November 1973

B73-10243

NASA TECH BRIEF

Lewis Research Center

Laser System Detects Tower Deflections

The Problem:

Structural qualification testing of the Viking spacecraft shroud carried out on a tower-type test facility required accurate measurements of shroud deflections under various loading conditions. The test facility itself deflected due to the reaction forces of the loading system and from wind loads; and, since shroud deflection measurements were referenced to the test facility, large measurement errors resulted from the motion of the test facility.

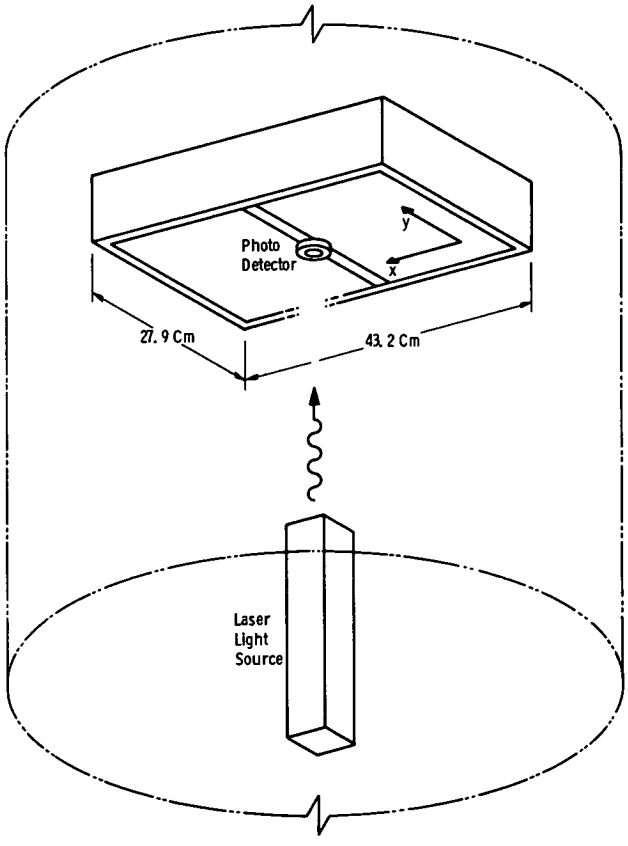
The Solution:

Continuously measure and record the deflection of the facility during testing, using a light beam tracked by an X and Y servo and recording system. Facility deflections are then subtracted from the shroud deflections during data reduction on a computer.

How It's Done:

The system is based on tracking a light beam by using a two-axis photo detector and feeding the signals into an X and Y servo system (see figure). A standard, low cost X-Y plotter was used to provide the required servo systems; the photo detector was mounted in place of the normal inking system. Signals from the detector were fed into the X and Y inputs. By using a high-gain amplifier, the tracking errors were minimized. Accuracy over the plotter area (27.9 x 43.2 cms (11 x 17 inches)) was approximately 0.254 mm (0.010 inch). Output signals for the position information of the top of the tower were taken from the servo system feedback potentiometers. The photo detector was mounted at the top of the facility at an elevation of approximately 54.86 m (180 feet), and the light source was mounted on a firm base directly below the detector in order to eliminate any possibility of tilting the light source.

The low-powered helium-neon laser used as the light source had an effective range of about 61 m (200 feet). For short distances, e.g., 3 m (10 feet) or less, a collimated incandescent source could be used. The range of the system is limited by the diameter of the beam and the area of the photo cell.



Preliminary tests of this system gave accurate and continuous tower deflection data.

(continued overleaf)

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B73-10243

Patent Status:

NASA has decided not to apply for a patent.

Source: Richard H. Fabik
Lewis Research Center
(LEW-11870)