NASA TECH BRIEF

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Hyperbola-Generator for Location of Aperiodic Events

Plotting Device
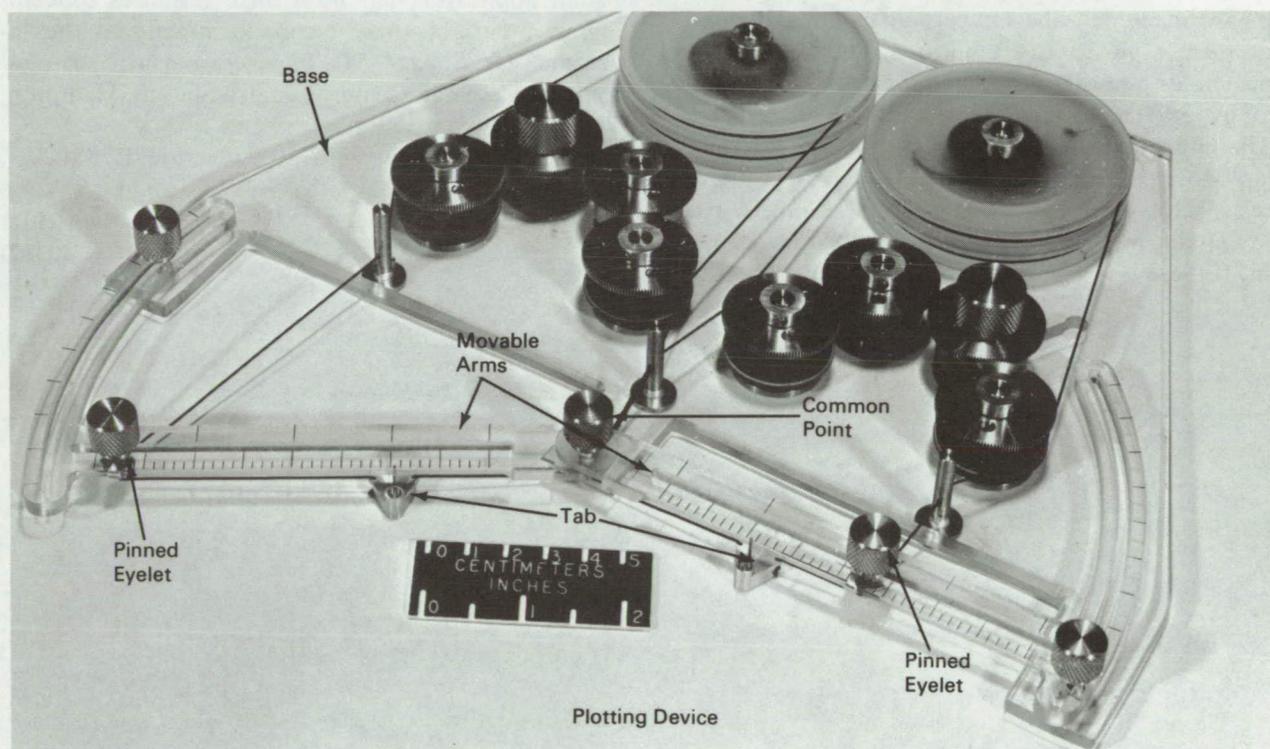
A new device, when used in conjunction with three or more detectors and a local receiver and recorder, can quickly pinpoint the location of any aperiodic event. It is essential that the position of each detector be accurately known; however, neither the distances between them nor the angles subtended by the base lines that join them are critical. Transmission between detectors and receiver may be by either radio or land line.

The key requirement is that the detector signals be received and recorded as functions of time. Two commonly available recording devices are a high-speed oscillograph and an oscilloscope equipped with a long-duration phosphor. The time data can be scaled directly from traces of the detector signals. The oscilloscope's sweep or the oscillograph's drive mechanism can be actuated by the detector's incoming signal.

The device consists of: a clear plastic base, of which each half carries a pair of concentrically mounted storage spools and two meshed metering gears (see fig.); an arrangement of two slotted arms rotating about a common point; an eyelet pinned to a map

through the common point and through each arm slot; a cord for each pair of spools, linking them by way of the gears and eyelets; and a tab with a hole in it, fastened to the cord between each pair of eyelets. The cords are held at a constant tension by spiral springs within the spools.

For three detectors, A, B, and C, the left-arm slot, common point, and right-arm slot are pinned at points A, B, and C on a map. When the recorder shows corresponding traces from A and B, the difference (x feet) in distance of A and B from the source is calculated from the difference in arrival times of the two signals and from the propagation velocity. The tab between A and B is then offset from the center of the baseline between A and B by $x/2$ ft. A pencil point is inserted through the hole in the A-B tab and pulled away from the base line to describe a hyperbola locating all points that are x ft. closer to A than to B. This procedure is repeated for points B and C, and the intersection of the two hyperbolae locates the site of the disturbance.

Operation requires minimal training and is readily adapted to the field. The mechanical error in the device's prototype was ≤3 percent of the longest base line; refinement should reduce this error to ≤1.5 percent. If there is a 1 percent error in the location of the detectors in terms of the longest base line, a 2 percent error in the offsetting produces a 1.5 percent error in the location of the disturbance; and a 4 percent error in the offset generates a 4 percent error in location. The technique could be applied to locating explosions and to navigation.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Langley Research Center
Hampton, Virginia 23365
Reference: TSP70-10695

Patent status:

This is the invention of a NASA employee and a patent application has been filed. Inquiries concerning license rights may be made directly to the inventors, Mr. Spitzer, Mr. Paucker, and Mr. Vann, at Langley Research Center, Langley Station, Hampton, Virginia 23365.

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