

# COMMUNICATION SATELLITE TRIALS IN HMS WAKEFUL

by Lieutenant Commander C. G. Traill

Trials recently completed in HMS *Wakeful* were designed to test the feasibility of ship communications via a near synchronous satellite. In the future as the tenure of shore stations overseas becomes less secure, it will become increasingly difficult to meet the need for rapid communications with ships at sea, by the use of existing HF techniques dependent upon the use of relay stations. The success of this trial is therefore an important event in the history of Naval Communications.

Technically the trials confirmed that satellite communications from a ship to other ships and shore stations are a practical proposition. Voice and telegraph signals were transmitted with exceptionally low error rates and these rates were maintained irrespective of weather conditions.

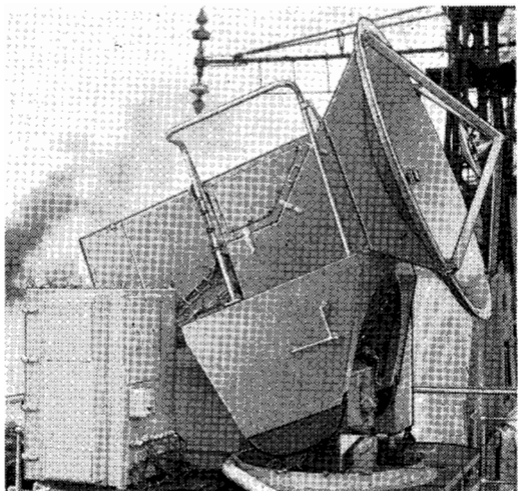
The terminal was built to take part in the Initial Defence Communication Satellite Project (IDCSP) under an agreement concluded between the U.S. Department of Defence and the British Ministry of Defence allowing a limited number of U.K. Earth stations to operate within the system. In addition to the *Wakeful* system three land based stations are now in operation at Christchurch, Cyprus and Singapore each manned by one of the three Services.

The satellites are active repeaters (as opposed to passive reflectors) launched into near stationary equatorial orbits at a height of approximately 20,000 miles by a Titan 3C Rocket. Two launches so far have been successful and a total of fourteen satellites is available for communication trials.

The ship project is part of the research programme into satellite communications at the Admiralty Surface Weapons Establishment and is under the control of Dr. Glanville Harries. The system was designed, built and fitted in 13 months.

The terminal consists of a 6 ft diameter aerial, with auto-tracking facilities, fed by a 20kW transmitter operating in the military band of microwave frequencies. The signal is amplified in the satellite and retransmitted at a slightly lower frequency. In order to keep the ship system noise temperature as low as possible, the parametric head amplifier has been cooled using gaseous helium to 20°K. The magnitude of the problem can be seen from the fact that, using 5kW of transmitted power, the receive signal is  $10^{-16}$  of a watt or one tenth of a millionth of a millionth of a milliwatt. Two separate receivers in the system enable the ship to monitor its own signals as well as those from another sending station.

The transmitter/receiver was built in the Space Division of Plessey Radar Ltd., at Cowes, Isle of Wight and a specially designed stabilisation system, using Ferranti Gyros was installed in *Wakeful* by ASWE. The transmitter, receiver, modulator equipment, aerial control and signal processing



**HMS Wakeful's satellite dish.**

equipment are contained in two transportable cabins which were dropped into position on the ship's deck.

The success of the trial in general and the confirmation of the predicted figures for capacity, signal thresholds, error rates, system losses, stabilisation accuracy and radiation levels have enabled ASWE to proceed with confidence on a streamlined system using reduced power and only one cabin which will be ready for fitting in mid-1969.