

BIRD DETECTION BY RADAR

BY IRVEN O. BUSS

THE detection and interpretation of reflected radio waves from flying birds began with the development of radar prior to America's entering World War II. Throughout the war sudden and mysterious radar signals rushed combat men to battle stations, sent fighter planes on 'goose' chases, prompted lookouts to report unidentified aeroplanes diving into the sea, gave rise to several E-boat scares, started at least one invasion alarm, and tested the vocabulary of many skippers. Today, after more than four years, interpretation of some of these targets becomes possible.

McKay (1945), of the Admiralty Miscellaneous Weapon Development Department, quoted passages from a German document prepared during 1945 under the heading "Spurious Echoes" (*Scheinziele*) which suggest that the Germans saw echoes on their radar caused by birds, but they said: "It is probably a matter of sharply bounded layers of discontinuity in the atmosphere."

Phantom signals puzzled American submariners operating about the islands south and east of Japan. Their radars showed inexplicable signals from unidentified targets that sometimes came in on collision courses at up to 36-knot speeds. Scores of explanations from four-strippers to radar strikers resulted, yet no one suspected birds.

During the summer of 1941, "Dr. E. S. Shire, then developing centimetric radar equipment at the Air Defense Research and Development Establishment, Ministry of Supply," reported "that birds can reflect radio waves with sufficient strength to be detected by radar sets" (Lack and Varley, 1945). The same writers report that "Since 1941, there have been numerous well-authenticated records of birds being detected by radar, first from England, then from Malta and Gibraltar, and later from New Zealand and the United States of America. Indeed, with the introduction of higher-powered transmitters late in 1943, bird echoes became such a menace on British coast-watching equipment that we specially trained radar operators to distinguish them from echoes of operational importance."

Reports of bird detection by American radars were similar to those reported from other countries. Brooks (1945) recorded the observations of a naval officer on duty in the Pacific, saying ". . . that on numerous occasions the radar equipment in use on his vessel has detected the presence of good-sized birds, albatrosses, man-o'-war birds, etc., at distances as great as five or six thousand yards. When distances as shown by instrument were checked against ocular estimates

of distances of approaching birds from the vessel it was found that the two figures were in close agreement." The veil of enigma surrounding interpretation of radar signals caused by birds had lifted. However, flight speeds based on radar tracks were not reported.

A radar track was identified by a naval vessel on April 24, 1945, as a group of birds flying at an average speed of 27 knots. This target was picked up by radar at seven miles and subsequently identified by specially trained lookouts as a legion of ponderous, flapping birds which they thought were pelicans. Another ship reported a radar track on a tight formation of more than 50 birds of unidentified species flying northwestward at an altitude of 200 feet. This second group was tracked on April 22, 1945, and showed speeds varying from 60 to 100 knots. On five other occasions, these two ships experienced the same 'ghost' targets, and on March 25, 1945, another ship detected a target in the same area that tracked with a variable speed ranging from 20 to 70 knots. Certainly both land-based and ship-borne radar operators developed other tracks of flying birds. That these birds were not positively identified is largely due to the fact that few radar operators are ornithologists.

The writer's assignment as Fighter Director Officer aboard a U. S. Naval ship involved the daily use of radar. Continued vigilance for the mysterious signals was maintained in the hope that eventually such targets would be detected on the ship's radar. Not until October 19, 1945, did such an opportunity arise. At 2001 (8:01 P. M.) local time, when off the coast of China in the Yellow Sea, signals were intercepted on one of the ship's radars that corresponded exactly to those reported in July, 1945. Birds were immediately suspected, but darkness prevented a visual check of the target. The track of this target showed that its altitude was low, that it was on a true heading of 205 degrees, and that during the seven miles it was tracked its average speed was 27 knots.

Twenty minutes after the first target was intercepted (2021 or 8:21 P. M.), signals were detected on the radar screen that looked and behaved in similar fashion. Again it was on a southern course (180 degrees true), traveled relatively low to the water, and averaged 30 knots over a six-and-a-half-mile track.

Target number three was detected at 2120 (9:20 P. M.) and looked no different than the other two 'ghosts.' Like numbers one and two, it was low to the water, traveled southward (195 degrees true), and averaged 31 knots.

At nine minutes after eleven (2309) the fourth radar contact was

made. The completed track showed a southerly course (220 degrees true) and a speed of 29 knots.

The fifth and last target tracked during darkness was picked up at eleven minutes after five (0511) on the morning of October 20. Like the preceding four targets, it was traveling southward (202 degrees true) and was averaging about the same speed (26 knots). A comparison of the five summary plots showed that in each case the target was picked up at a similar short distance, traveled at low altitude, tracked for about seven miles, averaged between 26 and 31 knots, and was on a southward course (from 180 to 220 degrees true).

Daylight revealed many flocks of migrating waterfowl. The heavy flight consisted almost entirely of ducks, and at least three-fourths of the ducks were Pintails (*Anas acuta acuta*).¹ The flocks were small to medium in size (none over a hundred), and all were flying 200 feet or less above the sea. Every bird was on a similar south-bound course!

A direct and efficient communication system between the radar station below decks and a visual lookout station topside made it possible to check radar targets by ocular observations. Only some of the flocks were detectable by radar. Some of these did not remain on the screen long enough to be tracked. There was a minimum flock-number which gave a trackable signal. Other types of radar used on higher-flying ducks would doubtless give different results, but the radar-signal characteristics would remain basically the same. Attempts to identify visually flocks of ducks that were trackable on radar were successful in two cases. The largest flocks, that were easiest to track, stayed farthest from the ship and made positive identification difficult.

A flock of some fifty Pintails flying between 150 and 200 feet above the sea was tracked on a course of 185 degrees true for seven miles and showed an average speed of 29 knots. The second flock was mixed, consisting of forty-one Mallards (*Anas p. platyrhynchos*) led by five unidentified species (probably *Anas crecca crecca*) which resembled the American Blue-winged Teal. This flock was at the same altitude as the flock of Pintails, flying on a true heading of 192 degrees, and averaged 28 knots. The wind at this time was from 315 degrees true with a velocity of 7.5 knots, which would not noticeably affect the duck's flight speed. The appearance and behavior of the radar signals from both flocks were indistinguishable from those detected during the night, and they leave no question as to their identity.

All of the speeds measured during these observations were within narrow range limits (26 to 31 knots). A flock of Gray Geese tracked

¹ Classifications used in this paper are based on Hachisuka, et al., 1942.

by Lack and Varley on January 12, 1945, traveled with an air speed of about 25 miles per hour, which is close to the above range of flight speeds. Cooke (1939), however, shows six different flight speeds for Mallards ranging from 46 to 60 miles per hour, and two flight speeds for Pintails of 52 and 65 miles per hour. It is highly probable that birds greatly accelerate their flight speeds for short periods of time when they are frightened or pursued, but this study shows that some ducks migrate at much slower speeds than is claimed by many writers.

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 THE BIRDS OF MONA ISLAND, PUERTO RICO

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MONA ISLAND is located in Mona Passage, forty-eight miles off the west coast of Puerto Rico and thirty-two miles off the east coast of Hispaniola. From a geological standpoint, it is volcanic in nature and is of relatively recent origin, pertaining to the Pliocene Period of the Tertiary.

From near at hand Mona gives the impression of an inaccessible rock emerging from the bottom of the Caribbean, with a barren tableland on the summit, bounded by sharply-cut, precipitous cliffs. The island has an area of approximately twenty-four square miles. Toward the southeastern section a level coastal plain extends from Sardinera to Uvero Beach on the extreme east-southeast coast, reaching the abrupt cliffs at the eastern point called Caigo o no Caigo. The plain has an average width of about one mile and is approximately eight miles long. A narrow dirt road has been made from Sardinera to