April 1970

Brief 70-10025

# NASA TECH BRIEF



## A Range-Rate Extraction Unit for Determining Doppler Effect

### The problem:

To devise an active ranging technique for VHF/S-band radar systems.

### The solution:

A range-rate extraction device that divides the target's Doppler frequency by a counter-generated number that is proportional to the transmitting frequency, thus producing target-velocity data in terms of speed and distance relative to the transponder-bearing target.

### How it's done:

With this device, Doppler effects can be determined by measuring the time required to count a fixed number of cycles of a two-way Doppler frequency plus a bias frequency. The time base for counting and the combined Doppler-bias frequency are automatically adjusted as a function of the transmitting frequency, so that the output data of the rate-range extraction unit is independent of the transmitting frequency. Two separate paths are used to develop the Doppler data for the range-tone loop. The bias frequency and the bias-frequency-plus-Doppler inputs to the separate paths are used to develop the Doppler information that is independent of the variation in the bias frequency. This is accomplished by subtracting the bias frequency from the combined bias frequency and Doppler signal. The subtracting function is performed in both the bias-only and bias-plus-Doppler paths by the programmable dividers located in each path. These dividers are synchronous decade counters, which are preset by thumbwheel switches to different frequencies, depending upon the frequency band that is being received (either S-band or VHF). The value of the transmitting carrier frequency is accommodated by an appropriate division ratio in the programmable dividers.

### Notes:

1. The range-rate extraction unit described in this document is in the production state of development.
2. The device is novel in that it provides a means to determine range-rate information that is independent of the transmitting frequency. It should be useful in commercial aircraft navigation applications, and may be of interest to designers and manufacturers of air traffic control equipment and radar navigation systems.
3. The following documentation may be obtained from:

   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.65)

   Reference: NASA-CR-107905 (N70-17522), Design Evaluation Report Goddard Range and Range Rate System

### Patent status:

No patent action is contemplated by NASA.

Source: General Dynamics/Astronautics under contract to Goddard Space Flight Center (GSC-10750)

Category 01