ANNEX A

Over-The-Horizon Backscatter Radar

Over-the-horizon radar has evolved to meet the requirement for very long range detection of airborne targets approaching the North American continent.[58] OTH is modified with the term 'backscatter' (OTH-B) when the radar receiver is located within a few hundred kilometres of the transmitter. In some versions, known as frontscatter, the energy is detected at a remote location. The US Navy is developing a relocatable-over-the-horizon radar, known as ROTH, based on the same principle but capable of being moved, although it might take many days or weeks to assemble in a new location.[59] OTH-B is currently entering operational service with the United States Air Force but has been providing information that has been operationally useful for a significant period of time.[60]

The principle of operation is that radar energy of the correct frequency, when aimed at the ionosphere, will be reflected back to earth at a far greater distance than the ordinary line of sight. This energy when striking targets in the beam will be reflected back to the receiver by a similar route. The doppler principle can be applied to reflections from OTH-B to allow the system to discriminate moving targets against a fixed background. Due to the very low frequencies and thus long wavelengths employed, the accuracy of tracking small targets is not high, therefore, this system while good for large area surveillance, would be of less use for accurate tracking. Also a result of the very long wavelengths involved, the structures associated with OTH-B antennas are very large and the transmitting and receiving units must be widely separated on the ground to avoid interference.

The height of the ionosphere varies by night and by day, and the frequency used by the OTH-B must be altered within the high-frequency band, to accommodate this. This results in performance changing with the time of day, as well as with unusual activities in the ionosphere. This dependency on a relatively stable reflecting layer inhibits the utility of OTH-B in the Arctic regions where the ionosphere is particularly unstable in a large doughnut-shaped area known as the Auroral Zone. However, it is possible that an OTH-B system could be made to operate inside this Auroral Zone, in an area centred on the magnetic pole in northwest Greenland and with a radius of about 2000 km.

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[58] *Jane's Weapon Systems 1988 - 1989*, London: 1989, pp. 302-303.

[59] "Raytheon Wins Relocatable Radar Contract," *Defense News*, 8 January 1990, p. 15.

[60] "Maine OTH-B Completes Development..." pp. 52 - 53. This article reports that the system in Maine has been able to detect a very small private aircraft over Puerto Rico, and has demonstrated some capability against the cruise missile, although any attempt to upgrade the system to improve this performance would be very costly. In addition, it cites an example whereby the Maine system was able to assist Canadian Air Traffic Control to locate a Cuban airliner that was in distress over the North Atlantic on 28 January 1990.