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COASTAL COMMAND REVIEW

May and June, 1942

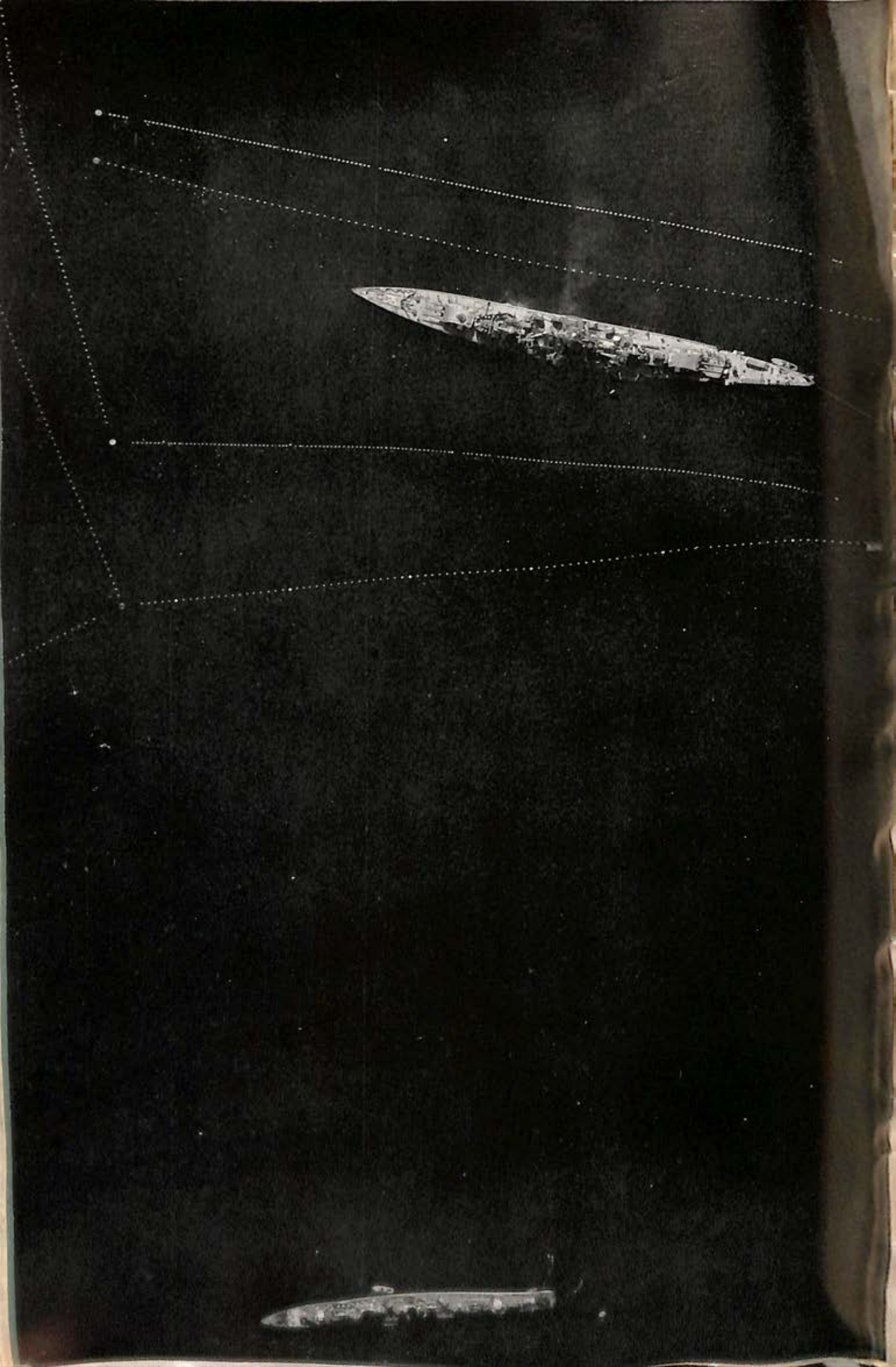
No. 3

**HEADQUARTERS,
COASTAL COMMAND
ROYAL AIR FORCE**

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“While this book is, of necessity, issued as secret, and no part of it must be communicated to anyone outside the Services, it is intended for the information of all officers but principally of all members of aircrews, under conditions of security approved by the Commanding Officer. The whole purpose of producing it would be frustrated if it were relegated to the interior of an official safe.”

*The Air Officer Commanding-in-Chief,
Coastal Command.*



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Plate 1. *Frontispiece.* *Lützow*, inside double torpedo-nets, and a destroyer in Bogen Fiord, Narvik.
11th June: P.R.U.

COASTAL COMMAND REVIEW May and June 1942

CORRECTIONS TO PREVIOUS ISSUE

Page 10, line 5 of *Attacks* paragraph : read *Beaufighter P/248*.

Page 30, three-quarters down the page : read *224* for *254*.

Plate 9, middle photograph : read *Wellingtons* for *Whitleys*.

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PART I

ANTI-SUBMARINE ACTIVITIES, MAY AND JUNE, 1942

(i) Review of Operations

Introduction

The period covered by this number of the Coastal Command Review has seen the introduction of the Searchlight aircraft and the torpex-filled depth-charge, and the provision of reinforcements—chiefly in the south-west—in the form of five Squadrons, and a detachment of a sixth, loaned by Bomber Command (51, 58 and 77 Squadrons of Whitleys; 304 and 311 Squadrons of Wellingtons and a detachment of 44 Squadron of Lancasters). Several excellent attacks have been carried out by the new personnel.

The searchlight-fitted Wellingtons of 172 Squadron proved an immediate success in the Bay. From the beginning of June, when they began to operate, to the end of June, these aircraft have flown 205 hours (excluding passage time) on anti-submarine operations, making seven sightings and six attacks. Some of these attacks have been very successful; a notable example was that by F/172 in the early hours of 4th June. The U-Boat attacked may well have been the one which ran ashore while trying to make the Spanish coast in a badly damaged condition. She was subsequently re-floated only to be attacked again by the Sunderlands A/10 and X/10 who forced her into internment in Santander.

Since the introduction of the torpex depth-charge, the proportion of attacks causing serious damage to U-Boats has increased considerably; the first attack by V/58 on 16th May probably sank the U-Boat concerned, and the attack by F/172, just mentioned, was also with torpex charges.

Some matter of quite exceptional interest was released for publication in the Admiralty's red *Monthly Anti-Submarine Report* for May (C.B. 04050), which should be available at all Coastal Command Stations.

Throughout the period under review the main force of the U-Boat offensive has been engaged on the other side of the Atlantic. The enemy have, however, again started wolf-pack attacks on this side, and on the nights of 11th/12th and 12th/13th May, an outward bound convoy was attacked by several U-Boats and seven ships sunk; this attack, over 900 miles from the nearest Coastal Command base, could not be broken off by our aircraft. About the middle of June, a large-scale attack developed on a convoy homeward bound from Gibraltar, during which five ships were sunk. On the 15th June, air escort to this convoy, then in about 45.00 N., 17.00 W. (approximately 600 miles south-west of Land's End), was provided by two Liberators, T/120 and W/120, and two Lancasters, W/44 and X/44; these aircraft sighted five U-Boats and attacked them. After these attacks no further offensive was taken by the U-Boats against this convoy. This success is strikingly similar to that of 22nd December, when Liberator attacks played a large part in breaking up another large-scale attack on a homeward-bound Gibraltar convoy.

During May and June, 95 convoys and 35 independently routed ships were given aircraft protection, which entailed 975 sorties. Of the 548 sent as close escort, 91 per cent. succeeded in meeting the convoys, and 73 per cent. the independents to which they were sent—both very satisfactory achievements.

There appears to have been no standing patrol of U-Boats in the Rockall area throughout the period, and the U-Boats attacked north of 55 degrees were all apparently coming round from Germany to the Bay ports. There have been two series of attacks on parties intercepted on their way. The first batch of three was originally sighted near the south-west corner of Norway, by a P.R.U. aircraft at 1300 hours on 21st May, and was found next day at 1023, north-east of the Shetlands. Other sightings and attacks were made on the 22nd at 1830, 2112 and 2130, as the U-Boats moved to the north of the islands. At 1133 on 23rd May they were attacked north-west of the Shetlands, and at 1234 on the 24th north-west of Lewis. Finally, at 1154 on the 29th, an attack was made west of Brest on a

U-Boat which probably belonged to this party. Again, on 13th June, a Beaufighter returning from the coast of Norway, sighted a U-Boat at 0549 hours, and it or its companions were seen again three more times that day and twice on the next, several attacks being made.

In each case visibility was extremely good all through the U-Boats' voyage round Scotland, but in a high proportion of the attacks made upon both parties, the U-Boat was still on the surface or had submerged no more than a few seconds. It seems a justifiable inference that the crews were newly commissioned.

In all, eight U-Boats have been sighted in northern waters east of 0 degrees longitude. Several were found in Norwegian fiords and harbours; none of these was attacked except with light armament. Anti-submarine aircraft from Gibraltar sighted 13 U-Boats and attacked 10. These were the results by Squadrons, ignoring all targets not certainly identified as submarines (compare Charts I and II).

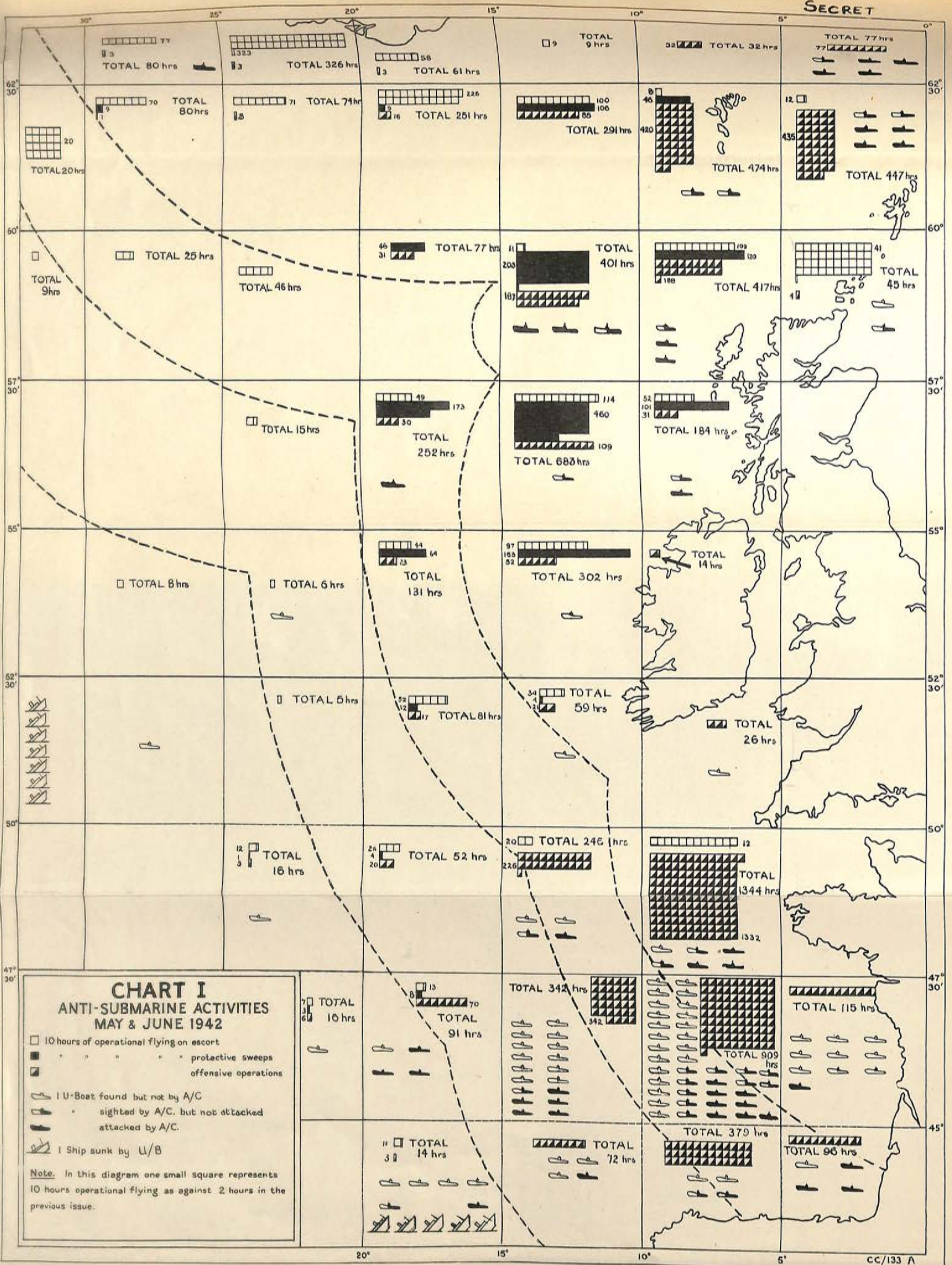
<i>Squadron.</i>					<i>Total Sightings.</i>	<i>Gun Attacks.</i>	<i>Depth-charge Attacks.</i>
10	Sunderlands	Mount Batten and Gibraltar.			11		9
44	Lancasters	Predannock ..			2		2
48	Hudsons	Wick ..			4		2
51	Whitleys	Chivenor ..			2		1
53	Hudsons	St. Eval ..			3		3
58	Whitleys	St. Eval ..			6	1	4
73	P.B.Y.'s	Iceland ..			1	0	1
77	Whitleys	Chivenor ..			3		2
120	Liberators	Nutts Corner ..			3	1	2
172	Searchlight Wellingtons ..	Chivenor ..			7	2	4
202	Catalinas	Gibraltar ..			5	0	4
206	Hudsons	Aldergrove ..			2	2	1
209	Catalinas	Gibraltar ..			1	0	0
210	Catalinas	Sullom Voe ..			1	0	0
224	Hudsons	Tiree ..			2		0
228	Sunderlands	Oban ..			4		2
233	Hudsons	Gibraltar ..			3	0	3
235	Beaufighters	Wattisham ..			3	0	0
240	Catalinas	Gibraltar ..			2	0	2
248	Beaufighters	Sumburgh ..			2	1	0
608	Hudsons	Wick ..			5	2	3
1406	Meteorological Flight ..	Wick ..			1	1	0
					73	10	45

SIGHTINGS OF U-BOATS NOT LEADING TO ATTACKS BY DEPTH-CHARGE

Time and Date.	Aircraft.	Duty.	Position.	Height of Aircraft.	Range.	Remarks.
MAY 0153/2 1820/2	Q/608 V/58	Special Strike on Aalsund Anti-submarine patrol	62.34 N., 06.15 E. 47.20 N., 06.59 W.	300 ft. ?	1 mile 1 mile	Turned to make attack but U-Boat crash-dived. Wireless operator sighted, but the captain did not, because the windscreen had oiled up.
0948/2 1115/3 1420/5 1225/6 1920/8	Civil aircraft P.R.U. Civil aircraft K/807 V/235	— — Search for missing aircraft Special Strike..	45.20 N., 09.48 W. 62.12 N., 03.40 E. 45.07 N., 09.25 W. 36.36 N., 07.12 W. 62.34 N., 00.27 E.	— — — — 1,000 ft.	— — — — 4 miles	No depth-charges. Submerged before attack could be made ; no depth-charges.
0940/9 1150/15	Hudson R/10	Transit Malta to Gibraltar Transit to Gibraltar ..	35.46 N., 03.18 W. 44.07 N., 08.54 W.	5,000 ft. —	? S.E., 20 miles ; Visibility, 12 miles	No depth-charges. Close astern of merchant vessel ; on approach was found to have disappeared ; no depth-charges.
1317/16 0835/7 0815/20 0806/21 0703/21 1430/21 1738/21 1300/21	Wellington B/235 Wellington H/206 do. M/228 D/224 P.R.U.	Transit to Gibraltar .. North Stab .. Transit to Gibraltar .. Meteorological flight do. Anti-submarine search U-Boat hunt ..	43.40 N., 08.25 W. 60.58 N., 02.52 E. 47.38 N., 07.21 W. 57.05 N., 13.40 W. do. 57.32 N., 11.55 W. 58.04 N., 10.48 W. 58.15 N., 06.15 E.	1,500 ft. 200 ft. 1,500 ft. 1,600 ft. 1,500 ft. 200 ft. 200 ft. —	2 miles 2 miles ? 5 miles 3 miles ? 1 mile —	No depth-charges. No depth-charges. No depth-charges. No depth-charges. do. Depth-charges did not drop. Depth-charges did not drop. See p. 12. Three U-Boats in convoy with other surface craft.
1023/22 1930/22 2312/22 0732/24 0731/25 0910/25	B/235 H/48 O/608 X/224 Hudson N/228	Vaaro patrol .. Long Slips IV .. Anti-submarine patrol .. Anti-submarine sweep .. Transit Malta to Gibraltar .. Anti-submarine patrol on transit from Sullom Voe-Oban.	61.16 N., 01.57 E. 60.17 N., 06.58 W. Position unknown 59.19 N., 07.46 W. 36.22 N., 01.12 W. 59.43 N., 02.34 W.	100 ft. 4,000 ft. ? 650 ft. 4,000 ft. 2,500 ft.	3 miles 28 miles ? 4 miles 1 mile 4-5 miles	No depth-charges. Seen with binoculars. Submerged too long. No details ; aircraft missing. Depth-charges did not release. No depth-charges. Submerged too long.
0527/26 1218/26	L/120 O/210	Lotus reconnaissance Lotus III ..	Ands Fiord. 70.11 N., 14.44 E.	900 ft. 100 ft.	5 miles 10 miles	No depth-charges. Gun attack. No depth-charges carried.

Sightings of U-Boats Not Leading to Attacks by Depth-Charge—(contd.)

Time and Date.	Aircraft.	Duty.	Position.	Height of Aircraft.	Range.	Remarks.
JUNE						
1250/4	H/248 ..	Vaaro patrol ..	61.38 N., 03.18 E.	?	?	Crash-dived before gun attack could be made. No depth-charges.
1522/5	K/77 ..	Anti-submarine patrol	46.00 N., 05.46 W.	1,000 ft.	2 miles	Submerged too long.
0123/7	B/172 ..	Anti-submarine patrol	45.39 N., 06.39 W.	2,000 ft.	11 miles	Seen by searchlight at 1 mile, identified at 400 yards. Submerged after gun attack.
0328/7	F/172 ..	Anti-submarine patrol	45.05 N., 06.30 W.	2,000 ft.	S.E., 7½ miles; searchlight, ½ mile	Submerged too long.
1634/9	N/202 ..	U-Boat hunt ..	37.46 N., 00.37 E.	3,000 ft.	Beneath aircraft	Submerged too long.
1200/10	O/202 ..	Anti-submarine patrol	36.59 N., 01.15 W.	4,500 ft.	1 mile	Front gunner sighted; submerged too long.
1427/10	J/248 ..	Special sweep escort	61.10 N., 03.00 E.	—	—	See p. 20.
0549/13	M/248 ..	Vaaro patrol ..	61.46 N., 02.18 E.	100 ft.	200 yards	Crash-dived before gun attack could be made.
1110/13	A/48 ..	U-Boat search ..	62.05 N., 01.05 E.	1,500 ft.	10 miles	No depth-charges.
1355/13	do.	do.	62.15 N., 00.20 E.	?	7 miles	Submerged too soon.
1453/13	do.	do.	62.18 N., 00.12 E.	?	?	Submerged too soon.
0645/16	M/209	Transit to Gibraltar ..	43.19 N., 17.39 W.	1,500 ft.	?	Submerged too soon.
0650/18	Wellington	Transit to Gibraltar ..	45.38 N., 08.25 W.	?	?	No depth-charges; dummy attack made.
0700/20	B/1406	Meteorological flight	63.40 N., 00.00	2,000 ft.	2 miles	No depth-charges.
1310/20	P.R.U.	—	60.08 N., 03.56 E.	?	?	No depth-charges. Gun attack.
1359/22	V/51 ..	Anti-submarine patrol	47.11 N., 09.10 W.	1,000 ft.	2½ miles	Also saw five more U-Boats in Bergen.
1824/24	X/10 ..	Anti-submarine patrol diverted to U-Boat hunt.	47.01 N., 09.00 W.	1,000 ft.	8 miles	Submerged too long.
0902/23	U/10 ..	Anti-shiping to Gibraltar ..	45.37 N., 09.00 W.	?	?	No depth-charges.
1319/20	Hudson	Transit to Gibraltar ..	36.13 N., 06.30 W.	2,500-3,000 ft.	?	No depth-charges.



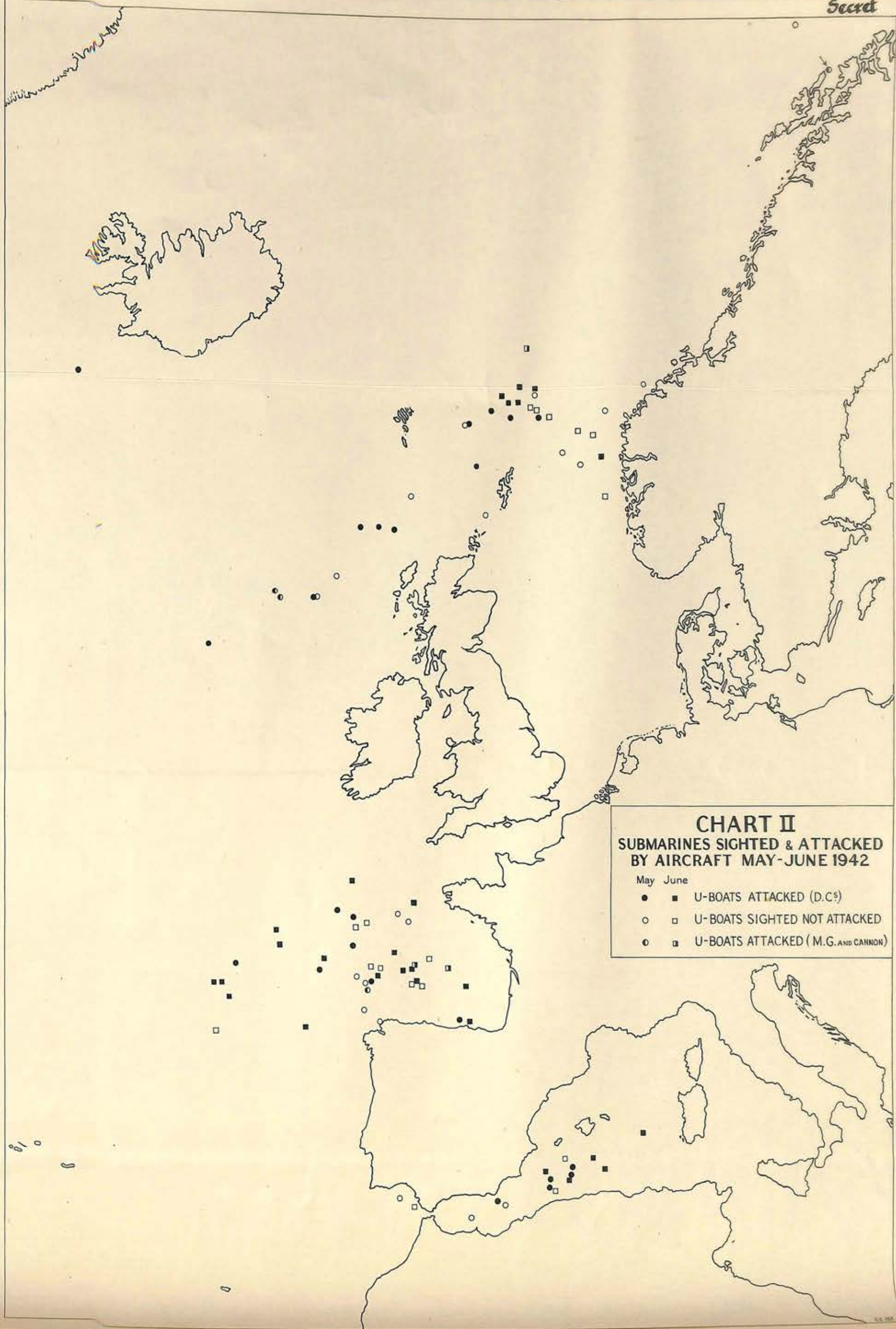


CHART II
SUBMARINES SIGHTED & ATTACKED
BY AIRCRAFT MAY-JUNE 1942

May June
 ● ■ U-BOATS ATTACKED (D.C.s)
 ○ □ U-BOATS SIGHTED NOT ATTACKED
 ◐ ◑ U-BOATS ATTACKED (M.G. AND CANNON)

(ii) The Attacks

An account is given here of all Coastal Command attacks on submarines during May and June, except for some of those which were made by gunfire or upon objects not identified with certainty. The more interesting episodes are printed under titles. Unless otherwise stated, all the submarines were sighted fully surfaced; Torpex depth-charges are specifically mentioned whenever their use may have affected the issue. The results of attacks are given on the authority of the Naval staff at Command Headquarters. It should be noted that, in the absence of photographs, the crew's estimate of distance forms the unquestioned basis of assessment, though in fact most people tend to underestimate the extent of a stretch of water when there is no object to give scale. It has been found that the actual distance is often two or three times that estimated from the air. Some assessments are therefore likely to overstate the chances of a miss astern when the U-Boat had already submerged.

* * * *

At 1305 hours on 1st May, *B/233*, a Hudson of Gibraltar, was flying at 1,200 ft., visibility 7-8 miles, when a submarine (probably Italian) was seen 3 miles on the port beam, making 10 knots. The submarine disappeared 13 seconds before the attack, which was made from just abaft the port beam at 80 ft., with four 250-lb. depth-charges (25 ft. setting, 60 ft. spacing). They straddled the line of advance, 80-100 yards ahead of the swirl, and ought, therefore, to have fallen between the conning tower and the bows. No results were observed, and the spacing of 60 ft. makes it possible that a stick correct for range, line and depth should fail to come within lethal range, but the U-Boat and crew should at least have been very severely shaken. (36.40 N., 01.55 W.)

Surrender Offered : U-Boat now interned

At 1456 hours on 1st May, Hudson *M/233* from Gibraltar, flying at 1,700 ft. in haze, visibility three miles, sighted a U-Boat two miles away making eight knots. The aircraft dived and attacked from 30 ft. at an angle of 40 degrees to the track, from the U-Boat's port bow, releasing three 250-lb. depth-charges (set to 25 ft., spaced to 60 ft.) while the U-Boat was still on the surface with the decks awash. Number one depth-charge was a direct hit abaft the conning tower, but failed to explode. Numbers two and three exploded close to the starboard side abaft the conning tower. After the explosions the stern rose out of the water and the U-Boat disappeared. One minute later a patch of oil 100 yards in diameter appeared; then, about 10 ft. of the bows broke surface at a steep angle and again disappeared. After another minute the U-Boat came up, bows first, at a steep angle, and levelled off, very sluggishly. The conning tower opened, with a puff of white smoke, and about ten men emerged, their hands raised in surrender. They remained like this, making no attempt to man the gun, so the aircraft did not open fire, though at 1520 hours it had to leave owing to shortage of petrol. By the time that relieving aircraft and destroyers arrived, the U-Boat, though very severely damaged, had got away, to Cartagena, where it has been interned. The episode confirms the belief that if a submarine has suffered what is suspected to be serious damage, immediately after diving, it will always endeavour to regain the surface without delay, and will generally succeed. (37.00 N., 01.00 E.)

* * * *

On 2nd May, Catalina *C/202* from Gibraltar, flying at 3,000 ft., received a Special Equipment contact ahead and one minute later, at 1310 hours, sighted an Italian submarine seven miles ahead. The aircraft dived, getting within half-a-mile before the submarine disappeared. About 10 seconds later an attack was made from the port quarter at 45 degrees to the track, and seven 250-lb. depth-charges (set to 25 ft., and spaced to 40 ft.) were dropped from 50 ft. As the distributor spacing failed, the depth-charges fell in a salvo, on or very close to the swirl. The conning tower should have advanced 195 ft. during the interval, so that the salvo exploded about 100 ft. astern of the tail; but the approach to this attack must have been well executed for the aircraft to have got so close on a day of no cloud and excellent visibility. At 1440 hours two destroyers arrived, and the Catalina remained until 1745 hours, but nothing further was seen. (37.32 N., 00.10 E.)

On 2nd May, Whitley *B/58* sighted a U-Boat $2\frac{1}{2}$ miles away, at 1647 hours ; it was making six knots. The aircraft immediately altered course, but the U-Boat dived when still $1-1\frac{1}{2}$ miles away. An attack was carried out from the port bow at an angle of 30 degrees to the U-Boat's track, with six 250-lb. depth-charges (Mark VIII, with Mark XIII pistol, set to 25 ft.). They were released from 50 ft., 10 seconds after the U-Boat had submerged, when only the swirl left by the conning tower was visible. The stick, spaced at 45 ft., straddled the U-Boat's line of advance, and No. three depth-charge fell 70 yards dead ahead of the swirl. No oil, other than the scum from the depth-charges, was seen and no sign of air bubbles or wreckage, although the aircraft stayed in the vicinity for 15 minutes and returned to the scene of attack at 1720 hours and searched for another half hour. The depth-charges should have been right for line and depth, and the crew of the U-Boat must have had a very severe shaking up. (45.30 N., 11.50 W.)

* * * *

On the 3rd, Liberator *A/120* received a contact on the Special Equipment, five miles to starboard, and a U-Boat moving at seven knots was found at 2143 hours. The aircraft attacked when the U-Boat was at periscope depth with eight 250-lb. depth-charges ; they were released from 100 ft., set at 25 ft., with spacing of 50 ft. The stick fell 80 yards ahead of the swirl, straddling the track of the U-Boat. One patch of oil, with air bubbles in the centre, appeared 15 seconds after the explosions, and vague outlines of frothy sludge and debris were seen near the edges of the depth-charge upheavals. It is clear that damage had been inflicted, but the U-Boat may have gone just out of lethal range for depth. (45.58 N., 16.33 W.)

Beginner's Luck : Two U-Boats in Fifteen Minutes

On 5th May, Whitley *E/58*, flying at 4,000 ft. in nil cloud and visibility 10 miles, sighted at 1502 hours, a U-Boat five miles on the port bow, making eight knots. The aircraft remained on its southerly course for 30 seconds so as to get up sun, then did a tight turn to port losing height all the time, and attacked at an angle of 50 degrees to the track from the U-Boat's port quarter, releasing six 250-lb. depth-charges (set to 25 ft. depth, and spaced in the water to 60-70 ft.) from 50 ft. at 145 knots. The U-Boat had disappeared eight seconds earlier, but it could be clearly seen under the water when the aircraft crossed the line of advance after releasing the stick. Number three depth-charge exploded 50 yards right ahead of the swirl, and as the U-Boat should have advanced 57 yards by the time of the explosion, the stick ought to have straddled it just abaft the conning tower. Four or five minutes after the attack, a patch of oil, about 100 yards across, was seen in the position of the attack. The spacing of 60-70 ft. could allow the U-Boat to be out of lethal range although completely straddled, but the large amount of oil indicates that damage was inflicted ; the U-Boat and crew must also have had a very severe shake up. (45.12 N., 09.09 W.)

E/58 had just left the scene of this attack on baiting tactics and was flying at 2,000 ft., when another U-Boat was sighted six miles ahead, at 1517 hours. The aircraft lost height and attacked from the U-Boat's port beam, firing the front guns as the U-Boat dived, and numerous hits were seen on the bridge structure before it disappeared. The tail of the U-Boat was still out of water as the Whitley passed over. The aircraft circled for seven minutes, then searched the vicinity for half an hour, and returned to the position of the previous attack, but nothing further was seen. Incidentally, the pilot and the crew of this aircraft had no previous experience of this type of warfare.

* * * *

At 0123 on 7th May, Wellington *B/172* was flying at 2,500 ft. in haze (no moon), when the Special Equipment received a faint contact at 11 miles' range. The aircraft started homing and obtained contact at $7\frac{1}{2}$ miles. A phosphorescent light was then sighted on the water ; investigation from 1,000 ft. identified it as a wake. The aircraft approached from astern at 500 ft., switched on its Leigh light when a mile away, and at 400 yards distance saw a large U-Boat on the starboard bow, making 15 knots. The aircraft crossed ahead and turned to starboard to get into position for attack, while the rear gunner fired 200 rounds at the U-Boat, which was then diving. When the turn had been completed and the aircraft approached, low cloud interfered with the searchlight and the U-Boat was not found again. (45.20 N., 06.37 W.)

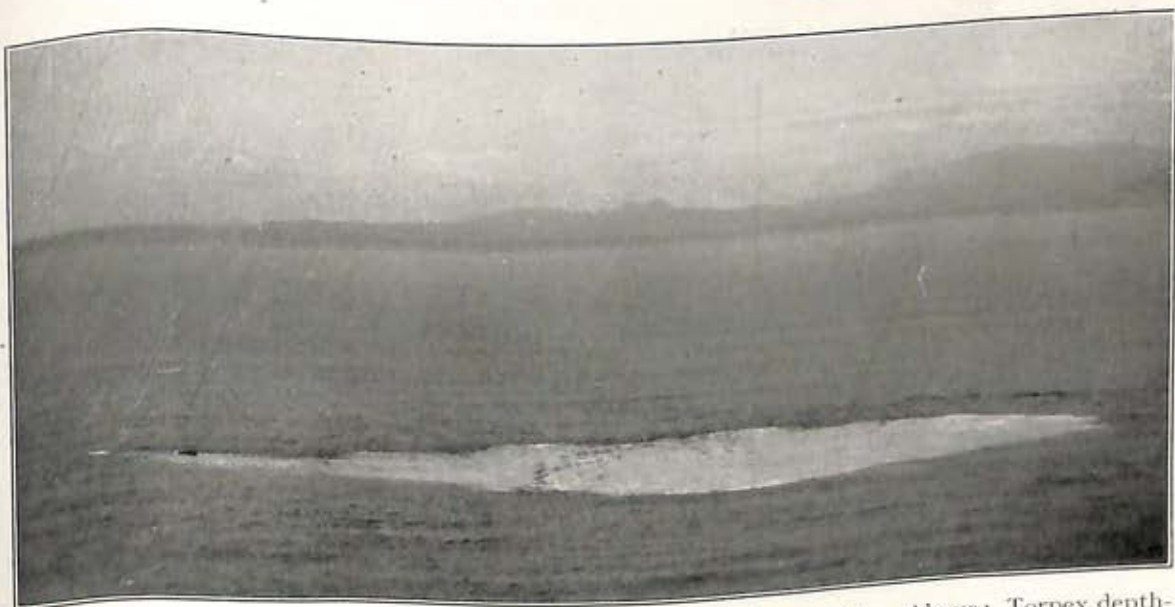


Plate 2. ATTACK ON A U-BOAT BY V/58. May 16th (see page 11). Above: Torpex depth-charge explosion, taken by mirror-camera from 100 ft. Below: The U-Boat re-surfacing two minutes after the attack.



Plate 3. ATTACK ON A U-BOAT BY V/58—*cont.* The U-Boat about to submerge again, nearly 2½ minutes after the attack.

At 0805 hours on the 8th, Sunderland *B/10*, flying at 1,500 ft., sighted an oil streak, at least 300 yards long, moving at 3 knots; it was 20 ft. wide, narrowing to 2 ft. at the head. Two attacks were made with depth-charges set to 25 ft., at an interval of 26 minutes, during which the streaks changed course. In the first case the bursts were observed 200 yards, and in the second 300 yards ahead, across the line of the streak. After each attack the oil bubbles increased greatly. After the second, the U-Boat reduced its speed from 3 knots to one. *B/10* shadowed its course until relieved by *A/10*, which arrived at 1305. Oil bubbles were then constantly coming to the surface at the end of the streak, and they appeared to move along, above the track, at 1 knot. Half an hour later, *A/10* attacked with four depth-charges set to detonate at 25 ft. Subsequently it went away for an hour. At 1517 a second group of bubbles was seen rising from the edge of the oil patch near the beginning of the streak. The speed of advance was now reduced to less than three-quarters of a knot (as was ascertained by dropping a smokefloat). Four Hampdens were attracted to the scene by a second smoke float, and one of them, *N/415*, attacked at 1650. Five minutes later the oil appeared to thicken and spread. *A/10* made a second attack at 1950 with its four remaining depth-charges, set for 150 ft. Half an hour later, shortage of petrol forced the aircraft to return to base. No further results had been observed. (The streak was followed from 48.10 N., 09.32 W. to 48.10 N., 09.19 W.)

* * * *

On 8th May, Sunderland *U/10*, at 1,300 ft., sighted a U-Boat 6 miles ahead, at 1350 hours. The aircraft immediately attacked in a shallow dive, the U-Boat crash-dived, and had submerged for 32 seconds when eight 250-lb. depth-charges (set to 25 ft. and spaced to 45 ft.) were released from 50 ft. The pilot estimated that the stick fell short, but that No. 8 depth-charge exploded directly on the line of advance, 150 yards ahead of the swirl. An oil streak was seen after the explosion in the disturbed patch of water. The stick was correct for distance ahead of the swirl but fell slightly short of the side, so that No. 8 and possibly No. 7 depth-charge exploded about 13 yards abaft the conning tower, but after 37 seconds the U-Boat was probably at 70 or 80 ft. depth, well below lethal range; still it probably got severely shaken. This is the first case in which the all-important interval between the disappearance of the U-Boat and the release of the depth-charges had been taken by a stop watch, also marked in yards. It seems to have helped because the pilot was correct in his estimation of how far ahead to drop the stick. (47.44 N., 10.47 W.)

A Probable Kill.

On 16th May, Whitley *V/58* was investigating a merchant vessel with Spanish markings at 1455 hours, when the pilot sighted a submarine 4 miles to the south-west, making 8 knots. The pilot altered course to starboard, ran up, and attacked at an angle of 40 degrees to the U-Boat's course from a height of 30 ft., with eight 250-lb. depth-charges, torpex-filled (set to 25 ft. depth, spaced at 30 ft.). The after part of the U-Boat was visible at the time of the attack, and the stern did not disappear until the last of the depth-charges exploded. They straddled the U-Boat, 40-50 ft. ahead of the stern, two to port and the remainder to starboard (Plate 2). The aircraft circled, and when the scene came into the pilot's vision again, he saw the stern begin to re-appear at a steep angle (Plate 2). Just as the aircraft flew over, the conning tower became visible, and the after half had come up by the time the rear gunner opened fire; 800 rounds were fired until the aircraft was out of range. The conning tower first, and then the stern, disappeared at an ever increasing angle, two and a half minutes after the attack (Plate 3). The Whitley circled and once more flew over the scene of the attack, where a rapidly increasing oil patch was observed; air bubbles of several feet in diameter were coming to the surface in the centre of the patch, which soon attained a diameter of 100-200 yards. As the pilot believed that the aircraft had already exceeded the prudent limit of endurance, he set course for base at 1504 hours.

The "close up" photograph of the conning tower after its reappearance (Plate 3), seems to show damage to the bridge casings, while the position of the U-Boat, still at the edge of the explosion mark, proves that it was not under way. The depth-charges therefore may have shattered the batteries or disabled the

Fight with a damaged Submarine

On 28th May at 1350 hours, Sunderland *R/10* from Gibraltar, flying at 1,000 ft., sighted an Italian submarine, 5 miles ahead, making 10 knots. The aircraft dived to attack but had to take avoiding action owing to heavy flak; the submarine carried one large and several smaller guns. A second dive resulted in an unsatisfactory run, in which, however, the submarine was raked with machine-gun fire. Another attack, made from 40 ft. amid heavy flak, was delivered from the port quarter while the submarine was turning to port; four torpex depth-charges were released but overshot. The aircraft's port bomb circuit being unserviceable, the remaining four depth-charges had to be manhandled to the starboard rack. These were dropped in, another attack made up the track from 30 ft., as the submarine turned to port (they were of 250-lb. torpex, set for 25 ft., spaced to 36 ft.). The stick straddled the submarine, one depth-charge exploding on the port side and the rest on the starboard at 30 degrees to the track. The submarine was completely hidden by spray. When this subsided, its speed had fallen to 3 or 4 knots, and the course became erratic. A large rent in the plates of the port bow threw a continual wave on the upper deck, and a large dent in the side plating near the water line, just forward of the conning tower. *R/10* stayed near the submarine till a Hudson arrived at 1830, though its machine-guns gave much trouble and it was repeatedly hit by flak; the starboard engine and float were damaged. On the Sunderland's return flight the oil streak from the submarine was seen to extend for 45 miles to the position where it received its injuries. (37.59 N., 02.08 E.)

The relief Hudson, *V/233* then attacked, returning the submarine's fire and dropping depth-charges from 125 ft., but the nearest (of 250 lbs.) exploded about 15 ft. off the tip of the stern, so that it could scarcely have inflicted damage. Four more attacks were made with the front and turret guns, pulling out of a dive at 200 ft.; on one occasion a man in a white tunic was seen to fall sideways in the bridge screen. But petrol shortage obliged the Hudson to leave 25 minutes after its arrival.

* * * *

At 1154 hours on 29th May, Hudson *D/53* was flying at cloud base at 2,000 ft., when a U-Boat was sighted $2\frac{1}{2}$ miles ahead, making 9 knots. Special Equipment was being used, but gave no contact. The aircraft lost height in an S-turn and attacked at 50 ft. from the starboard quarter at 60 degrees to the track, while the U-Boat was on the surface. Four 250-lb. depth-charges were released (T.N.T., 25 ft. setting, 60 ft. spacing; the speed was 180 knots). No. 1 depth-charge burst alongside the starboard quarter, abaft the conning tower, and the remainder on the port side. The aircraft made a tight turn to port and passed over the U-Boat 10 seconds after the attack, while it was submerging. Fifty rounds from the front gun and 60 from the rear were fired into the hull. A patch of brown scum 30 by 20 ft. was seen after its disappearance. No further sign of trouble was seen, except that the U-Boat had no forward way when disappearing—a fact which suggests damage to the main motors or the motor switchboard or the fuses. The aircraft had to leave five minutes after the attack because of excessive petrol consumption. (47.32 N., 09.50 W.)

* * * *

At 1414 hours on the 29th, Sunderland *Z/10*, which had been diverted to hunt the U-Boat, attacked by *D/53*, was flying in cloud at 5,000 ft., when a U-Boat was sighted 5 miles to the starboard beam, making 8 knots. The aircraft lost height in two turns and reduced the distance to a mile and a quarter before the U-Boat submerged. Fifty seconds later, an attack was made up the track from 140 ft. Seven depth-charges were dropped (250-lb. torpex, 25 ft. setting, 35 ft. spacing); No. 5 failed to release. The first depth-charge exploded 100 yards ahead of the swirl and the remainder 130–150 yards. The conning tower should by then have advanced 163 yards ahead of the swirl, so that the last three depth-charges were right for range, and probably for line, but they are likely to have been too shallow. The U-Boat must however have been very badly shaken up. (46.28 N., 09.57 W.)

P.B.Y. *A/73*, United States Navy, Iceland, sighted a U-Boat in the act of diving, 6 miles away, at 0540 hours on 30th May. Three anti-submarine bombs, set to 50-ft. depth, were dropped $2\frac{1}{2}$ minutes after its disappearance, and exploded at an estimated distance of 200 ft. ahead of the swirl. It is to be hoped that this was a considerable under-estimate, as is so often the case, for the U-Boat could easily have advanced 400 yards. It may have been at any depth to 150 ft., but a guess attack was justified by the fact that the aircraft had almost reached its limit of endurance. (62.53 N., 24.52 W.)

A Basking Shark?

At 0627 hours on 31st May, Wellington *R/304* found a wake moving at 2 knots, with a large swirl at the apex. Depth-charges were dropped in two sets of three, with their respective centres 30 yards ahead and 60 yards on the port bow. The wake ceased immediately after the attack. Then medium-sized air bubbles rose for 7 minutes, and oil bubbles for a quarter of an hour till they formed a cigar-shaped patch several hundred yards long. The position was 58.16 N., 13.05 W. and the target was probably a basking shark, as with *M/304* on 26th May. These fish (Plate 6) are plentiful between the coasts of Scotland and Ireland from June to September, and depth-charges would reduce them to oily scum.

A submerged U-Boat cannot form a wake with a swirl travelling at its apex. A periscope leaves a narrow V-shaped wake, while a stream of bubbles may travel along the surface behind a submerged U-Boat from which oil or air is leaking—the intervening distance depending of course upon the depth of the U-Boat as well as her speed under water. But a swirl cannot move, for it is only the relic of a foam patch made by the conning-tower in a crash dive, and as soon as the U-Boat has vanished below the surface this creamy bow-wave round the conning-tower ceases to move at the universal crash-dive speed of 8 knots and becomes stationary at the end of the wake. In a calm sea it may last as long as 5 minutes, and attacking it is of no use unless the time and direction of the dive have been observed. The conning-tower when submerged cannot produce a tell-tale ripple unless it is so close to the surface that the entire hull could be seen in outline from the air; and in actual fact, it would inevitably break surface if such a method of travel were attempted.

A depth-charge attack, that same day, upon another wake moving at 2 knots, by Wellington *A/304*, put an end to the phenomenon but resulted in no bubbles. Perhaps this too was a basking shark. (57.46 N., 14.12 W.)

* * * *

At 0717 hours on 1st June, Hudson *D/53*, in visibility 1-4 miles, had just emerged from a cloud bank at 1,500 ft., when it sighted a suspected U-Boat wake $2\frac{1}{2}$ miles away on the starboard bow. As the pilot approached he saw what appeared to be a periscope, leaving a V-shaped track, and about 20 yards ahead, a distinct swirl mark. The object disappeared, and 25 seconds later an attack was carried out from just abaft the starboard beam at an angle of 80 degrees to the track, and four 250-lb. depth-charges (set to 25 ft., actual spacing 60 ft.) were released from 50 ft. The rear gunner and the pilot saw one big explosion about 80 yards ahead of where the periscope had been, but though the aircraft circled for 38 minutes, no after effects were noticed. The attack was probably a miss astern. (48.49 N., 09.55 W.)

* * * *

At 0812 hours on 1st June, Hudson *O/53*, flying at 1,000 ft. in 3 miles visibility, sighted a U-Boat at a distance of 2-3 miles on the port bow making 6-8 knots. An attack was made from the U-Boat's port bow at an angle of 40 degrees to the track, releasing four 250-lb. depth-charges (set to 25 ft. and spaced to 60 ft.) from 50 ft., while the stern was still above water. After releasing the depth-charges the hull was visible through the water, but the stern had disappeared by the time of the explosions. No. 1 depth-charge was estimated to have exploded over the conning-tower, the remainder were to the starboard side. The aircraft immediately made a tight turn to port, and flew over the position of attack. Within a minute an eruption of air was seen inside the leading edge of the explosion mark, about 5 ft. in height and 10 to 20 ft. across. This was followed almost

immediately by a thick, brownish patch of oil, 50-100 yards across, in the same position. Then, as the aircraft had reached its prudent limit of endurance, it set course for base. The eruption of air is thought to have come from the blowing out of the rapid dive tank, and the large amount of oil, which was thicker and more oily than water in any ballast would have been, points to damage as well as a severe shake up. (46.28 N., 11.59 W.)

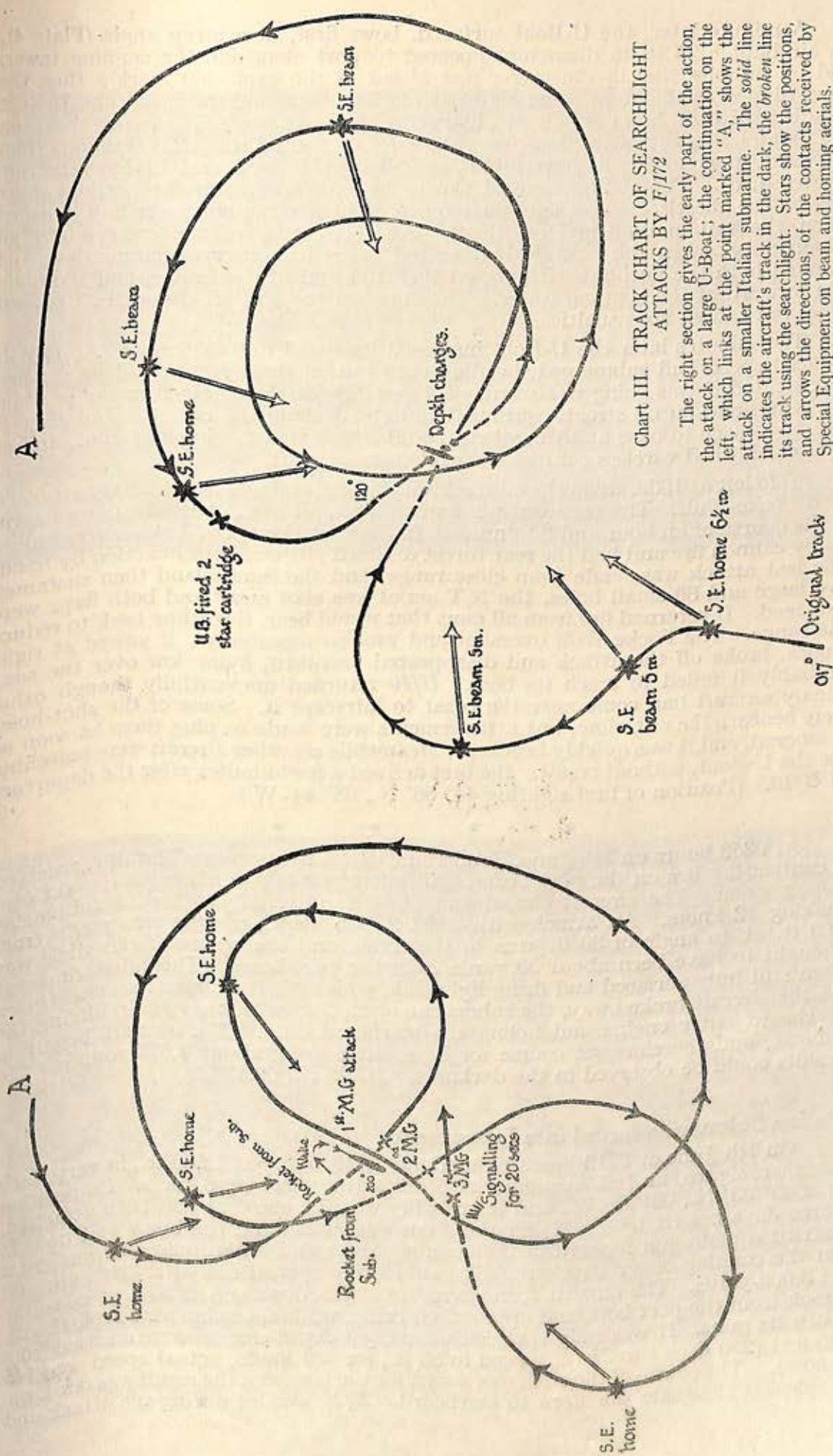
Searchlight Attack on U-Boat and Italian Submarine

The first attack by searchlight was made at 0144 hours on 4th June, by Wellington F/172 (Chart III). It was flying at 2,000 ft. in clear weather, before moonrise, when the homing aerial received a contact at $6\frac{1}{2}$ miles range on the starboard bow. The pilot waited till the crew had moved to action stations and then turned slowly to port, using the beam aeriels, which obtained a contact at 5 miles to starboard. This was kept till the aircraft regained its original track, whereupon a right-angled turn to starboard enabled the homing aerial to pick up the contact at 5 miles. The aircraft homed, losing height, and on reaching 1 mile on the scale, switched on the Leigh searchlight. At $\frac{3}{4}$ mile a U-Boat was seen ahead. The altimeter gave the height as 450 ft., but wrongly; the barometric pressure was not accurately known. The pilot, unable to get down to attacking height in such a short distance, dived steeply, with the result that the fuselage obscured the light, so that the U-Boat was lost to sight and he overshot. He then turned to port, switching over to the beam aeriels, which picked up the U-Boat at $3\frac{1}{2}$ miles. A further turn to port brought a contact on the homing aerial. At that moment the U-Boat fired a red star cartridge. As the aircraft homed to 1 mile, the Leigh searchlight was switched on and the U-Boat was seen 3 miles ahead. An attack was made from 50 ft., at 150 knots, from 20 degrees abaft the starboard beam. While the U-Boat was fully surfaced, four torpex depth-charges were released (250 lbs., set to 25 ft. depth, spaced to 35 ft.). Three depth-charges were seen to explode; No. 1 at 5 yards from the starboard side abaft the conning-tower, No. 2 7 yards to port, abreast the conning-tower, and another close to No. 2.

Later, the aircraft made a number of turns, using both beam and homing aeriels, and eventually picked up a contact at $3\frac{1}{2}$ miles, on the homing. When the range had been reduced to 1 mile, the searchlight was switched on again and revealed a smaller submarine with a semi-circular wake behind it. It had in fact just turned 180 degrees to starboard from its inward course, presumably to investigate the attack on the large U-Boat which was outward bound. As the searchlight was switched on, the small submarine fired a rocket which burst into white stars. At the same moment, a yellow light began signalling from a position about 2 miles ahead. The aircraft passed the submarine at 150 ft. from starboard to port, traversing the Leigh light to extreme deflection, so that the rear gunner was able to fire 100 rounds at her. The aircraft now turned to port to investigate the signalling, which had ceased 2 or 3 minutes before, but nothing was sighted or contacted. After another circuit, the aircraft homed on the small submarine, which was firing another rocket and was not moving. After switching on the searchlight, another 500 or 600 rounds were fired into her, and numerous hits and ricochets could be seen on the casing, saddle tanks, and bridge structure. Another attack with machine guns was made on the down track. At 0225 the aircraft had to leave for base, because fuel was running short and the wireless had broken down so that no relief could be sent out until its return. (48.08 N., 06.15 W.)

Fights with a Seriously Injured U-Boat and a Focke-Wulf

At 1547 hours on 5th June, Sunderland U/10 was flying at 5,000 ft. over the Bay of Biscay, when the Special Equipment received a contact at 8 miles range; visibility at the time was 12 miles, and there was no cloud. A wake was then seen through binoculars; the aircraft dived towards it and found a U-Boat, making 10 knots. An attack was made from 50 ft. at a speed of 205 knots, 25 seconds by stop-watch after the U-Boat had disappeared. Eight torpex depth-charges were released from its starboard quarter (250 lb., set to 25 ft. depth, spaced to 35 ft.). The centre of the stick was *aimed* to explode at the presumed position of the conning tower, 130 yards ahead of the swirl, and is believed to have in fact *exploded there*; the depth-charges straddled the line of advance.



A minute later, the U-Boat surfaced, bows first, at a steep angle (Plate 4), an air bubble 25 ft. in diameter appeared to port alongside the conning tower, and oil bubbles rose in the wake, just ahead of the explosion mark; then the bows dipped as the stern came high out of the water, and gradually the U-Boat steadied, with its bows awash and listing to port. It was still moving ahead on the motors. In the next 10 minutes the aircraft poured some 2,000 rounds from the nose, port and tail guns into the hull, upper deck and bridge structure (Plates 4, 5). The U-Boat moved slowly in figures of 8, finally getting under way on the Diesels. A couple of men appeared in the conning tower but vanished when the tail gun opened on them. At 1635 some of the crew seized an opportunity, when the aircraft had ceased firing to conserve ammunition, and manned both the anti-aircraft gun, on the after end of the bridge, and the main gun forward of the conning tower. They opened fire and hit the aircraft several times but caused no casualties.

Ten minutes later the U-Boat increased its speed to 8-10 knots. At 1731 it reduced speed and submerged, heading east as though to return to base; when first sighted it was going westward. A large oily patch remained in the position of diving, and an oil streak continued to extend along the course. The aircraft sent a message to base at 1819, when the oil streak was moving at 1 knot, and at 1924 established wireless contact with relieving aircraft.

U/10 left at 1939, when the oil track was fading, and was immediately attacked by a Focke-Wulf. The enemy made four attacks, all from abaft, beam or astern, in the course of an hour and 5 minutes. In the first three, *U/10* was several times hit by cannon fire and had the rear turret disabled; it was kept in action by hand. The last attack was made from close range, and the Sunderland then sustained five large and 80 small holes, the R/T aerial was shot away and both flaps were damaged. It returned fire from all guns that would bear, throttling back to reduce the range. The Focke-Wulf overshot and was hit repeatedly; it yawed at right angles, broke off the attack and disappeared eastward, flying low over the sea; probably it failed to reach its base. *U/10* returned uneventfully though other enemy aircraft had come near the coast to intercept it. Some of the shot-holes were beneath the waterline, but arrangements were made to plug them as soon as it moored, and it was quickly beached. Meanwhile six other aircraft were searching for the U-Boat, without result; the first arrived a few minutes after the departure of *U/10*. (Position of first sighting 44° 56' N., 03° 44' W.)

* * * *

At 0358 hours on 7th June, Sunderland *R/10*, flying from Gibraltar, received a contact 3 miles on the port beam. Visibility was 500 yards, with the aid of a young moon. The aircraft circled and homed, and finally sighted a submarine making 12 knots. An attack with eight 250-lb. depth-charges was made from 100 ft. at an angle of 30 degrees to the track, and the centre of the stick was thought to have been about 30 yards from the port beam. The submarine was then still fully surfaced and firing light flak, which hit the aircraft several times. As the aircraft broke away, the submarine opened up with heavy flak, hitting the starboard outer engine and holing the starboard float. The aircraft began to vibrate, and therefore set course for base, after firing about 1,075 rounds. No results could be observed in the darkness. (37.25 N., 02.57 E.)

Italian Submarine forced into Internment

On 7th June at 0712 hours Sunderland *X/10*, flying at 1,500 ft., in very hazy weather, sighted an Italian submarine 5 miles away, making 6 knots. Its position was 43° 35' N., 03° 45' W., and it probably was the one that had been attacked, three days before, by *F/172*, for the stern was awash and the bows well up. It carried a main gun forward of the conning tower and an anti-aircraft gun abaft on the conning tower structure. The submarine opened fire with the main gun at 3,000 yards. The aircraft manoeuvred to attack down sun at 30 degrees to the track from the port bow, and approached firing, while the submarine replied with both its guns. It was fully surfaced when eight depth-charges were released from 30 feet (250 lb. set to 25 ft., spaced to 35 ft., for 130 knots, actual speed was 145 knots). The centre of the stick was aimed for the bow, and the result was one large explosion alongside the stern to starboard. *X/10* was hit during the attack and

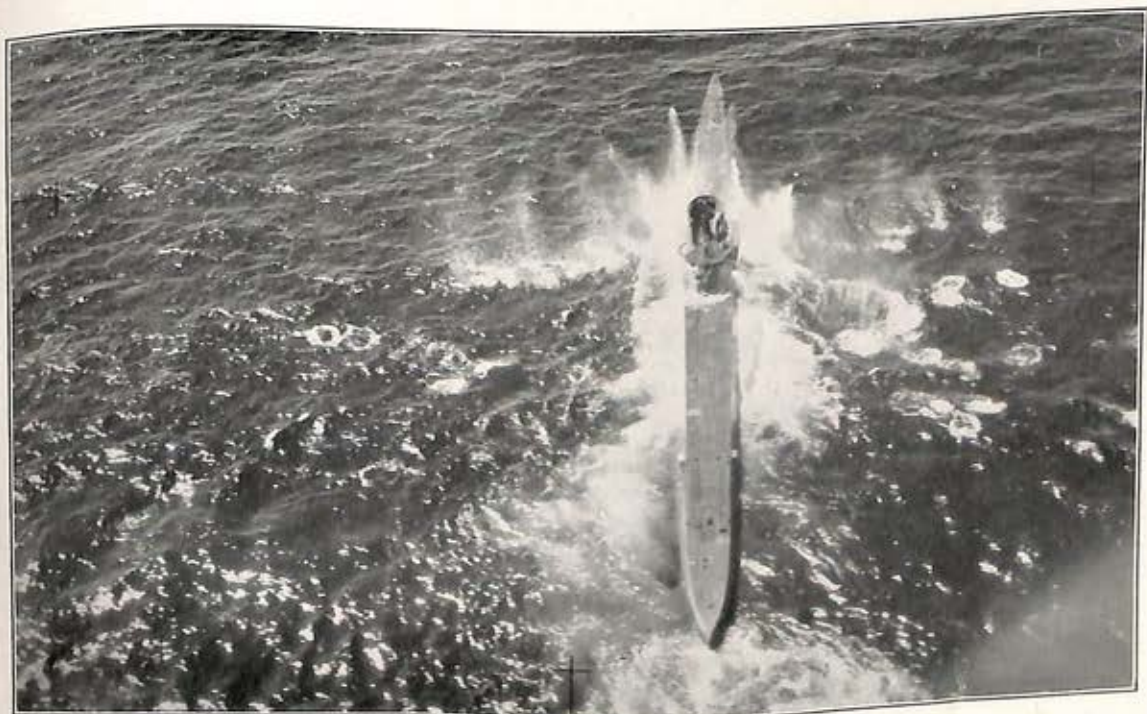
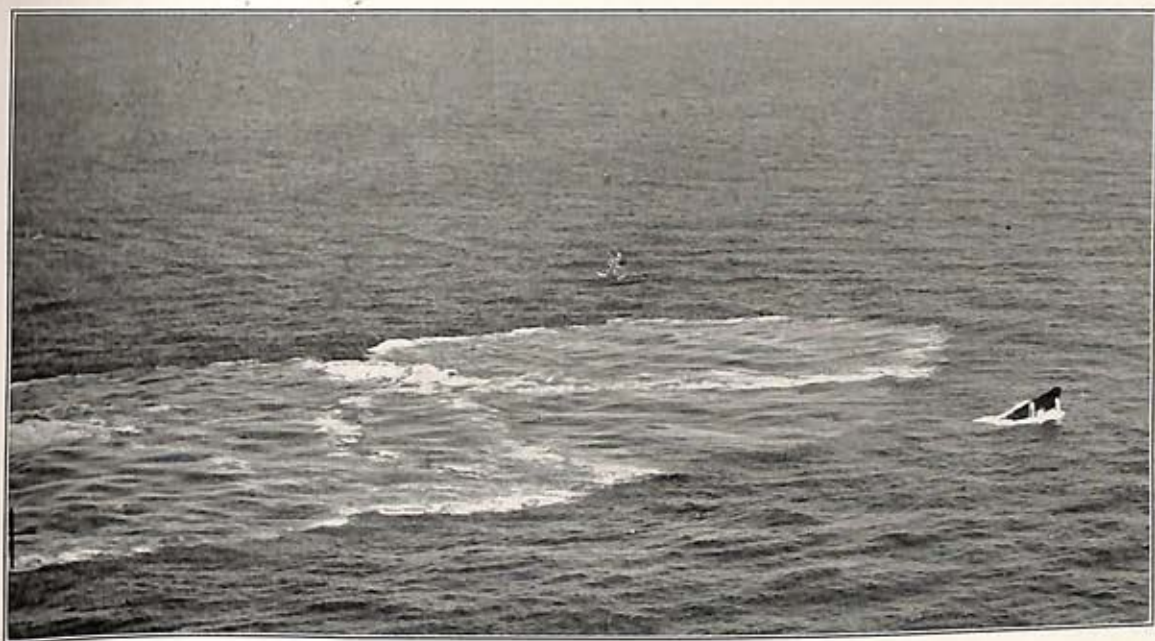


Plate 4. ATTACK ON A U-BOAT BY *U/10*. June 5th (see page 18). Above: The bows re-surfacing a minute after the depth-charge explosions. Below: The damaged U-Boat amid bullet splashes.



Plate 5. ATTACK ON U-BOAT BY U/10—*cont.* The damaged U-Boat amid bullet splashes.

two of the crew were wounded by shrapnel. The rear gunner began to fire as soon as his gun would bear, and raked the submarine with 500 rounds. It then commenced zigzagging at reduced speed, shadowed by *X/10* at $1\frac{1}{2}$ miles distance.

At 0743 hours, *Sunderland A/10* arrived and circled the submarine, which fired some light flak and scored hits on the tail. The flak ceased as the aircraft ran up the track, possibly as the result of the return fire, but the submarine then scored one hit from the main gun causing a large hole in the hull and wounded one of the crew. *A/10* attacked from the starboard beam from 80 ft. with eight torpex depth-charges (250 lb. set to 25 ft., spaced at 35 ft.). The centre of the stick fell about 30 yards on the starboard beam and the last two depth-charges exploded under the submarine, amidships. No. 1 depth-charge hung up. After the attack the submarine turned to port and seemed to eject a torpedo from the stern. *X/10* observed that the submarine was stationary, and it remained so until this aircraft left the scene at 0754.

A/10 had already left owing to lack of fuel; it was immediately attacked by an *Arado 196*, which made two attacks, during which the midship gun of *A/10* got in 50 rounds and the tail gun 800, then it disappeared.

This submarine crawled back to Santander, where the crew abandoned her after landing the wounded, and was interned. She was beached with a heavy list to port, and a large hole showing amidships on the starboard side.

* * * *

At 1144 hours on 7th June, *Sunderland M/202*, from Gibraltar, was flying in cloud at 4,000 ft., and sighted an Italian submarine 16 miles away, making 14 knots. The aircraft lost height as it approached, keeping the bomb racks in to avoid breaking effect till about 25 seconds before reaching the submarine, when they were ordered out, too late for an attack. The aircraft passed over the submarine, turned, raking the hull with machine-gun fire, and released four 250-lb. depth-charges set to 25 ft.—the other four hung up—while the submarine was still on the surface. It was straddled by the explosions, and again raked with machine-gun fire, to which it replied with light flak. It then turned 180 degrees and submerged. Thirteen seconds later, the rest of the depth-charges were released. They exploded in salvo, 50–60 yards ahead of the swirl and a few yards to port—presumably under the stern. Damage must have been caused, because an oil patch appeared and grew to about 300 by 150 yards, and 40 minutes after that began, some foam and bubbles rose 200 yards from the swirl. The bubbles ceased after 2 minutes. The aircraft then left, but returned at 1410, to find a considerable patch of oil and one separate oil streak, and stayed for half an hour. (37.52 N., 04.05 E.)

Unquestionably a Kill

At 1129 hours on 9th June, *Catalina J/240* from Gibraltar, flying at 2,000 ft., sighted an Italian submarine 10 miles away, making 6 knots. The aircraft dived to attack up the track as the submarine slowly turned to port, but when the distance had been reduced to 1,000 yards and the height to 200 ft., the submarine opened fire, and the aircraft therefore turned to starboard and attacked across the stern. Four 450-lb. depth-charges were released (set to 25 ft.), while the submarine stayed on the surface, and they exploded to either side of the stern, the nearest 5 yards from it. The aircraft circled the submarine three times and fired 1,000 rounds, while its foremost gun replied. Twenty minutes after the explosions, the submarine dived, leaving much oil on the surface, but 5 minutes later it came up again, in approximately the same position, and remained stationary. It began to settle by the stern, and 35 men came on deck. Six of them dived overboard, and when the aircraft opened fire again, five or six more fell into the sea while some others waved white flags and dived in. Then the submarine sank by the stern. The aircraft's captain tried to land on the water, so as to take prisoners on board and leave some life-saving apparatus, but a heavy swell prevented him; his hull was damaged in the attempt. When he left, at 1315, several of the men in the water seemed to be dead. (38.21 N., 03.21 E.)

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At 1229 hours on 9th June, Catalina *D/240* from Gibraltar, flying at 400 ft., sighted a submarine 2 miles away, making 10 knots. It crash-dived immediately, but an attack was made with eight depth-charges. They exploded 150 yards ahead of the swirl, well astern of the actual position of the submarine, which would in any case have gone too deep for damage. Baiting tactics offer the only real hope in such cases. (38.18 N., 01.56 E.)

At 1940 hours on 9th June, Wellington *A/304* attacked what was believed to be a wake travelling at 4 knots and zigzagging over a course of 3-4 miles. It continued zigzagging away in spite of depth-charges, which exploded 30 yards ahead and onwards to port. Probably it was either a surface oil streak or the leak from a wreck. (55.24 N., 09.26 W.)

At 1423 hours on 10th June, Hudson *L/608* was flying at cloud-base (1,500 ft.) and saw a U-Boat 5 miles away, making 8-10 knots; the Special Equipment was in use but gave no contact at any time, even when passing over it. The pilot fired the front gun on his approach run and from 150 ft. pressed the release for three depth-charges. The U-Boat began to submerge as the aircraft went over, but two figures in black oilskins were noticed remaining motionless on the bridge. On looking back, the depth-charges were seen to have exploded a hundred yards short, so that the pilot must have pressed the bomb-release as well as the gun-firing button. Beaufighter *J/248*, which was acting as anti-aircraft escort to *L/608*, also made two attacks with cannon and machine-gun fire. The aircraft carried out baiting tactics, and on returning for the second time at 1653 hours *L/608* saw the U-Boat surfacing half a mile ahead and got in several bursts of machine-gun fire before it submerged again. (61.08 N., 03.00 E., and 61.10 N., 02.43 E.)

At 0708 hours on 11th June, Whitley *G/77* signalled that a U-Boat had been sighted and then "attacked with depth-charges; no hits". The aircraft did not return. (46.08 N., 07.40 W.)

A U-Boat Damaged

At 0934 on the 11th, Sunderland *W/10*, flying at 2,000 ft. in clouds and rain (using the beam aeriels), saw a U-Boat 5 miles ahead, in a patch of better visibility; it was making 8 knots. It was still on the surface when six depth-charges were dropped up the track from 30-50 ft. (250-lb. torpex, set to 25 ft., actual spacing 40 ft.). They exploded all round it, and on their subsidence it was seen to be lying almost stationary in the centre of the disturbed area, with a list to starboard. It porpoised slowly (first bows up, then stern up), turned sluggishly to port and very gradually submerged, three or four minutes after the attack. A minute later it reappeared and opened fire with cannon.

The Sunderland, returning fire, immediately attacked up the track from 600 ft., dropping an anti-submarine bomb, but it fell short. Another was then released, and this exploded alongside. A great deal of oil then appeared; in spite of a rough sea which rapidly broke up the patch, it maintained a width of at least 50 yards. *W/10* stayed 3½ hours, keeping contact by Special Equipment in bad visibility, while the U-Boat remained on the surface, moving slowly; its speed now varied between 2 and 4 knots, and occasionally it stopped, while its course was erratic, with a variation of 20 degrees. In all, 700 rounds were fired from the aircraft, which was itself hit in the port wing. (43.20 N., 12.33 W.)

At 0832 hours on 13th June, Sunderland *O/202*, from Gibraltar, flying at 4,000 ft., sighted a submarine 9 miles ahead, making 12 knots. The aircraft dived and attacked on the beam, releasing seven depth-charges, set to 25 ft.; one hung up. They straddled the submarine forward, and the explosions obscured it completely. When seen again, it appeared to be listing heavily to starboard and slightly up by the stern, but righted itself immediately. A thick stream of brown smoke poured out behind the conning tower for the next half hour. As the aircraft circled, the submarine kept its bows always towards it and fired the forward gun. At 0950 the remaining depth-charge had been changed to the serviceable rack and the aircraft was turning to make another attack when the submarine was suddenly lost to sight. (39.17 N., 06.02 E.)

At 1831 hours on 13th June, Hudson W/48, at 2,000 ft., saw a wake 20 miles away. On approaching, seagulls were found to be circling round it. Eventually a periscope was seen at its head, very high out of the water, moving at 10 knots; the navigator had the impression he also saw part of the conning tower. The U-Boat must have been trimmed down. On the crew's estimate, three torpex depth-charges fell short while one of 250 lbs. T.N.T. dropped 15 yards astern of the point of the wake and produced a much larger explosion. A large area of sea took on a brownish colour, an oil patch persisted for 10 minutes, and large air bubbles rose for 20 minutes. The depth-charges must have exploded fairly near, perhaps close enough to inflict real damage. (62.42 N., 00.25 E.)

* * * *

At 1840 on the 13th, Hudson K/48, at 2,000 ft., saw a commotion in the water a mile distant, and on approaching to 100 yards the pilot caught a glimpse of a dark mass momentarily breaking surface at 2 or 3 knots; a couple of very large bubbles rose astern of it. A stick of depth-charges exploded 50 yards ahead of the swirl mark left by the object a minute after it disappeared. As a result one very large and many small bubbles were seen, and something rather pointed came out of the water for 15 or 20 ft.; the navigator described it as slate grey, the rear gunner (who saw it against the light) as dark green. Perhaps it was really a whale or a basking shark. (62.40 N., 00.55 W.)

* * * *

At 0131 hours on 14th June, Hudson V/608 was flying in patches of cloud at 2,000 ft. and through a gap saw a U-Boat 2 miles away, making 8 knots. The aircraft dived, and attacked down the track from 30-50 ft. while the conning tower was still awash, using three torpex and one T.N.T. depth-charges (set to 25 ft., spaced to 40 ft.). The stick fell along the U-Boat's course, with its centre 40 ft. ahead of the swirl, so that all but the first were right for range. Damage must have been inflicted, because a large quantity of oil appeared; it spread into a streak 300 yards across and 1,500 yards long. But the U-Boat cannot have been incapacitated, otherwise she would have surfaced. (62.48 N., 00.35 W.)

A Probable Kill.

At 0219 hours on 14th June, when cloud base was at 2,500 ft. and extremely good visibility prevailed below, Hudson H/608, flying at 2,700 ft. in 10/10 cloud, noticed an oil patch which was 60 yards wide and tapered westwards for 1,000 yards. The pilot thought too that he saw some indefinite object, when he was still 15 miles away, and concluded that the mark might have been left by a U-Boat which had dived on a westerly course. He resumed his anti-submarine patrol, returned again at 0353 and flew westward at 2,700 ft. Looking through binoculars, he saw a wake some 18 miles ahead; only the conning tower of the U-Boat showed above water. The aircraft approached under cloud cover, broke cloud and found the U-Boat 4 miles distant, again entered cloud and reduced the range to 2 miles before the U-Boat started to submerge. Then the aircraft dived and approached up the track, to attack from the starboard quarter at 60 ft. Fifteen seconds by watch after the U-Boat disappeared, four 250-lb. torpex depth-charges were released, set to 25 ft., spaced to 40 ft. The crew judged that the centre of the stick came about 60-80 yards ahead of the swirl and therefore a few yards abaft the actual position of the conning tower. The periscope standards and conning tower made a momentary appearance in the explosion mark. Then a large amount of air boiled to the surface, followed by oil which was thick and very black at first but became iridescent in early light. It spread in an elliptical patch till it covered an area about 1,000 yards long by 400 wide; unidentifiable pieces of small debris showed within it. While torpex does, in fact, leave a very thick, black, oily residue, the amount of oil seen is impressive evidence of most serious damage, if not of a kill. (62.34 N., 00.59 W.)

Attacks on a Wolf Pack.

The first attack by a Lancaster was made on 15th June. W/44 flew below the clouds at 1,500 ft., looking for a convoy, till 1241 when it saw a U-Boat 3 miles ahead, making 10 knots. The Lancaster dived and attacked at 70 degrees to the track from the port quarter within 5 seconds of the U-Boat's submergence; it still showed through the water when the aircraft passed over. Six 250-lb. depth-charges were released (set to 25 ft., spaced at 35 ft.) and they exploded 20-30 yards

ahead of the swirl, obliterating all signs of it. They should have been just abaft the conning-tower. Immediately afterwards there arose a patch of oil, 40 yards in diameter, and a steady stream of air bubbles came through it. Ten minutes later, a second oil patch appeared and lengthened into a streak, 300 yards long and 40 wide, and a third and slightly longer streak began 400 yards onwards in the same direction; the oil was thinner than in the first patch. At 1314 a column of water shot up to a height of 30-50 ft., three-quarters of a mile beyond and slightly to port, and upon its subsidence the conning tower and periscope came into view for several seconds. They disappeared with little, if any, forward movement. The Lancaster dropped a 250-lb. anti-submarine bomb which exploded some 20 seconds later, and perhaps 20 yards short of the swirl. The aircraft remained in the area fifty minutes more, without result. Clearly the U-Boat had suffered damage, though not necessarily mortal. (44.39 N., 16.49 W.)

On the same day (15th) another Lancaster, X/44, escorted the same convoy at 1,000 ft., well below the clouds, and at 1821 sighted a U-Boat 5 miles away, moving at 10 knots parallel to the convoy and 5 miles on the port bow from its centre. The aircraft circled, losing height, and attacked at 100 ft. at right angles to the track, releasing six depth-charges. The U-Boat had disappeared 15-20 seconds earlier, and as the two explosions observed were estimated to have occurred not more than 30 yards ahead of the swirl they should have missed astern by 40 yards. However, the U-Boat must have felt disinclined to persist in its intention to attack the convoy. (45.05 N., 17.10 W.)

At 1925 on the 15th, Liberator T/120, also escorting that convoy, saw a swirl around the dark grey line of a diving U-Boat. This was 6 miles distant, and the spot was reached too late for attack. At 2107 another swirl was seen, apparently about 3 minutes after the dive. Half an hour later the convoy signalled that a U-Boat had been reported, giving its bearing, but T/120 could not find it. At 2318, however, when at 1,800 ft., the Liberator saw a U-Boat trimmed down but making 12-15 knots; it was 2 miles away, and 30 miles from the convoy. Six 250-lb. depth-charges, released from 35 ft., 10-15 seconds after its disappearance, exploded 50 yards ahead of the swirl across the track, with No. 2 right on it; they were set to 25 and 50 ft. alternatively. The after part of the U-Boat should have been in that position, but no results were observed, and it can therefore be assessed only as badly shaken. It must have suffered sufficiently to force it to abandon its designs upon the convoy, which passed an undisturbed night. (45.03 N., 17.39 W.)

* * * *

Wellington C/172 received a series of contacts on the Special Equipment after 0312 on 16th June. Eventually it homed on one from $3\frac{1}{2}$ miles, switching on its Leigh searchlight when it approached within 1 mile. At 0340 a U-Boat was seen, making 15 knots. As the aircraft rolled out of a dive at 100 ft., four 250-lb. torpex depth-charges were released, and it was thought that one exploded close to port and another a few yards off the starboard side. The other two were not observed, but there can be no doubt the U-Boat was very badly shaken, if not forced to abandon its course. After the attack, the aircraft climbed to 500 ft. and turned, making contact $3\frac{1}{2}$ miles to starboard, in preparation for a second run. The Leigh light was again switched on at three-quarters of a mile, but the U-Boat opened fire and a cannon shell passed the aircraft's side. Switching off the light, a turn was made to starboard, so that the U-Boat came into view on the port quarter; the rear gunner opened fire at 300 yards and got off 150 rounds. The U-Boat then ceased fire. The aircraft again climbed to 500 ft. and circled, holding it on the beam airdials at a range of $3\frac{1}{2}$ - $4\frac{1}{2}$ miles, till all contact was lost, 10 minutes later. (45.30 N., 06.25 W.)

* * * *

At 0147 hours on 20th June, Wellington D/172 received a contact on the Special Equipment $3\frac{1}{2}$ miles ahead, when flying at 1,500 ft. The aircraft turned on reciprocals, losing height, and obtained a second contact at 3 miles, two points to the starboard quarter. Upon reaching three-quarters of a mile, the searchlight was switched on, when flying at 400 ft., and an Italian submarine was seen, making 10 knots. From a height of about 100 ft., four 250-lb. torpex depth-charges were dropped, with a 35 ft. setting and 26 ft. spacing. The submarine was still fully

surfaced. Spray obscured it as the aircraft passed over, but when that subsided the rear gunner fired 70 rounds from each of his guns. No further contact was obtained, nor was the submarine seen again, in spite of 6 miles visibility. Even if the attack did not cause damage, the crew must have been considerably shaken. (45.12 N., 08.32 W.)

At 0150 hours on 20th June, Wellington *B/172* received a contact by Special Equipment at $7\frac{1}{2}$ miles range, and homed. At 1 mile a wake was seen, from 3,000 ft. The pilot circled, losing height, and homed at 500 ft. At $\frac{3}{4}$ -mile the searchlight was switched on, and revealed a U-Boat, making 10 knots, which opened up with cannon fire. The aircraft got too far to port to release its depth-charges, flying on a parallel course at 200 ft., but the rear gunner fired a burst as he went past and another as the aircraft banked to starboard, 100 yards ahead. The U-Boat is believed to have dived immediately after. (45.32 N., 04.35 W.)

A Remarkable Approach.

At 1445 hours on 23rd June, Whitley *B/77* sighted a U-Boat at a distance of 20-25 miles. It was making about 12 knots. The aircraft continued at cloud base, 3,000 ft., and in order to attack down sun, flew on a course of 056 degrees which kept the U-Boat one point on the port bow, till the range had been reduced to 10 miles, when a turn to port was made, and the pilot then straightened up to attack on a course of 350 degrees. The U-Boat began to submerge at $1\frac{1}{2}$ -2 miles distance, when the aircraft had reached 1,000 ft. The attack was made from 40 ft., 30 seconds after disappearance, with five 250-lb. depth-charges (set for 35 ft., spaced at 36 ft.); No. 5 failed to release. The centre of the stick fell 150-160 yards dead ahead of the swirl, and the explosions should therefore have taken place about 20 ft. abaft the conning-tower, but the U-Boat may have been too deep to suffer injury; no results were observed. But with 50 miles visibility an aircraft could scarcely have succeeded in approaching more closely unobserved. It has been suggested that the U-Boat may have surfaced to shoot the mid-day sun, in view of its position. (46.59 N., 14.01 W.)

Fight with a Damaged U-Boat.

At 1610 hours on 23rd June, Whitley *C/58*, flying at 2,500 ft., sighted a U-Boat through a gap in the clouds. It was 5 miles away to port and making 10 knots. The aircraft turned, losing height, and broke cloud at 800 ft., when the U-Boat was again sighted half a mile to starboard. An attack was made from 50 ft. with three torpex and three amatol 250-lb. depth-charges (set for 25 ft., spaced at 32 ft.). At least four explosions were seen straddling the U-Boat. When the aircraft had completed a tight turn, a large column of water, 30 ft. high, occupied the U-Boat's position, and this subsided into a patch of oil and foam which spread to 100 yards in diameter. Some 5 minutes after the attack, 15 ft. of the bows rose exceedingly steeply and so remained for a couple of minutes, while the rear gunner fired about 200 rounds, scoring hits upon it as the tracer showed. Then the U-Boat righted and disappeared without forward movement. The aircraft flew away for 8 minutes and returned to see it surface again. A gun crew of five men emerged, and they fired a few rounds, hitting the aircraft, but scattered when its machine gun opened upon them. Passing over at 100 ft., the rear gunner obtained hits on the conning tower, from the vicinity of which broke puffs of white smoke. Next a dive attack was made, passing over at 30 ft., when two of the gun crew collapsed under the front gunner's fire and the rest under the rear gunner's, one of them falling overboard; but shells passed through the aircraft from the bomb compartments to the top of the fuselage. The aircraft passed over the submarine three more times, raking it with the machine-guns, until at 1650 it disappeared, very gradually and with no forward movement; the conning tower remained visible 2 minutes longer than the rest. Some more oil was left on the surface, but no air bubbles. Fuel shortage obliged *C/58* to return 10 minutes later, but there can be no question that its attack had damaged the U-Boat very seriously. It was not found again, in spite of long search, which encourages a hope that it had foundered. (45.25 N., 07.05 W.)

* * * *

At 1427 hours on 27th June, Whitley *O/51*, flying at 2,500 ft. in visibility 2-3 miles, sighted a U-Boat making 8 knots, half a mile distant; it had been concealed by haze. The aircraft reduced height as rapidly as possible, making a right

hand turn, while the rear gunner fired a 30-seconds burst; hits were seen just below the conning tower. The aircraft continued its circuit and made the final run from astern. The U-Boat disappeared when the aircraft got within about 500 yards. Six 250-lb. depth-charges (set to 35 ft., and spaced at 36 ft.) were released from 50 ft., presumably some 5 seconds after the disappearance of the U-Boat, though the crew estimated the interval at 20 seconds. The attack was made from the port quarter at an angle of 30 degrees to the U-Boat's track. The centre of the stick exploded 100 ft. from the head of the swirl; the crew judged this distance correctly, as the photographs proved. The conning tower should by that time have advanced 130 ft. from the swirl. The photographs show that No. 5 depth-charge exploded nearest to the U-Boat, only 10 ft. in plan from the pressure hull, but if the U-Boat had submerged not much longer than 5 seconds, the tail part was probably only a few feet under water, so the depth-charge would have exploded at least 20 ft. under it. But after the spray from the depth-charges had subsided, there appeared a patch of oil some 150-200 ft. in diameter. Air bubbles continued to rise in the centre of it until the aircraft left, after 17 minutes. Twenty-four minutes later, the aircraft returned to its marker. Though the oil patch still remained, there were now no air bubbles, and no sign of the U-Boat. Obviously the depth-charges, though out of lethal range, had fallen close enough to force out oil and even to damage the U-Boat, while the crew must have had a severe shaking. And considering the close range at which the U-Boat was sighted, the aircraft did extremely well to attack so promptly. (45.52 N., 11.29 W.)



Plate 6. BASKING SHARKS. These fish, which grow to 40 or 50 ft. long, are sometimes attacked in the belief that they are submarines (*see* page 15). Often they remain motionless on the surface for long periods, down by the stern, with nose awash and the long dorsal fin projecting above the surface ; at a distance it can easily be mistaken for a periscope. This shark generally feeds on plankton, and it does not travel more than a few fathoms deep. Frequently it moves slowly forward, just below the surface, so that the fin creates a wake.

Basking sharks are to be found in all temperate seas, particularly the North Atlantic ; they appear off the coasts of Ireland and the west of Scotland in the spring, and move off towards Norway at the approach of autumn. Except during the breeding season, when as many as 50 may congregate, they are generally to be seen in pairs, or else singly.



Plate 7. ENEMY SHIPPING. Above: *R/10* on a flight to Gibraltar, attacking a ship, north-west of Spain, with torpex depth-charges, May 15th (see page 29). Below: A convoy, with a trawler escort vessel astern and one on each wing, off the Hague, May 17th (see page 25).

PART 2

ANTI-SHIPPING ACTIVITIES, MAY AND JUNE

(i) Review of Operations against Merchant Shipping

Coastal Command's anti-shipping operations take place in three main areas—Norway, southern North Sea, and Bay of Biscay—each of which has characteristics, operational as well as geographical, which distinguish it from the other two. In this article separate sections are devoted to the three areas, in order of the magnitude of Coastal Command effort.

The operations against merchant shipping involved the following amount of flying :—

	Jan. and Feb.	March and April.	May and June.
Anti-shipping reconnaissance	1,100 hours	2,100 hours	1,900 hours
Anti-shipping strikes	300	600	800

The distribution of this effort, together with the number of sightings and attacks, is summarised in Chart IV.

It is unfortunately only possible to give considered results of those attacks which took place in May. The amount of damage done during a shipping attack is often not observed at the time, and it may be days or weeks before each attack can be assessed. The May results, however, are very good ; they include several successful strikes. Eight ships were sunk (16,000 tons total), 11 seriously damaged (31,000 tons), and 31 others damaged (115,000 tons).

FROM DENMARK TO THE CHANNEL ISLES

The Enemy

The most important traffic in this region is that which runs between the Elbe and Rotterdam, the cargoes of which were described in the last issue of this *Review*. The traffic increased considerably during May, when some 220 ships were seen, and the rise continued during June, when some 250 ships were seen. There was, however, a certain falling-off towards the end of that month, when the tonnage in Rotterdam shrank considerably.

It appears that attacks on these ships—Coastal Command made four strikes involving more than five aircraft each—is causing them to alter their sailing times. For at the beginning of May, most of the northbound convoys left the Hook a little before midday, giving our reconnaissance patrols an opportunity to locate them off the Den Helder region in the afternoon, so that our striking forces could attack them off the western Frisians after dark. But towards the end of May and during June, convoys left the Hook about midnight, so that we must now either locate them and strike before daybreak, or wait till the next night when the convoy is in the Heligoland area, a long way from our bases.

No average time for the arrival of southbound convoys at the Hook can be given, though more arrived between noon and last light than in the morning.

The formation of the merchant ships and escorts which compose these convoys is fairly stereotyped. Thus, a convoy of six ships or less is usually in single line astern, with the escorts ahead, astern, and flanking it. A convoy of over six ships (see Plate 7) is usually in two lines astern, with escorts forming a diamond round it : It has frequently been noted that the largest ship is in the centre of the convoy.

One large convoy was observed in two groups, 2 miles apart, each strongly escorted. Both merchant ships and escorts fly balloons by day and by night: on one occasion two balloons, one at the bow and one at the stern, were observed on a single ship. It is pleasing to report that one of our aircraft which hit the cable of a ship-borne balloon received no more serious damage than a cut leading edge to the wing. At times, single large ships with one or two escorts were sighted in the area.

A few convoys were very much strung out, each group of two or three ships having its own escort and covering a distance of over 12 miles. These scattered convoys have proved less easy to discover in the dark.

Escort vessels include trawler type auxiliaries, "M"-class minesweepers, and now Sperrbrecher in addition. These are large merchant ships converted for use both as extra heavy anti-aircraft vessels and as mine exploders. It is to be noted that they may in many cases be the largest ship in the convoy.

On their way to and from Norway, these convoys probably ceased to use the route along the west coast of Denmark when the Skagerrak became navigable in April. A few patrols between Heligoland Bight and Esbjerg during June, however, showed that there is a certain amount of small coastal traffic between the mouth of the Elbe and Esbjerg. The size of the ships reported ranged from 800 to 1,500 tons, and no escorts were observed. No information is available as to the cargoes carried.

Both enemy traffic and our operations are on a much larger scale along the stretch of coast between the Hook and the Elbe than elsewhere. Some interesting details can be given. A ship 390 ft. long, identified as a possible raider, was noted as a new arrival in Le Havre on 17th June. Next she stopped at Boulogne, and was found in Dunkirk harbour on the 21st, escorted by no less than 14 E- or R-Boats and 10 auxiliaries. She had left Dunkirk again, with her escorts, by the 25th.

There have been indications of a movement of oil from Western France northward, by both sea and rail, probably to supply the Fleet concentrations in Norway, and it is to be expected that tankers may from time to time move up from the Bay of Biscay and the Channel Ports. Thus a tanker which left Le Havre in April reached Bremerhaven by 21st June. It is known to have stopped at Rouen, Boulogne, and Dunkirk on its very leisurely way. Another probably moved from Boulogne to Dunkirk early on 15th June. Tankers seem to have a habit of making frequent stops at successive ports.

The unhappy discovery was made that the forward part of a large tanker damaged off Ameland in April had been cut off and towed to Wilhelmshaven by 8th May. This vessel, previously used to supply the *Tirpitz* at Trondheim, was wrecked shortly after starting on the return trip northwards, and was believed to be a total loss. However, the Swedish steamer *Ruth* (3,700 tons), which was towed for 16 hours after being hit during a strike off the Dutch coast early in May, has sunk in 12 fathoms of water and is unlikely to be salvaged; it has a cargo of coal.

It appears to be generally true that shipping in the Channel and Straits moves by stages from port to port under very heavy escort. Concentrations and movements of E- and R-Boats and other escort vessels in particular ports therefore afford a valuable clue to the expected arrival or passage of an important ship.

In the Straits the chief item of interest was the movement of Sperrbrecher. It is probable that at the beginning of May two of these (one of the large type and one of the small) were in Boulogne. By the 9th the *Idarwald* type Sperrbrecher from Le Havre had joined them. On the 11th she had left the port, and by the 19th the other large one (470 ft.) had also departed. She was seen in Cherbourg on the 25th. During June most of the Sperrbrecher moved farther westwards and have again been found in Brest and the Biscay ports. While in port they probably serve as part of the harbour defences.

From the beginning of April onwards, photographs revealed a continual movement of shipping between the mainland and the Channel Islands, some half a dozen vessels of over 200 ft. having been identified as engaged in this traffic. The ports concerned are St. Malo, Cherbourg, St. Peter Port, St. Helier and Alderney, and the two mainland ports have been active transporting stores to the Islands. Apart from the bigger ships, several coasters have been engaged in this traffic, and it is a reasonable assumption that the 40 odd invasion barges in the area are used as transports, for their numbers fluctuate considerably in individual ports.

16 Group

Reconnaissance

One hundred and sixty-six reconnaissance sorties were made during the two months, 18 to the Channel and Straits and the rest to the Hook-Elbe area, and of these 155 succeeded in carrying out a patrol. This effort resulted in the reporting of 102 convoys (defined as groups of two or more ships, with at least one over 500 tons), 14 independent ships of over 500 tons, and some 37 small ships. The relative success of patrols at different times of day is shown in this table :—

Time of Day.				Patrol Hours.	Convoys and Independents over 500 tons Sighted.	Patrol Hours per Sighting.	Average Length of Patrol in Hours.
						Hours.	Hours.
Hook-Elbe	{	Daylight	23	69	0.3	0.5
		Civil Twilight	6	21	0.3	0.6
		Night	82	23	3.6	1.0
English Channel	{	Daylight	1	0	—	0.3
		Night	17	3	5.7	1.2

It will be seen that in the Hook-Elbe area, each daylight and twilight patrol has a good chance of reporting at least one ship or convoy. At night, however, shipping is encountered only one twelfth as frequently, and in spite of the longer patrols, only one sortie in three or four, on the average, has reported anything.

As is shown by the table at the end of this section, most of the reconnaissance was done by Beaufighters and Hudsons. The latter, flying mostly at night, made 10 attacks in the course of their patrols.

Strikes

There is no clear-cut distinction between a strike and a reconnaissance patrol, but a strike may be defined roughly as an operation which usually involves a number of aircraft and is directed against a specific target, the position of which is known with some accuracy. In the Hook-Elbe region this is usually a convoy which has previously been located by Coastal Command reconnaissance. The 15 strikes of these two months (12 by night, one by civil twilight, and two by day) involved a total of 126 aircraft (an average of nine aircraft per strike). Seventeen of these aircraft failed to reach the enemy coast. Of those that got there, about 60 per cent. found their target (or, occasionally, some other convoy), and of these about 85 per cent. attacked. The most important strikes all occurred by night in May: on the 7th, in nautical twilight, 11 aircraft were despatched and seven attacked; on the 15th, in nautical twilight, 18 aircraft were despatched and about 15 attacked; on the 28th, in moonlight, 21 aircraft were despatched and about 13 attacked; and on the 29th, in moonlight, 29 aircraft were despatched and about 19 attacked.

One aircraft was sent on a strike in the English Channel, and this found and attacked its target.

Effort against Merchant Ships by Squadrons

Type.	Squadron.	Reconnaissance.			Strikes.		
		Number of Sorties.	Convoys and Independents over 500 tons.		Number of Sorties.	Convoys and Independents over 500 tons.	
			Sighted.	Attacked.		Sighted.	Attacked.
Hudson	407	26	10	6	56	32	26
	320	14	3	2	17	13	11
	59	31	4	2	24	14	13
	53	8	0	0	1	1	1
Hampden ..	415	16	1	0	15	3	2
	489	11	0	0	0	0	0
Beaufighter ..	236	43	70	0	1	1	1
	235	19	29	0	0	0	0
	248	2	1	0	0	0	0

NORWAY**The Enemy**

The primary concern of 18 Group during the two months has been the German naval units; however, the Hudson, Blenheim, Beaufighter, and Beaufort reconnaissance patrols sighted some 60 convoys and independent merchant ships between Kristiansund and Trondheim, while P.R.U. and other long-range aircraft, extending as far north as Narvik, reported a considerable number more.

The shipping on the Norwegian coast follows a tortuous route among the islands, which provide considerable natural protection. So far as is known there is no fixed timetable, but ships appear to congregate at certain places along the coast, which may be traffic control points.

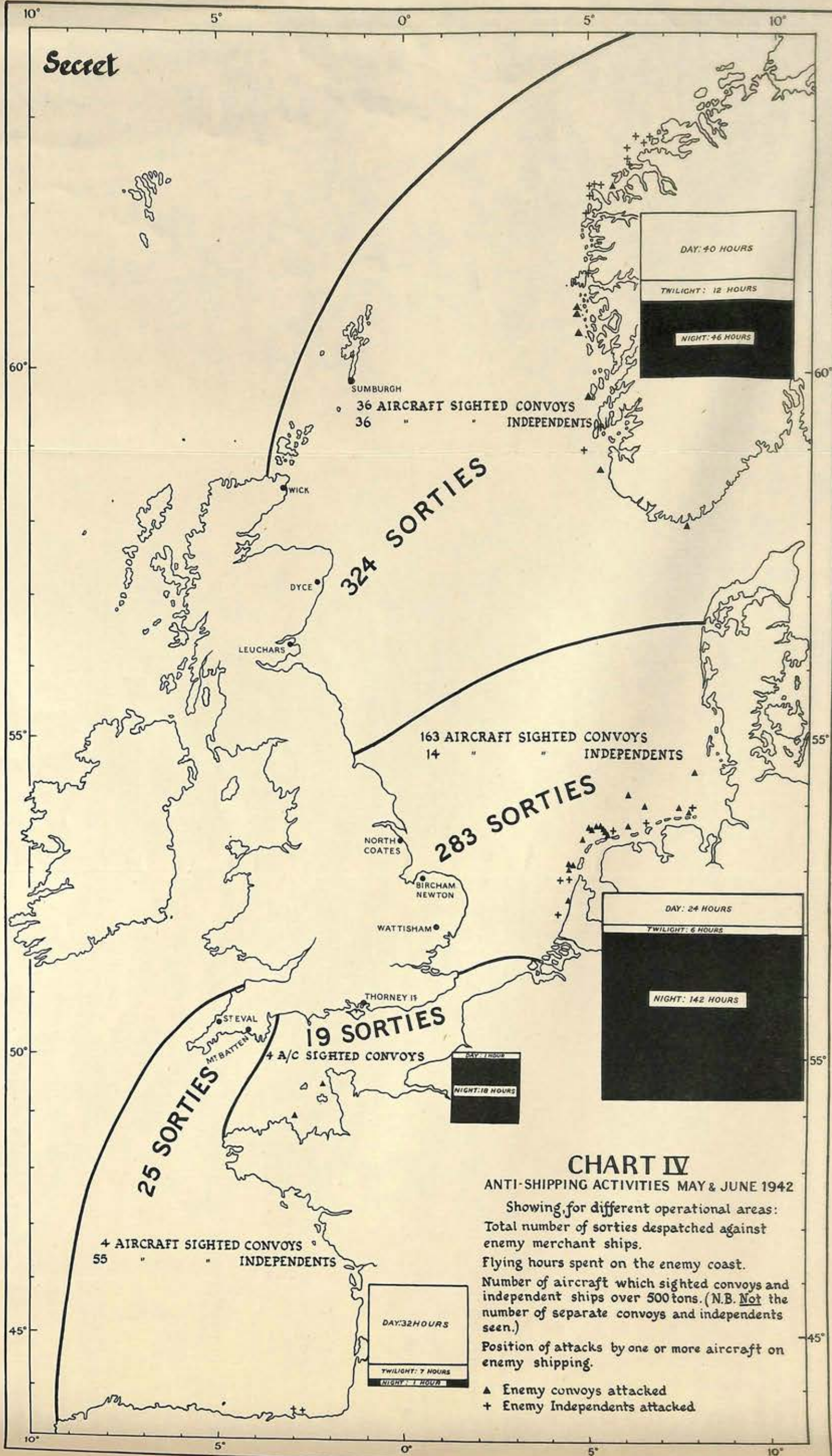
18 Group*Reconnaissance*

Excluding P.R.U., 268 reconnaissance sorties were made during the two months, of which 217 succeeded in carrying out a patrol. These resulted in the sighting of 33 convoys (with at least one ship of over 500 tons) and 25 independent ships of over 500 tons besides, and a few smaller vessels. The relative success of patrols at different times of the day is shown below :—

Time of Day.	Patrol Hours.	Convoys or Independents over 500 tons Sighted.	Patrol Hours per Sighting.	Average Length of Patrol in Hours.
Daylight	39	44	0·9	0·3
Civil Twilight	12	7	1·7	0·4
Night	23	7	3·3	0·4

It will be seen that, unlike the reconnaissance patrols off the Dutch coast, no one sortie has a very high chance of finding shipping even in daytime. In fact, sightings have been made by rather less than one in three of the daylight patrols, one in six of the twilight patrols, and one in eight of the night patrols. The chances that aircraft on the Dutch coast will find a target are higher, both because the patrols there are longer and because shipping is encountered more frequently for a given amount of flying. It is uncertain to what extent this is due: to greater density of shipping, to better conditions for sightings, or to ability to make closer guesses as to where the shipping will be found.

Secret



As the table at the end of this section shows, most of the reconnaissance was done by Beaufighters and Hudsons, and some by Beauforts and Blenheims. Eight Hudsons with bombs, and three Beaufighters with cannon, attacked shipping in the course of these patrols.

Strikes

There were 13 strikes against merchant vessels: eight by day, and five by night, involving a total of 57 aircraft (an average of $4\frac{1}{2}$ aircraft per strike). Seven of the aircraft failed to reach the enemy coast. Of those that got there, 33 per cent. found their target and 75 per cent. of them attacked.

Effort against Merchant Shipping by Squadrons

Type.	Squadron.	Reconnaissance.			Strikes.		
		Number of Sorties.	Convoys and Independents over 500 tons.		Number of Sorties.	Convoys and Independents over 500 tons.	
			Sighted.	Attacked.		Sighted.	Attacked.
Hudson ..	48	31	9	2	15	4	3
	608	38	10	6	17	8	7
Beaufort ..	42	11	1	0	6	0	0
	86	25	1	0	14	3	2
Blenheim ..	404	9	3	0	0	0	0
	254	4	3	0	0	0	0
Beaufighter ..	248	74	12	2	0	0	0
	235	38	13	1	0	0	0

BAY OF BISCAY

The Enemy

The iron ore traffic in small vessels, from Bilbao to Bayonne, continued much as usual during the two months, while that carried on by larger vessels may have increased slightly.

As was hinted in the previous issue, blockade running by vessels from the East seems to have started. A vessel of the *Munsterland* class (6,400 tons) was sighted and attacked on 15th May by a Coastal Command aircraft (Plate 7) and later turned up in Bordeaux where she was seen at the Customs House quay unloading. Her arrival followed that of a vessel of the *Fujiyama* class (6,200 tons) which was seen there at the beginning of May, after being sighted on 20th April off the northwest coast of Spain. Both pretended to be British ships. The first ran up the Red Ensign when challenged, and had it painted on two of her hatches. The second had a red, white and blue roundel painted on No. 5 hatch, and a British ensign on the main mast. The nature of their cargoes may be indicated by reports that Buna rubber has recently been offered for sale in Sweden, which means that the rubber situation inside Germany must have eased somewhat.

Towards the end of June, there were some indications that the enemy may be intending to increase his trading (in particular in ore) in the Biscay area. Also the departure from Bordeaux of several vessels of a type suitable for blockade running, suggests that the movement of essential goods from Germany to Japan may have started. These vessels have not since been located in other West French ports, and as far as is known have not passed up the Channel.

19 Group

Twenty-five reconnaissance aircraft were despatched on anti-shipping operations in the Bay of Biscay—some to the French coast in the Bordeaux region but most to the North Spanish coast. All but two carried out their patrol. This effort resulted in the reporting of four convoys (*i.e.* groups of more than one ship) and 55 independents, being ships of over 500 tons, and 20 ships or groups of ships under 500 tons. Only one patrol was flown at night and it resulted in two sightings.

The success of search by daylight and twilight is shown in this table :—

Time of Day.	Patrol Hours.	Convoys or Independents over 500 tons Sighted.	Patrol Hours per Sighting.	Average Length of Patrol in Hours.
Daylight	32	49	0.7	2.1
Civil Twilight	7	10	0.7	1.0

The average amount of flying per sighting in this region, both by day and by twilight, is intermediate between the figure for Holland and that for Norway, but the average patrol length is considerably greater than elsewhere owing to the lack of air opposition. By day each patrol is likely to make more than one sighting. In twilight, when the patrols have been rather shorter, an average of about one sighting per patrol would be expected.

A single aircraft was dispatched on a strike to the Bay of Biscay area ; it failed to find its target.

Effort against Merchant Shipping by Squadrons

Type.	Squadron.	Reconnaissance.			Strikes.		
		Number of Sorties.	Convoys and Independents over 500 tons.		Number of Sorties.	Convoys and Independents over 500 tons.	
			Sighted.	Attacked.		Sighted.	Attacked.
Sunderland ..	10	18	53	0	0	0	0
Whitley	502	2	5	0	0	0	0
	58	4	1	0	0	0	0
Hampden ..	489	0	0	0	1	0	0

(ii) Some Attacks

Attacks by Glide Approach, off Norway

Having failed at Alesund to see the tanker it had been detailed to attack, Hudson *M/608* turned to patrol the shipping leads to the southward, and at 0155 hours on 2nd May sighted two small vessels and behind them a destroyer, with a minesweeper ahead of each bow. The destroyer was 5 miles away, rounding the south-east point of Sande Island, and only half a mile from land. The aircraft was flying at 3,500 ft., under 4/10 cloud at 4,000 ft., but visibility was poor and tricky, except when looking directly up moon, because of shadows cast by the broken strato-cumulus cloud.

The pilot turned away to north-west, down moon, as though he had not observed the ships, and continued on this course for two or three minutes. Then he turned back and slowly closed the throttles, hoping the enemy would believe that the sound was still receding. Shutting the engine cooling gills, he approached in gliding "S" turns till he could glide up moon to the destroyer in a shallow and silent dive. A slight turn, when over the minesweepers, brought him into position to attack the destroyer from bow to stern. He levelled off at 100 ft.,

when almost over the bow, and released a stick of four 250-lb. G.P. bombs, set for 3 seconds delay and spaced at 20 ft. Then the pilot dived to sea level, eased the throttles wide open and turned away from the moon towards the open sea. The gunner looked back and saw two explosions, fore and aft of the bridge.

As the aircraft rounded the point, it flew alongside another destroyer, at deck level; this had hitherto been unnoticed. But not a shot was fired from any of the enemy vessels. The aircraft climbed to 3,000 ft. and circled, to find that the first destroyer had turned sharply and was moving very slowly towards a small jetty, against which it eventually came to lie. Only one bomb burst could be seen in the water, and the other three were presumed to have hit, but damage could not be observed in the poor light. An attempt to locate the second destroyer had to be abandoned owing to petrol shortage.

Ten nights later, this aircraft carried out an anti-shipping patrol on the Norwegian coast and utilised the same tactics. There was no cloud and though the moon had not risen, the aurora borealis lit the north-western sky. *M/608* therefore patrolled inland parallel to the coast in a north-easterly direction, flying at 7,000 ft. as a safeguard against flak. At 0020 hours a convoy was seen south of Sande Island—a ship estimated at 10,000 tons, followed by two others of medium size and two small escort vessels. As the aircraft had ten 100-lb. bombs on board, it was decided to make two attacks, approaching down the mountain side on the east of the fiord so as to obtain a still darker background than the unlit sky above it.

The pilot turned inland, throttled back and circled to lose height. Then, barely clearing the mountain tops, he glided into the fiord, just south of the convoy, and along it, hugging the side, till it was time to turn outwards for the attack. The aircraft had glided down as low as 50 ft. above the water when still 300 yards short of the large ship, so that the throttles had to be opened. To forestall opposition, the pilot sprayed the decks and superstructure with the front gun as he approached. Six bombs, set for 3 seconds delay and 20-foot spacing, were aimed at waterline on the ship's side below the main superstructure. The pilot had to pull the nose up very sharply to clear the masts; consequently the gunner had an excellent downward view but could see no splashes either side of the ship, and all bombs were therefore presumed to have hit.

As the aircraft went down to sea level, guns opened fire from the four smaller vessels and from several positions ashore, but shot in almost every direction except the right one. The aircraft flew out to sea, climbed, and circled into position for the second attack. Meanwhile the ships closed up round the target vessel, which lay stationary.

This approach was made 10 minutes after the first, and in the same manner, but the aircraft was observed by the enemy ships as it glided along the fiord. Their fire, however, became more and more inaccurate. Only when the pilot levelled off and opened the throttles, did the nearest escort vessel's fire become fairly accurate, but the wireless operator silenced it by a few bursts from the side guns. Even at the moment of attack, the flak remained very erratic, though with more concentrated aim.

This attack was made from stern to bow of the large vessel, with the four remaining bombs, set for 3 seconds and spaced at 20 ft. The aircraft dropped them from 50 ft. The ship was now seen to be on fire, as a result of the previous bombs, just forward of the bridge, while this stick caused a huge column of sparks to shoot up from the funnel. The aircraft returned quite undamaged.

Operations against the "Prinz Eugen"

At 1630 on 16th May the P.R.U. reported a cruiser—subsequently identified as the *Prinz Eugen*—preceded by two destroyers, in Trondheim Leden, steering south-west at high speed. On the assumption that this force would pass Stadlandet about midnight, fourteen Beauforts were despatched at 2313 on the 16th to search for and attack the cruiser in this area. All returned, having failed to locate the force.

At 2323 on the 16th, six Hampdens were despatched to lay mines in the Haugessund area.

Reconnaissances flown during the 17th made the following reports :—

- (a) *Tirpitz* and a cruiser were seen in the usual positions in Lo Fiord.
- (b) At 1205 a cruiser and four destroyers were sighted in the position 59.43 N., 05.26 E.
- (c) A little later an aircraft sighted a large naval unit and four destroyers in Bommel Fiord, 59.40 N., 05.23 E.
- (d) The same force was sighted again at 1540 in the position 59.11 N., 05.21 E.
- (e) At 1706 a further sighting of the force on a southerly course was made at the position 58.30 N., 05.35 E.

These sightings justified the conclusion that the force would pass the Lister light somewhere between 1900 and 2000 on the evening of the 17th. Orders were therefore issued from Coastal Command Headquarters to 18 Group that all available Beauforts, with a Beaufighter escort and a diversion of high flying Hudsons, should endeavour to attack the cruiser in the Lister area at the time when it was anticipated the force would pass to the eastward.

The total force which took off to attack consisted of twenty-seven Beauforts, six Blenheim fighters, eight Beaufighters and thirteen Hudsons.

The first wave was composed of twelve Beauforts of 42 Squadron, six Blenheims of 404 Squadron, two Beaufighters of 235 Squadron and two of 248 Squadron. Their orders were to sweep north-west from Kristiansund until the target was located. The Beauforts were to attack with torpedoes, in two waves of six aircraft each, the second wave to be dispersed 2,000 yards astern so as to be in a position to drop whichever way the target applied helm. The Blenheims were to spread out on each beam of the striking force and make dummy torpedo attacks so as to confuse the anti-aircraft defences of the target ship and its escort. They were also to attack any enemy fighters seen in the vicinity. The Beaufighters were instructed to go ahead of the main striking force on sighting the target, and to attack the escorting destroyers with cannon-fire.

The first aircraft was airborne within 50 minutes of the receipt of orders, and the force set course in formation 10 minutes later, at 1800 hours.

On information received from 18 Group, the force altered course towards the target, which was found at 2015 hours, steering 140°. The ships comprised the *Prinz Eugen* and four escorting destroyers. Two destroyers were disposed respectively half-a-mile and one mile ahead, 500–600 yards on starboard bow. Another was a mile astern of the cruiser, in line astern of the cruiser and of the first two destroyers. The fourth was half-a-mile astern to port.

Each wave of Beauforts was divided into three sections of two aircraft. The first wave attacked the starboard bow when *Eugen* turned to port, and the second the starboard beam as she turned hard to starboard to avoid the first attack. All six aircraft of the second wave went in through the screen of destroyers, one of which was making some smoke. The three leaders of this wave were all shot down. In the meantime the Beaufighters had gone ahead of the force and pressed home cannon-fire attacks on the escorting destroyers, with good results, for their anti-aircraft fire was considerably reduced during these attacks. The Blenheims, in accordance with their orders, made dummy runs towards the target, and also attacked enemy fighters which crossed their path. A large number of enemy fighters was seen and encountered during the engagement, but attacks were not pressed home, and little damage was suffered. The force then withdrew, and reached base, landing between 2215 and 2300 hours.

An analysis of the attack delivered by the first striking force shows that out of the twelve torpedo aircraft, three were shot down while closing to attack and the remaining nine dropped their torpedoes. Of these, three dropped at ranges of 2,000 yards and under, and the others at ranges in excess of 2,000 yards up to 4,000 yards. One certain and two probable hits are claimed. Failure to hit the target is not surprising in view of the attacks by enemy fighters, which were carried on throughout the run up to the target, and of the heavy anti-aircraft fire, fired both from the ships and from shore batteries.

A striking feature of the operations was the effectiveness of our own fighter-cover. Although only eight Beaufighters and six Blenheim fighters could be made available to cover the torpedo aircraft, the enemy fighters were considerably hampered in their operations and a measure of protection was offered to our own aircraft. In addition the fire of the Beaufighters kept down the anti-aircraft fire from the enemy destroyers.

The second wave consisted of fifteen Beauforts of No. 86 Squadron with accompanying Beaufighters. Owing to a position error in the sighting report given by a reconnaissance aircraft and to a wrong time of origin in the re-broadcast of the sighting report, these aircraft took too northerly a course and failed to locate the target. They were subsequently intercepted by a strong force of enemy fighters and after a sharp fight, in which four Beauforts were shot down and five Me. 109's were destroyed, they returned to base. Of this formation seven aircraft jettisoned or lost their torpedoes.

All pilots reported that at sea level the Beaufighters were a match for an equal number of Me. 109's, both in speed and manœuvrability, while the Beauforts in formation provided a very difficult and formidable target to enemy fighters. In fact they accounted for all the five Me. 109's destroyed.

Typical reports on the Action

A Beaufighter of 248 Squadron, which sighted the enemy ships at 2014 hours, "turned to attack the leading destroyer. We put 200 rounds of 20 mm. and 600 rounds machine-gun fire on this destroyer, from 800 yards to within 100 yards range. Intense flak was encountered, shot holes appeared in the starboard wing and port engine. Numerous hits were observed on bridge of destroyer, and her fire slackened considerably. Returned second time and fired long burst from astern on another destroyer which was already covered with black smoke, and then formed on two Beauforts apparently flying towards base, saw one force-land in sea, float a few seconds, and then sink."

A Beaufort of 42 Squadron "at 2014 hours saw one cruiser and four destroyers whilst still in formation with other Beauforts. Leader altered course to starboard and we went into attack. Aircraft was attacked by one Me. 109, which missed owing to my evasive action in turning to port. Immediately afterwards dropped torpedo at cruiser, which presented very good target, and a hit was thought probable. Aircraft was then hit by flak and partially disabled, as a shell-burst on the stern frame damaged the elevator controls and rudder controls. Aircraft could not turn, and was very difficult to handle. 2019 hours, aircraft was attacked by three Me. 109's, one of which was driven away by a Beaufighter. The second Me. turned away and the third closed in to attack. The rear gunner was dazed by a hit on the turret, and the wireless operator took his place until he recovered four or five minutes later. Enemy aircraft was shooting low and was not keen to close in with our aircraft, which should have been an easy target, as no evasive action was possible. Wireless operator claimed several possible hits on this enemy aircraft. The Beaufort was damaged in the tail and turret by machine-gun bullets and cannon shells, also shell splinters in the cockpit." Only excellent airmanship enabled this pilot to fly back over 300 miles of sea and make a successful crash landing.

PART 3. OTHER ACTIVITIES

(i) Sea Ice

The routing of our convoys to North Russia and Canada has focussed attention as never before on ice conditions in the northern seas. Seldom has there been such a bad ice season in arctic waters as the past winter, and never have those waters possessed greater importance.

It was not till 1942 that the ice limits in the Greenland Sea were fixed by Coastal Command's aerial reconnaissance. The reports of scientific expeditions, merchant ships, sealers and fishing craft have enabled charts to be drawn showing the average extent of ice over a period of years, and the extreme limits that it is known to have reached at different times of the year. But no two winters are quite the same; the last twenty have averaged 5° F. or more above those of the preceding twenty, even though the winter of early 1942 was the most severe for many years. Accordingly, the actual limits of ice seldom agree with the average limits given on charts. (The Air Ministry publishes a book of *Monthly Ice Charts*, M.O.M. 390a.)

The Permanent Ice Field

Within 600 miles or so of the North Pole there is little to be seen but ice, even at the end of summer. The permanently frozen waters surrounding the Pole consist of large fields of ice, many miles in extent and from six to nine feet in thickness, separated by narrow channels of water. The ice is not anchored to land, but is subject to winds and currents which cause a general slow drift from east to west, to the northward of Asiatic Russia, Franz Joseph Land and Spitzbergen. Winds, sea currents and, near the outer limits, swell, cause the fields of ice to be squeezed together, and large blocks of ice to be broken off and forced up. These form what are known as pressure ridges, or hummocks, and can be thirty to fifty feet high. Except for a short time in summer, air temperatures on the Polar Ice Cap are usually well below freezing point so that there is little chance of the ice thawing; during most of the year it is growing in thickness, partly from ice forming on the underside of the cap and partly from the accumulation of snow on top.

How Ice Forms

Outside this permanent ice field, the extent over which the sea is frozen depends upon the time of year and the severity of the climate—which is by no means uniform along a given parallel of latitude. The sea gives up its heat slowly, and, in the northern part of the Barents Sea, for example, does not usually reach its freezing point (about 29° F.) until November. The first indication that ice is forming is a somewhat oily appearance on the surface, in the form of streaks if sufficient wind is blowing. Sometimes, however, if weather conditions are quiet, the first visible stage is the formation of discs of ice, often with up-turned edges, and anything from one to five feet in diameter. This is known as "pancake" ice. In either case, provided low temperatures continue, the surface gradually becomes more completely covered with a slushy form of ice which hardens and becomes thicker. But wind and swell, alternating with conditions of calm, break up the ice into small fragments. As the season advances these fragments grow in size and the intervening water freezes over, so that the small cakes and fragments become cemented together into large slabs. These are called "floes," and may grow to fifty or a hundred feet across, before they are broken up again by wind and sea. The outer edge of the ice, which, throughout the late winter, continues to extend southwards, is composed of floes of varying sizes; sometimes these are tightly packed together, but more usually they cover only a third of the sea. Out to 30 miles or more from what seems to be the seaward edge of the ice, there will probably be an occasional isolated floe that has survived the warmer waters of the open ocean because it was larger than its fellows.

If one were to fly over the ice edge in a northerly direction, that is roughly at right angles to the direction of the edge, the density of the ice (that is, the amount of sea covered by it) would be seen to increase, as would also the size and thickness of the floes; but it is unlikely that the density of ice would be 10/10 even when 100 miles or so inside the edge. There would still be lanes or "leads," as the channels are called, and occasional pools or open patches of water.

Ice forms most readily in shallow water and near land, because there is less water to be brought to freezing point and because the coldest winds are those that blow off-shore. Ice that grows out from the shore is known as "fast" ice, while all ice that is not anchored is called "drift" ice. Fast ice seldom extends far from the shore because wind, sea and swell, and the rise and fall of the tide, all conspire to break it up. Where, however, in high latitudes, such as off North Russia or East Greenland, there is a conjunction of shallow water, little tidal range and little on-shore wind for two or three weeks at a stretch, the fast ice will grow out several miles and become a foot or more thick, before being broken off to join the masses of drift ice in the open sea.

Icebergs

Another form of ice frequents some parts of the ocean—the iceberg. These may be found amongst drift ice, but, as they take so much longer to melt on account of their great bulk, they may also be encountered many miles south of the limit of the comparatively shallow floes. They have their origin in those vast valley accumulations of snow and ice which we call glaciers. Provided the valleys concerned run straight down into the sea where the shore is steep to and the water deep, the seaward end of the glacier periodically breaks off and floats away. An iceberg is then said to have been "calved." The height above water is generally less than 100 ft.

The Ice Season

In high latitudes, inside the Arctic Circle, air temperatures fall a long way below freezing point in the winter; the maximum amount of ice is not, however, met with during winter but during spring, for ice is still formed and goes on growing in size and thickness until the average temperature rises again to freezing, or rather melting point. This point is not reached in the Greenland Sea, for instance, until round about April or early May, which is in consequence the worst part of the season. From May until July the temperature both of air and sea increases rapidly, with a correspondingly marked retreat of the ice, most of which has disappeared by the middle of July in the seas frequented by our ships; an occasional iceberg in certain localities is the only remaining danger. The position of the ice edge is not, however, simply a function of the average air temperature for ice drifts at the whim of the winds and currents. A warm current from low latitudes and a prevalence of mild south-westerly winds keep the sea free of ice off the north coast of Norway and to the south-west of Spitzbergen, while a cold current and a prevalence of cold north-easterly winds off the east coast of Greenland is largely responsible for ice remaining in the vicinity of north-west Iceland at all times of the year except from mid-August to mid-November. Cold currents flow through all the main exits from the Polar Sea and penetrate into particularly low latitudes down the eastern coasts of Spitzbergen, Greenland, Labrador and Siberia, carrying with them heavy pack ice that may have spent several years near the North Pole. On their journey southwards and south-westwards, these currents gather up icebergs emerging from fjords, and fast ice broken or torn away from the shores. New ice also keeps forming; so long as the water and air temperatures remain low. This jumble of heavy and small ice, known as "packed drift ice," accumulates until it reaches a locality where the current is no longer in evidence and warmer water is reached, as happens, for example, about 50 miles south-west of Bear Island. It may now be buffeted by warm southerly winds, that hasten the melting process started by warmer water; in this event, the ice edge will retreat a little, until the wind changes to a northerly direction, when back comes the ice to lower latitudes again. With the advance of summer, each recession is a little more marked than the subsequent advance, so that each month sees a net improvement in the situation.

Much of the ice near the outer margin is often thawing and waterlogged. When this is the case, it is of a darker tone, and relatively soft and harmless to shipping; it is called "brash."

The Ice Menace to Shipping

We learnt many years ago that the safest way of sending our merchant shipping across the seas during war is to escort a number of them in convoy. Ocean-going merchant ships can thread their way through ice as long as it is not too heavy and they can see their way, or provided they can be guided or helped by ice-breakers.

Destroyers and escort vessels, on the other hand, have such thin plating that an ice floe 2 ft. or so thick can easily punch a hole in it. Furthermore, the closer together ships in convoy keep, the easier they are to protect from air attack. If they go through ice they will unavoidably become separated and so cease to be manœuvrable as a unit.

Air attack on our convoys bound to and from Russia is a serious matter at the best of times and is not improved by our having to keep outside the ice, which, during the months of February to early June of this year, has meant passing within 250 miles of the nearest enemy aerodrome. To make matters worse, the sun does not set over the Barents Sea from May to the beginning of August. The only hope is to keep as far as possible away from Norway, and to do this the Admiralty must be informed of the position of the ice edge. As the crews of aircraft that have flown in the Greenland and Barents Seas well know, fog is a frequent companion of ice; and so the convoys must be routed clear of ice in order to avoid damage due to collision in fog. Moreover, when the German battleship *Bismarck* set out for her commerce-raiding cruise, she tried to evade our forces by passing along the edge of the ice in the Denmark Strait between Iceland and Greenland—just as a few German merchant ships had attempted to do earlier in the war. On all grounds therefore the ice conditions in that Strait must be watched in order that up-to-date information concerning the width of the ice-free channel may always be available to the Naval Commander-in-Chief.

Reconnaissance of the Denmark Strait

One of the most interesting jobs undertaken by the Royal Air Force in Iceland is the Ice Reconnaissance carried out in the Denmark Strait and along the Greenland coast to just north of Scoresby Sound. During the months of June to September the sortie is made approximately twice weekly, but it is a daily commitment from October to May. The object is to plot the position of the ice accurately, noting where the more or less solid ice commences and the extent of the area covered with isolated floes and brash. For the position of both varies considerably with different winds, as intervening spaces of clear water open and close, and during the winter the ice edge fluctuates considerably. The information gathered is of great importance to the Admiralty; it largely governs cruiser dispositions as well as the air patrols laid on to intercept surface raiders which may attempt to break out into the Atlantic by passing north of Iceland and through the Denmark Strait.

The narrower part of the channel between the ice and the coast of Iceland lies in a north-westerly direction from the Claw, the north-west corner of Iceland. During the winter of 1940–1941, the ice came within 40 miles of the coast, and it was within 60 miles during the winter of 1941–1942. In exceptional years it reaches the coast of Iceland, but that is a very rare occurrence; it is on these few occasions that polar bears make their way to the north coast of Iceland. In the summer months the sortie becomes a reconnaissance of the Greenland coast rather than of Ice.

The flights have been almost always carried out by Hudsons, although occasionally Whitleys and United States P.B.Y.s have been used. No. 269 Squadron has done the great majority of the flights. The aircraft leave Kaldadarnes or Reykjavik and fly to the Claw, where they invariably take departure from Bjartangar Point. In the winter a track of about 310° True is flown from Bjartangar, until the edge of the firm ice is encountered, and then that is followed to the prudent limit of endurance—it runs in a north-easterly direction. The edge of the ice is accurately plotted by the navigator, and he also plots the position of the brash ice which is present in large areas before the main ice edge is reached. Approximately once a week in winter one of these flights is ordered to be made from Bjartangar Point across to the Greenland coast in the vicinity of 68° N., with the object of locating any clear water channels that may exist in the icefields. During the summer months the aircraft usually fly from the Claw to the Greenland coast, making a landfall at Kangerdlugsnak in the position 68° N., 37° W. The coast is then followed to Scoresby Sound and still further north to the position 71° N., 23° W. On these summer flights isolated icebergs are seen close to the Greenland coast, but no floes; considerable numbers of large icebergs are seen in Scoresby Sound and just outside its entrance. The fields

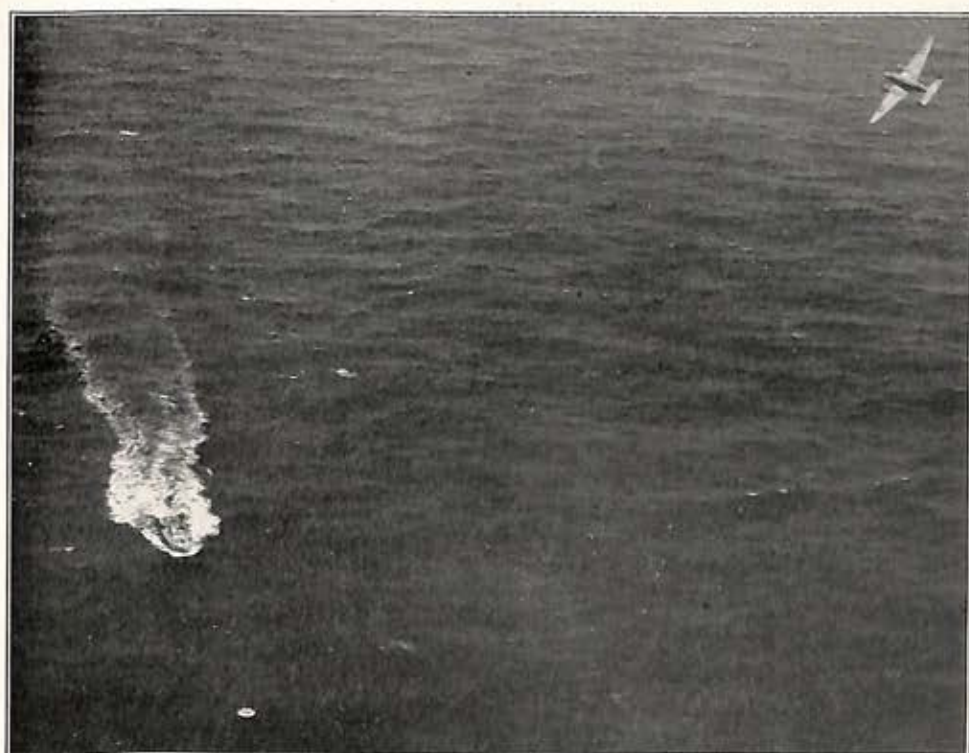


Plate 8. A RESCUE. June 9th. At 0340 hours a Halifax of 4 Group sent an S.O.S., followed by "Am force-landing in sea, position 52·09 N., 01·40 E."—later corrected to 02·40 E. A Hudson of 279 Squadron found the dinghy at 0825 (in the position 52·07 N., 02·42 E.), dropped a smoke-float, and circled till at 1015 a high speed launch arrived from Yarmouth. A Walrus was also sent with fighter protection.

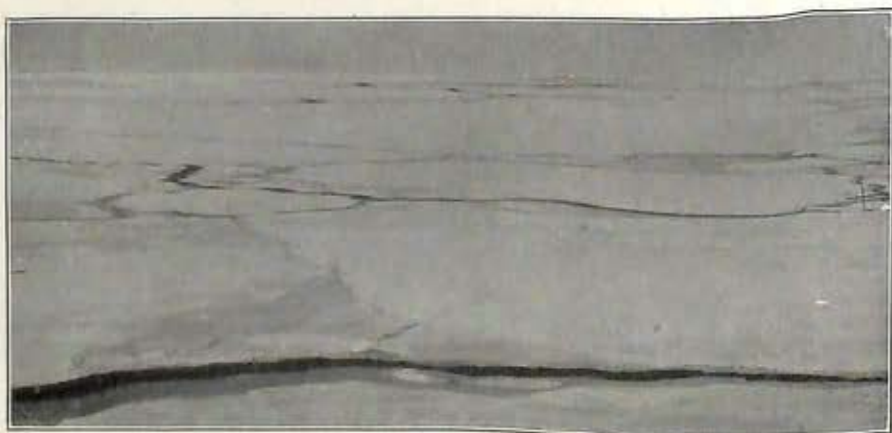


Plate 9. SEA ICE. From the top downwards : Greenland from Denmark Straits—Floes—Icebreaking—Icefield with water Leads.



Plate 10. ICEBERGS IN DENMARK STRAITS. The two tall bergs were photographed from 600 ft ; the low berg is among brash.



Plate 11. ICEBERGS OFF SCORESBY SOUND. Photographed from 1,000 and 1,800 ft.

of packed drift ice usually commence to form during September, and from then onwards rapidly spread south and south-eastwards. From this time onwards a very careful watch is kept on the ice position, with accurate plots.

Flying in the Denmark Strait

During the flight along the Greenland coast the crew view some of the most forbidding scenery in the world, with many glaciers entering the sea but not a sign of vegetation or human life until the small settlement in Scoresby Sound is reached. The mountains and hills are snow-covered all the summer, except for bare areas of rock and low lying land on the southern slopes. In the winter, Greenland becomes one vast expanse of snow and ice. The aircrafts' crews have been in friendly competition as to who could produce the best and most original photographs (Plates 9, 11).

On these flights U-Boats have been sighted on the edge of the icefield, obviously doing the same work as our aircraft. The first occasion was just before the *Bismarck* sailed, and the second coincided with the move of the *Tirpitz* up the Norwegian coast. Unfortunately, attacks could not be carried out as long-range aircraft were being used.

In spring very large areas of the Denmark Strait are covered with sea fog. One crew was flying at about 250 ft. in the fog, plotting the ice edge by Special Equipment, when they flew between two huge icebergs, which towered above them, and the danger of flying low over this area in conditions of poor visibility was most vividly brought home to all.

From time to time, mail, code books and small comforts are dropped on the Meteorological Stations at Angmagssalik and Scoresby Sound in Greenland and in Jan Mayen Island. The brief visits by aircraft must be a welcome break to the inhabitants of these stations, who are cut off from the outer world for nine months of the year.

A great variety of weather is experienced on these sorties. Some days the sky will be clear and the visibility up to a hundred miles with a clearness that is never seen in the British Isles. Other flights are carried out in snow storms, and very severe icing conditions can be experienced, especially with the movement of a warm front up the Denmark Strait in winter. But all crews are eager to carry out this sortie.

(ii) Some Incidents of May and June

*From the **Hambürger Fremdenblatt**, 12th May*

"A low-flying Hudson was recently brought down by naval flak off the Channel coast. It crashed into the sea a bare 30 metres from the shore, and its crew of four, two Englishmen, a Canadian and an Australian, all young, were saved. The aircraft had been hit in the elevators and the petrol tank, and the pilot had tried to make a forced landing.

When the tide went out it was not difficult to salvage the Hudson, which had some very interesting new developments on board."

A Quick Rescue

The rescue of the crew of Wellington A/305 emphasises the necessity for correct distress action being taken by the crew of an aircraft forced to alight on the sea; from the Air/Sea Rescue point of view, this is of paramount importance.

The first intimation of trouble received from this crew was an S.O.S. picked up by Bircham Newton M/F D/F, Section "G." Then followed the signal, "Reeling in aerial to land," which showed that the aircraft was ditching. Bircham Newton immediately obtained a fix which made the position 53.25 N., 02.54 E., at 0412 hours on 5th May.

Hudson V/279 had been standing by, in immediate readiness, at Bircham Newton, and was airborne at 0433 hours. It reached the position at 0516 hours when it was too dark to search; a flame float was dropped but no answering signal

was observed. The Hudson then began to fly up and down the Wellington's last known track ; several minutes later a Ju.88 was seen, and avoided, and immediately upon returning to the track, white flashing lights were noticed. These proved to be the dying flickers of the flame float. As the aircraft again turned back to the track, the turret gunner saw a marine distress signal two miles astern. It ceased when the pilot turned towards it, so he continued circling the flame float until a second signal appeared. The aircraft flew over and saw the dinghy by its light, at 0533. After dropping two more flame floats while the observer made a sighting report, the aircraft climbed to 1,500 ft. to send a message giving the dead reckoning position. This was quite near the Wellington's fixed position given by Bircham Newton. Upon its receipt, at 0556, Air/Sea Rescue at once diverted the motor launch patrol, which works in this vicinity when Bomber Command operations are in progress, and also sent two Hudsons to co-operate.

Meanwhile V/279 came down to 400-500 ft., found the dinghy again and continued to circle it, dropping smoke floats at intervals and a Lindholm dinghy. It stayed till the crew were picked up by motor launches, within four hours of ditching. This could not have happened so quickly had they not given adequate information.

Saved by losing Propeller

On 21st May, two Blenheim fighters of 254 Squadron left before dawn to meet a convoy. The weather was fair, but a layer of 6-8/10 fog prevailed over most of the route, with base at 200 and top at 800 ft. After two hours one of the pilots, who had just arrived from an O.T.U. and was making his first operational flight, found the oil pressure dropping on his starboard engine. He was 200 miles from land. He set course for base, accompanied by the other aircraft. As he slowly lost height he had to fly in cloud for part of the time, and the engine finally seized when in a cloud ; the aircraft swung and missed the other's tail by inches. When petrol from the outer tanks had been jettisoned, height could be maintained at 100 ft. and 125 m.p.h. by using emergency boost on the sound engine. The drag of the failed engine made it very difficult to hold to the course, but the observer of the other aircraft passed corrections by R.T. The aircraft arrived in this manner at the nearest land but it seemed that it would have to ditch, because it could not climb over the cliffs. At the last moment the starboard propeller flew off, and, relieved of this drag and weight, the aircraft gained height and landed safely at a near-by aerodrome, with wheels and flaps down.

A Rescue from Enemy Waters

On the night of 1st June a Halifax of Bomber Command, which had been attacking Essen, was shot down into the sea off Holland. The aircraft broke in half, but six out of the crew of seven managed to take to their dinghy. Whilst it was still dark, searches were carried out by the Air/Sea Rescue Squadron of Coastal Command, and in the morning the dinghy was located close to the Dutch coast by two Hudsons. While one was dropping sustenance and a spare dinghy, and the other sending a signal to base, the Hudsons were attacked by two Me.109's, and a running fight ensued. The navigator and rear-gunner of one Hudson were seriously wounded, and the aircraft had over 100 holes in it, but landed safely at the nearest aerodrome. As the enemy aeroplanes returned to Holland, one fired a burst over the dinghy.

On the 3rd, a Beaufighter of Coastal Command went out and found the dinghy again, but was attacked by two F.W.190's. Presumably the enemy were using the distressed crew as a bait. Fighter Command were then called upon, and a Walrus was sent out with escort, but owing to haze was unable to sight the dinghy. Four more Beaufighters were airborne, without result.

The search was continued throughout that night, but it was not until 1215 on the 4th that the dinghy was again sighted, by a Beaufighter of Coastal Command. One of the men in the dinghy flashed the lid of a tin to attract attention, and on the Beaufighter's second run over them, one held a thermos flask upside down. A Walrus was sent again with fighter protection, but the visibility became very poor and it was forced to return without seeing the distressed crew.

Two high-speed launches had been standing by, and it was decided to send them to the position at last light, with Air/Sea Rescue aircraft to assist in the search, and with fighter protection. The launches arrived at their rendezvous a trifle early, and hove to. A Ju.88 and, soon after, three Me.109's appeared and circled them at 150 ft., but did not open fire. The two launches immediately got under way. At 2300 hours, the dinghy's crew saw one and lit their last flare which brought it to them. The position was only 12 miles off Holland. On nearing the English coast, at 0030 hours, five E-Boats surrounded the launches and opened fire at 50 yards' range, but very inaccurately. The rescue craft, returning fire, speeded up to 40 knots, dashed through the middle and escaped without damage.

An account of the rescued crew's experience is likely to be published elsewhere.

Whitleys that returned on one Engine

A Whitley of 51 Squadron was returning on 6th June from an anti-submarine patrol over the Bay of Biscay when, at 2115 hours, the oil pressure of the starboard engine began to fluctuate and decrease fairly rapidly. (Actually a broken conrod had pierced the sump and cylinder block.) The aircraft was about 200 miles from the nearest point on the English coast, and some 70 miles from Brest.

Believing that the oil filters had choked and that no oil was being fed to the engine, the pilot throttled the engine right back to -4 boost. Height was maintained at 1,500 ft. for about an hour and a quarter, by which time the aircraft had reached about 30 miles off the English coast. At this point, the engine suddenly burst into flame, and although the automatic extinguishers were immediately applied, it burned fiercely for about three minutes. To lighten the aircraft, the depth-charges were released, but the pilot found that he could maintain height, and so refrained from jettisoning other equipment.

The aircraft continued on its homeward course maintaining height at 1,500 ft., and a landfall was made at St. Michael's Mount on the Cornish coast. Owing to ten-tenths cloud, the pilot was forced to descend to a height of only 700 ft., but he thought he would attempt to get to his base. As he approached Portreath however, visibility, which was already bad, decreased and the weather generally deteriorated.

The aircraft circled Portreath aerodrome, which is about 300 ft. above sea level, firing distress signals. At the second circuit, a green pyrotechnic was seen to be fired from the aerodrome.

There was no flare path or landing "T," nor was the pilot familiar with the aerodrome. The hydraulic pump was on the dead engine and, there being no time to manipulate the emergency landing gear and lower the undercarriage, the pilot crash-landed the machine with the undercarriage retracted. Despite the fact that the aircraft swung completely round near the finish of its crash run, no members of the crew were hurt, except the tail gunner, who was slightly shaken. The minimum amount of injury was caused to the aircraft, affecting the lower front portion of the fuselage, the engine nacelles and the propellers. The port engine, which had successfully carried the full weight of the aircraft for a distance of close on 250 miles was found to have received no harm.

Another Whitley, belonging to No. 3 O.T.U., was carrying out an exercise over the North Sea on 19th June at 1624 hours, when the pilot noticed that the radiator temperature of the port engine was rising. A minute later, a bad leak of Glycol developed and the radiator temperature went off the clock in about five seconds, while dense white smoke issued from the engine. The aircraft was then at 2,500 ft. Course was maintained towards land with the aid of the rudder trimming tab. After five minutes the port engine caught fire. The pilot switched off the wing fuel tank which supplied it, opened the port throttle fully and then switched off the engine and pressed the port Graviner switch. The fire seemed to be completely out after another ten minutes. In the meantime the aircraft was filled with fumes which came through the heating system from the engine. The heat system was turned off and the windows opened.

When the port engine failed completely, the pilot opened the starboard engine to full throttle with rich mixture, and fully fine pitch. The aircraft would not maintain height, although all possible equipment was jettisoned. Its height was now 1,500 ft. but the coast was well in sight. The starboard engine was running at $5\frac{1}{4}$ lb. boost, and the radiator temperature had almost reached 110 degrees; an attempt to restart the port engine had no success. The pilot headed for the nearest point of land, but realised he could not make it with any appreciable height, and gave orders to prepare to ditch. The aircraft had sunk to some 800 ft. when still about a mile from the coast. The pilot turned and flew parallel to the coast, intending to ditch as near as possible to three drifters which were approaching Cromer.

Glancing at the shore, the pilot saw a party of men working and realised that this part of the beach was not mined, so decided to land there with the undercarriage down. He made as flat a turn as possible, maintaining air speed at the expense of height, and was less than a hundred feet above the ground when he flattened out for the approach; the undercarriage locked down about fifteen seconds before touching the ground. The aircraft touched down first on a small sandy portion, at about 80 knots with the flaps going down. Then the aircraft was bounced around as it crossed a stretch of large stones and pebbles for 250 yards, but finally ran on to sand, where it was braked to a stop. None of the crew suffered injuries. The aircraft sustained a punctured tail wheel and a rip a foot long on the upper surface of the elevator (probably caused by flying pebbles), and had the aerals torn off or severed.

A Hampden defeats two Focke-Wulfs

On its return from anti-submarine patrol on 12th June, Hampden R/489 was attacked by two Focke-Wulf 190's, about 15 miles north-west of Ushant. The time was 1145, and R/489 was flying at 200 ft. The wireless operator had just been changing the accumulators with the aid of the rear gunner when he sighted the two enemy aircraft diving on the Hampden's starboard quarter. Both of them circled to port and began quarter attacks, opening fire with cannon and machine-guns at 400 yards and closing to 150 yards. The Hampden's rear gunner held his fire while a F.W. attacking from starboard came within close range and broke away to port, but then he brought his guns to bear on its companion which was attacking from the port quarter. Meanwhile, the pilot dived to sea level, jettisoned his depth charges and began to take avoiding action—he judged by the splashes in the water how to turn away from the enemy's fire. But the Hampden was hit, almost immediately, in several places. The wireless operator, who was firing the gas operated gun through the starboard window, had his right knee shattered by a cannon shell. The navigator too was hit in the back by shrapnel splinters, and knocked almost unconscious. The rear gunner kept up his fire and scored hits on the first enemy as it made its second attack from the starboard quarter. Black smoke poured from its engine and it promptly went off towards France.

Immediately afterwards the rear gunner engaged the second F.W. which attacked from the port quarter. But it now changed its tactics and began a series of stern attacks from 800 yards, closing to 600. Apparently it intended to silence the rear gunner. But he continued to reply, and the pilot went on turning to avoid the enemy's fire. Then the F.W. circled to a point ahead of the Hampden and made a series of attacks from the starboard bow. The pilot repeatedly turned towards it, whereupon it broke away to starboard of him, except on one occasion when it broke away in front. The rear gunner opened fire whenever it came within his field, and thought he made some hits. Finally, about 1215, the enemy set course for France.

The rear gunner had fired a total of 800 rounds, and throughout the whole engagement he coolly gave directions which enabled the pilot to take avoiding action. The wireless operator, in spite of his wound, made several attempts to bring the amidship gas-operated gun into action.