May 1969

Brief 69-10142

NASA TECH BRIEF

Improved Combustion Chamber Optical Probe

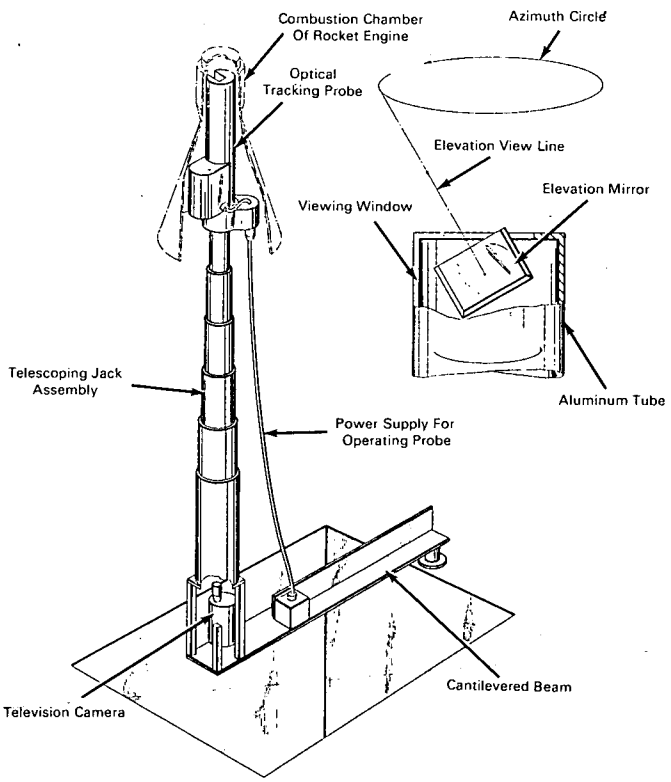

Figure 1. Perspective View of Improved Combustion Chamber Optical Probe.

The development of this optical inspection probe should be of interest to technical personnel in the aircraft, rocket, and diesel power industries, and to manufacturers of instrumentation and optical equipment. The device permits remote inspection of combustion chambers through 360 degrees, and is fully controllable in terms of elevation, focus, and sweep. This capability represents a meaningful improvement over present probes which are quite limited in their spherical spanning angle, and enables more accurate viewing than is currently possible. In addition, the hazard of physically entering combustion chamber interiors and throats of rocket engines in order to inspect them can be eliminated.

Numerous periscope-type probes have been developed in the past, but they lacked the capability of full hemispherical viewing. Other inspection devices have featured a reflecting mirror mounted for rotation

(continued overleaf)

about an axis which is perpendicular to the longitudinal axis of the probe, but in such instances the transverse axis did not penetrate the reflective surface plane. The hemisphere viewed with such devices is always in the general direction that the image is to be reflected, and "spherical viewing" is not achieved. (Spherical viewing would include the hemisphere in the direction toward which the image is to be transmitted, as well as the hemisphere extending away from the direction that the image is to be transmitted.)

This unique probe includes in combination an azimuth mirror and an elevation mirror. The elevation mirror is mounted for rotation about an axis which is generally transverse to the longitudinal axis of the probe. The transverse axis penetrates the plane formed by the reflective surface of the mirror. The mirror of the probe can be rotated selectively about the transverse axis as well as the longitudinal axis. The device receives the reflected image from the elevation mirror and transmits the image longitudinally of the probe, which may be in the form of an azimuth mirror mounted in the probe.

A perspective view of one form of the invention is shown inserted in the combustion chamber of a rocket engine. The apparatus consists of an optical tracking probe mounted on a telescoping jack assembly. The probe and jack assembly are mounted on a cantilevered beam for positioning the probe directly under the engine in alignment with the combustion chamber of the rocket engine. Operation of the jack assembly causes the probe to be raised in the combustion chamber of the rocket engine. The apparatus may include a television camera mounted on a beam focused to receive the image transmitted by the inspection probe. The top portion of the probe may be provided with lights for adequately illuminating the combustion chamber and throat. Bulbs can be enclosed in an explosion proof housing to prevent any fire hazard.

The azimuth position and elevation position of the elevation mirror are determined by operation of motors. Focusing of an objective lens is also controlled by operation of a motor. By rotating the elevation mirror, a view can be obtained of all objects that lie in the vertical plane passing through the penetration point of the elevation mirror axis on the elevation mirror plane. By rotating the probe tube, the vertical scanning plane may be positioned selectively about the vertical axis of the tube. The combined effect of rotating the elevation mirror about both the vertical and horizontal axes is that a view may be obtained of any object within the desired sphere.

Note:

Documentation is available from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: TSP69-10142

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, non-exclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

Source: Joe Walker
of LTV Aerospace Corporation
under contract to
Manned Spacecraft Center
(MSC-10953)