A NEW PHASE MEASURING TECHNIQUE FOR THE MINITRACK SATELLITE TRACKING SYSTEM

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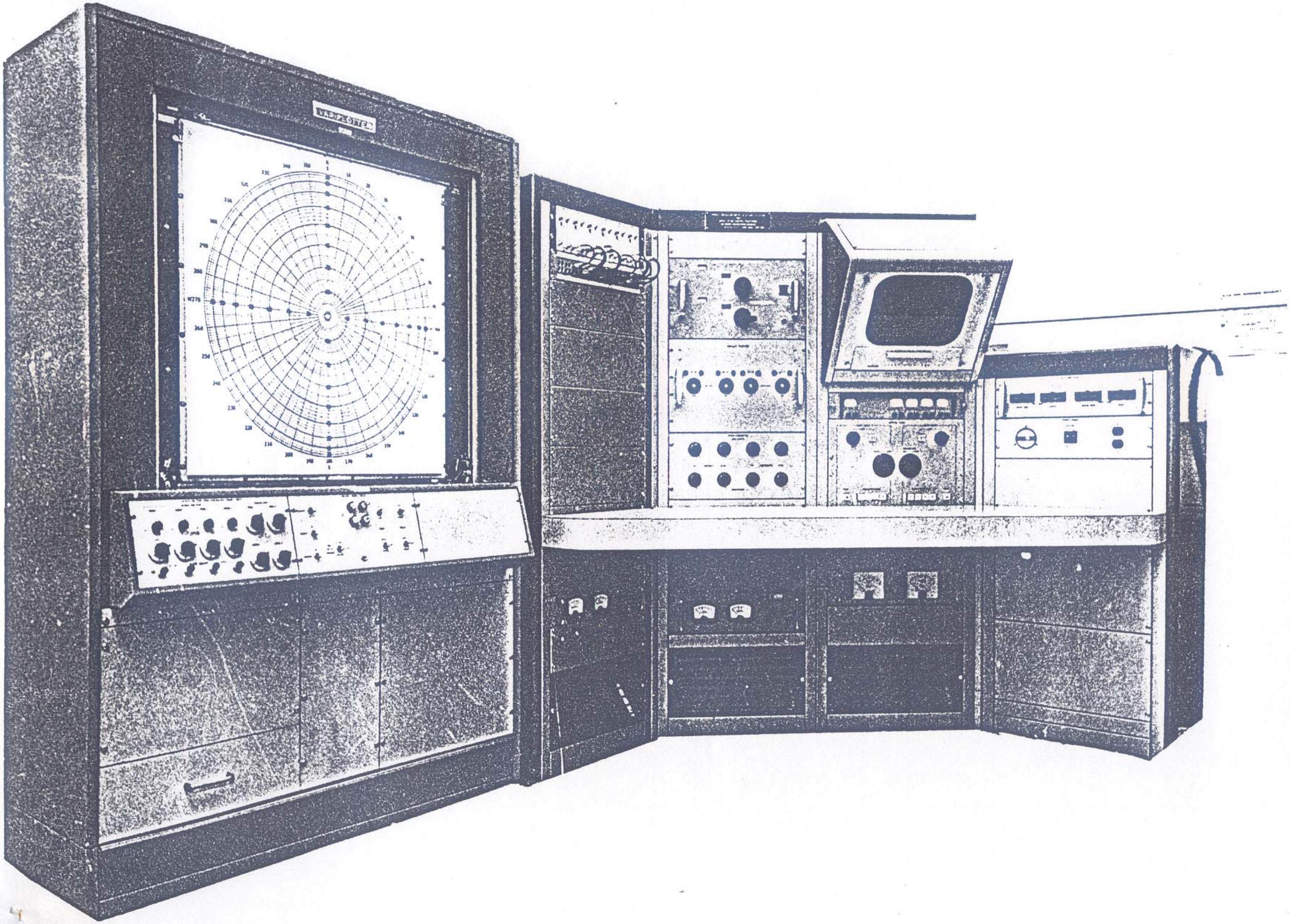
A New Phase Measuring Technique has been developed as a solution to some of the present limitation of Minitrack Satellite Tracking System. Two main problems are solved, one concerned with the processing of the information and the other, with the sensitiviy of the system.

The present Minitrack is not a real time system. The output information has to be solved from ambiguity, smoothed, and corrected at a centralized computer location with a resultant time delay. The output of the mew system is real time, free from ambiguity, and fully corrected. It will be used to plot the satellite position in X and Y coordinates and could be used to drive telemetry, antennas or optical cameras. Its digital output is a five decimal digit directional cosine number ready for transmission to the centralized computer for orbital computation.

The present Minitrack sensitivity is determined by a passive 10 cps bandwidth filter. The bandwidth is the narrowest bandwidth with linear phase vs frequency characteristics for a maximun differential doppler shift of 2 cps (approximately 2° per second angular rate). The new system has a variable bandwidth from from 0.03 cps to 3 cps with the corresponding increase in sensitivity. Its limitations are independent of the signal phase rate.

The system makes use of phase locked tracking techniques using electromechanical servo loops. A shift rotation directly proportional to the directional cosine of the satellite position vector is driven by a servomotor, and in turn drives a set of resolver phase shifters which simulate the output of the Minitrack receivers when tracking a satellite. The simulated signals are being compared with the actual Minitrack signals, and the error, if any, drives the servomotor closing the loop. The bandwidth of the system is determined by the bandwidth of the loop which easily can be narrowed down to 0.03 cps. Velocity and acceleration errors are reduced to zero by triple integration (Type 3 servo). The ambiguity problem is resolved in a similar way as in a multiple synchro transmitting system. System corrections are made in an analog way. The shaft output is converted to a voltage to drive the X-Y recorder and is encoded and recorded on punched paper tape for teletype transmission to the centralized computer location.



NASA G-65-1101