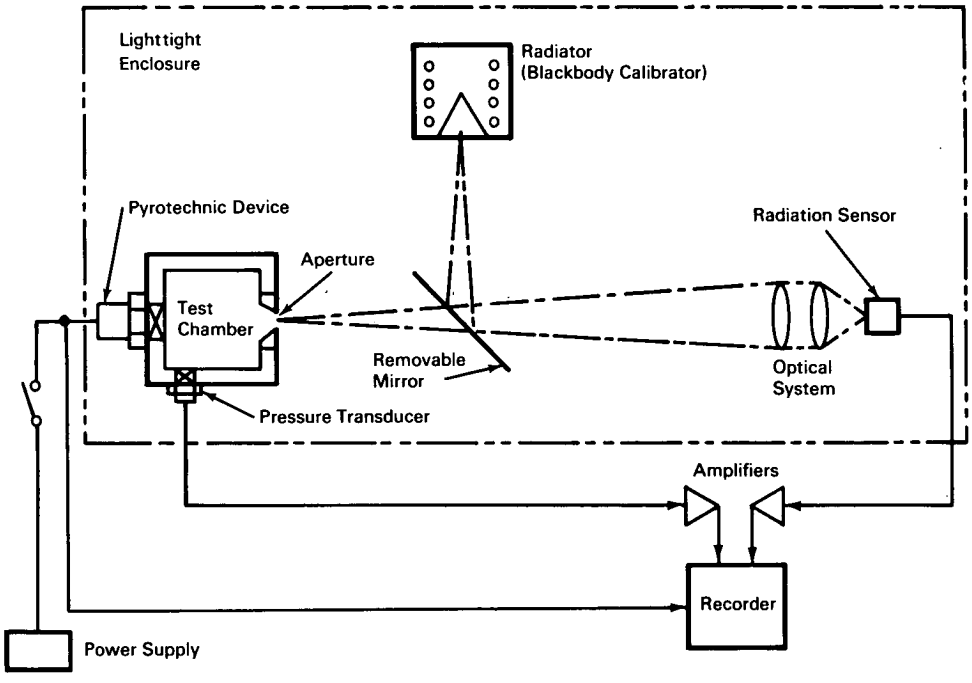
NASA TECH BRIEF

Improved System Measures Output Energy of Pyrotechnic Devices



The problem:

To develop a system for measuring the output energy of pyrotechnic devices. Among the methods in present use the most common is the closed bomb test, in which the pyrotechnic device is fired into a chamber of known volume and a pressure versus time record obtained. This method gives insufficient data for a complete analysis and characterization of the significant performance parameters of the pyrotechnic device.

The solution:

A system that discharges the reaction products of the pyrotechnic device into a chamber and measures the radiant heat output from a pinhole aperture as well as internal pressure changes on a common time base.

How it's done:

The test chamber, a cylinder with a unity diameter-to-length ratio, is designed to have the least practicable surface area in proportion to volume in order to minimize heat losses. The chamber is constructed of stainless steel of sufficient thickness to provide an effectively infinite thermal mass to further minimize heat losses during the burning time of the pyrotechnic device. The finish of the interior surface of the chamber has a value of at least RMS 63 to ensure a high

(continued overleaf)

albedo. A replaceable pinhole aperture is located in the chamber wall opposite to the port through which the pyrotechnic discharge is admitted. The aperture size is as large as possible consistent with minimum pressure drop.

A suitable radiation sensor is positioned outside of the chamber opposite to the pinhole orifice to receive the radiant heat energy from a firing of the pyrotechnic device. The pressure transducer, a strain gage type with a flush diaphragm, is located in a side wall of the chamber.

Outputs from the radiation sensor and pressure transducer, as well as ignition current and voltage versus time, if desired, are applied to a multiple trace oscilloscope and recorder. The entire system is mounted in a ventilated, lighttight enclosure. The inner surface of the enclosure and exteriors of the system components are finished in a flat-black nonreflective coating.

Before beginning a test, the system is calibrated by heating a radiator to a known temperature. The infrared radiation emitted is reflected by a mirror through the optical system and focused on the radiation sensor, thus producing an output signal proportional to radiation output, which may be recorded. The mirror is then removed and the pyrotechnic device is fired.

The pressure produced by the products of combustion of the pyrotechnic components is sensed by the pressure transducer, and the electrical output corresponding to the pressure changes is displayed on the recorder. The heat produced by the pyrotechnic reaction is reflected by the interior walls of the chamber and emitted through the aperture. The optical system focuses this radiation on the radiation sensor, which provides an output to the recorder.

Notes:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Western Operations Office
150 Pico Boulevard
Santa Monica, California, 90406
Reference: B66-10159

Patent status:

No patent action is contemplated by NASA.

Source: Edgar M. Shortly
of North American Aviation, Inc.
under contract to
Western Operations Office
(WOO-256)