propellant. Thrust modulation control is provided by the axial displacement of the pintle in the bore, which is controlled by the current flow in the magnetic control. A super insulator foam is formed on the outside surface of the case. The trap, located at the input to the nozzle, assures that the propellant is evenly consumed. The motor is started by the firing switch. A full removal of the pintle from the burning motor reduces the chamber pressure to such a degree that molten propellant on the burning surface evaporates and stops the burning process. The motor is restarted after shutoff by moving the pintle into the nozzle throat so that the chamber pressure is increased and the catalytic action of the silver with the propellant will cause heat and reignition.

**Notes:**

1. These solid rockets, which use a solid propellant requiring handling, storing, and firing at temperatures below 0°C, are referred to as "cold" motors. The cold temperature is needed because the propellant is solid and safe only at low temperatures.
2. In general, any liquid and/or solid propellant or ingredient that is diergolic with the mixture at mixing temperatures (which, if necessary, is fairly close to the freezing point, or a full solidification temperature) may be used to prepare the "cold" solid propellant.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B66-10673

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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(JPL-836)