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Monthly Engineering Report No. 6

Improvement of Wide-Band FM Radar
Detection Techniques

Period Covered: 1 March 1961 to 31 March 1961

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Page 1 of 2 pages

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This report covers the sixth period of contract activity for Improvement of FM Radar Detection Techniques.

The job has been staffed by a Consulting Project Engineer and a Senior Engineer working part time as required. Four full time engineers complement the contract staff. The period has been devoted to a continuation of efforts of the last period.

Activities of the Report Period

A broadband ferrodyne translator has been constructed using a traveling wave tube in the 1.6 to 2.4 kmc range. While this range is not compatible with the radar system, the work has permitted the evaluation of the broadband technique with existing equipment. The feasibility of the device has been demonstrated and a sound basis has been established for attempting to implement a device in the appropriate frequency range, 12.4 to 18 kmc. The translation achieved to date provided a 1 mc shift in the input frequency with a maximum suppression of input frequency and cross products of 17 db. This translation and suppression was achieved by transit-time modulation of the TWT helix voltage with a sawtooth voltage. A 20-watt sawtooth was applied at a 1 mc sweep rate. Flyback time of the sawtooth was approximately 10% of the sweep period. Some improvement in suppression may be obtained by improving the flyback characteristic. Work is continuing on this approach.

Having completed the design for the high voltage sweep circuit for the backward-wave oscillation, attention is now directed for future effort to include the high voltage source and power supplies necessary for the circuit operation. Packaging will then follow.

Breadboard work continues on the active filters and the associated sampling and readout circuitry. Two approaches are being taken for the filters. One utilizes a Bridge T null network as the frequency sensitive element alone; the second would utilize the same element in a degenerative feedback loop with high gain. The first has been successfully tested; the second is now being developed.

The aspects of system design are so dependent upon the area resolution that the type of scanning system required defines the system philosophy. The present approach is dependant upon a well defined RF beam impinging on the surface of interrogation. The applicability of such an approach depends on the ability to provide a sharply focused beam. Preliminary investigations have been conducted on antenna types to serve the purpose. Two methods have some promise: these employ lenses or ellipsoidal reflectors. Size and weight are the factors of concern in these types, although use of these would serve to evaluate the needs.

Program for the Ensuing Month

Continued development and packaging will provide the effort for the succeeding period. Efforts will be directed toward procurement of a suitable traveling wave tube for the translation scheme. Packaging of the BWO power supply follows. The filtering, timing and sampling component development will be continued.

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