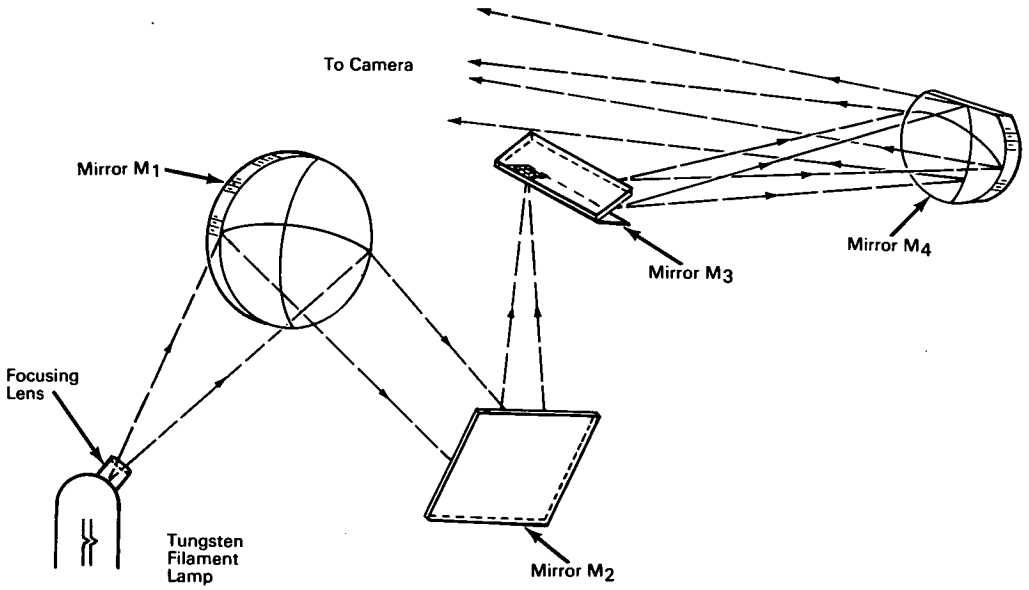
March 1966 Brief 66-10095

NASA TECH BRIEF

Ultraviolet Photographic Pyrometer Used in Rocket Exhaust Analysis



The problem:

A technique is needed for investigating the role of carbon as a thermal radiator and determining the geometry, location, and progress of afterburning phenomena in the exhaust plume of rocket engines using liquid oxygen/RP-1 as propellant.

The solution:

The use of photographic pyrometry, with instrumentation capable of producing a photographic image of the afterburning region as indicated by the ultraviolet emission from the OH molecule. An optical system with adequate transmission in the 2500 to 3500 angstrom spectral region must be employed. Calibrated intensity standards are photographed simultaneously with the object field, so that a quantitative reduction of the radiometric data can be performed. This results in a spatial mapping of the apparent color temperature of the object field.

How it's done:

The tungsten filament lamp serves as the primary image to develop the calibrated intensity standards. Light from the tungsten filament lamp is projected onto mirror M_1 and reflected to flat mirror M_2. Flat mirror M_2 rotates the primary image and reflects it to M_3 where the image is spatially divided into five zones of differing intensity by step attenuators associated with mirror M_3. Mirror M_3 additionally serves as the object for mirror M_4. Mirror M_4 then collimates the light which diverges from the primary image and sends it to the camera. Mirror M_4 thereby

(continued overleaf)

forms, at the plane of the exhaust plume, a virtual erect image of the step-attenuated primary image (the calibrated intensity standard); the standard is photographed along with the exhaust plume.

Notes:

1. This technique is applicable to processes requiring quantitative measurement of ultraviolet transmission.
2. The calibration source is a tungsten ribbon filament lamp equipped with a quartz window, which has been successfully used as an ultraviolet radiation intensity standard.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B66-10095

Patent status:

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

Source: B. P. Levin
of North American Aviation, Inc.,
under contract to
Marshall Space Flight Center
(M-FS-499)