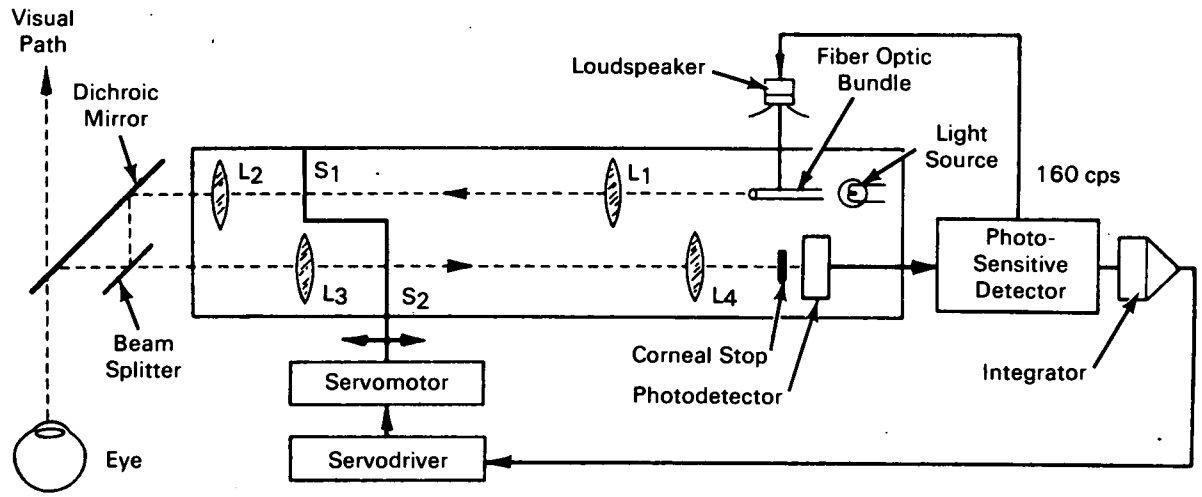
November 1970 CORRECTED COPY Brief 70-10401

NASA TECH BRIEF

Automatic Optometer Operates with Infrared Test Pattern

The problem:

To monitor the refractive strength of the human eye in order to study accommodation characteristics such as speed of response to changing views and maximum focusing power.



The solution:

An optometer that automatically and continuously images an infrared test pattern onto the retina; the condition of focus of the eye at any instant is determined from the optometer settings needed to maintain focus of the pattern on the retina.

How it's done:

Infrared light passing through a fiber optic bundle vibrating at about 160 Hz transverse to the image slit S_1 forms a bar pattern which is maintained at focus on the retina by servocontrol, even though the refractive strength of the eye lens may be changing continually. Light reflected from the retina passes through the half-field stop S_2 and the corneal-reflection stop to the photodetector; the photodetector signal contains 160 Hz component if the input image pattern is not in focus on the retina. The photodetector signal is directed to a phase-sensitive detector which furnishes to the servodriver a dc signal of the polarity and magnitude required to cause the servomotor to move the bar image at S_1 until there is a zero signal from the detector. The servomotor also controls the axial position of stop S_2 through a mechanical linkage, maintaining it in the retinal image plane despite changes in the refractive strength of the eye. The integrator makes possible a zero position-error system.

The time between the onset of a visual target displacement and the beginning of the resultant change

(continued overleaf)

in accommodative strength can be measured by noting the time lapse between target displacement and initial motion of the servomotor. The rate of change of refractive strength of the eye can be measured from time plots of servomotor motions.

Notes:

1. Accommodation responses of five commercial airline pilots under 35 years of age were measured for 2-diopter displacements of a target. For a target moving toward infinity, pilot response times were less than 1.5 seconds, but for a target moving toward the subjects, response times varied from less than one to more than six seconds.
2. A related instrument is described in NASA Tech Brief 70-10568.
3. Requests for further information may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: TSP70-10401

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: T. N. Cornsweet and H. D. Crane of
Stanford Research Institute
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