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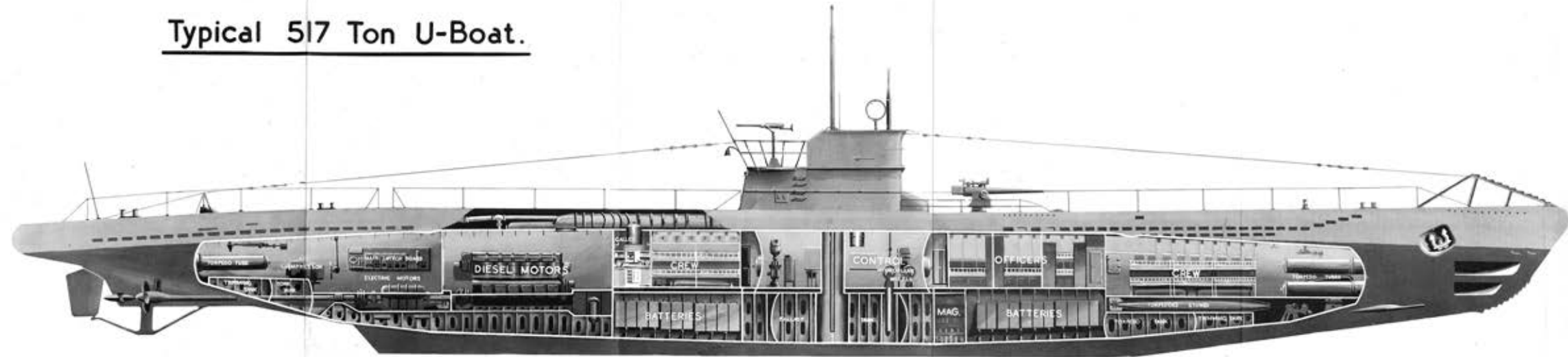
COASTAL COMMAND REVIEW

November, 1942

No. 7

**HEADQUARTERS,
COASTAL COMMAND
ROYAL AIR FORCE**

Typical 517 Ton U-Boat.



COASTAL COMMAND REVIEW

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→ * This class of U-Boat is about 215 ft. in overall length. The drawing is intended to show as clearly as possible the method of dividing the interior, and is therefore simplified by the omission of pipes and other complications.

EDITORIAL

Coastal Command, November, 1942

The month of November, 1942, will long be remembered as one which saw the opening up of a new front on the North African Coast. In the days when it was being planned, it was known as Operation "TORCH": and it has been proved to have been well named, for its success has kindled a light throughout the world, the beams from which have penetrated even the darkest recesses of the Occupied Countries.

Such an operation, by its very nature, is fraught with potential dangers. In this case, the magnitude of the forces involved and the distance over which they had to be transported from the shores of this country and the United States of America, provided many opportunities for the intention to be discovered and for interference upon a serious, and perhaps decisive, scale. That convoys numbering over 800 ships arrived without molestation until the final phase, was an achievement in itself, the credit for which must largely lie in the skilful routing of the convoys, the efficacy of air cover and the measures taken to "mislead and mystify" the enemy which were particularly effective.

It is not yet possible to give a coherent account of the operation in detail partly on the grounds of security and partly because, owing to the activity still continuing in the area, full information is not yet available. But some indication of the part played, particularly by the air, will doubtless be of immediate interest.

Coastal Command's Planning Staff were faced with three areas of probable danger:—

- (a) From the point of departure through the Bay of Biscay, flanked by the submarine bases of the Biscay ports and traversed by outgoing and returning U-Boats;
- (b) The approaches to the focal area of Gibraltar from the West; and
- (c) The waters of the Western Mediterranean in the neighbourhood of where the Allied landings would take place.

It goes without saying that such an operation would entail a readjustment of the forces of the Command and certain Squadrons were withdrawn from the line during the month of October and prepared for service overseas. This, in part, explains the fall in operational flying for that month. On the other hand, the demand to cover the outgoing convoys as long as possible and to fly intensively over the Bay to prevent the U-Boats making a last-minute dash to the convoys, necessitated additional assistance for the home-based aircraft. With this object in view, certain Squadrons of Bomber Command and VIII (U.S.) Bomber Command were attached to this Command and provided invaluable aid. As the convoys passed out of range of the home-based aircraft, they were picked up, with as little interval as possible, by those operating from Gibraltar. The outcome of this part of the operation was that no convoy sailing from this country was attacked west of Gibraltar, although U-Boats were at times in their vicinity in numbers.

As was to be expected, the growing accumulation of shipping at Gibraltar did not escape the attention of the enemy, who built up a particularly heavy concentration of German and Italian U-Boats on the eastern approach to the Straits. It was clear, too, from their subsequent actions that these had received orders to attack, almost without regard for safety, shipping passing through the area. From all accounts, between 2nd and 23rd November, that part of the Mediterranean had much in common with a trout stream at the height of the mayfly season: and the anglers—the aircraft and surface vessels—profited accordingly. It is probable that of some 60 U-Boats in the area west and east of Gibraltar, 35–40 were concentrated between the Straits and 8° E. The records are not complete, but at least 110 sightings and 64 attacks were made during these three weeks. Many assessments are outstanding, but it can be said with confidence that at least 4 U-Boats were definitely sunk and that there are grounds for believing that of not less than 29 damaged, 4 were seriously damaged and probably sunk. During the period from 23rd October to 30th November, Gibraltar flew over 4,000 hours on Convoy Escort and Anti-Submarine Sweeps, 75 per cent. of the effort being on the latter.

It is hoped that in later issues further information may be given concerning the organisation and incidents of the operation and the lessons to be learned from it. For the present, it must be sufficient to note the effort put out by Coastal Command and those who flew with them whilst it was taking place. A total of over 17,000 hours, including flying in the Bay of Biscay, between 23rd October and 30th November, indicates its volume: the safe arrival of the convoys at Gibraltar, and the relatively light losses thereafter, point to its efficacy: the disappearance of the U-Boats from the North Africa coast and the extreme wariness of the few seen since, leave little doubt as to the tale of destruction and damage during those vital days. The operation as a whole was once more an outstanding example of effort co-ordinated not only between the Services but also between Allies: and its success was due to the manner in which each made its allotted contribution. It was a combined operation and a combined victory.

Meanwhile, the daily work of the Command has gone on through the month. Exclusive of Gibraltar and North Africa (at least 112 sightings and 66 attacks), there were 35 sightings of U-Boats, followed by 20 attacks. Enemy fighter opposition in the Bay has shown signs of stiffening, and a tendency has been noted for them to fly in formations of 3–6 aircraft. There have been several notable

combats amongst which may perhaps be mentioned that of **U/330** (U.S.A.A.C.) which accounted for three out of five enemy aircraft on 21st November, and that of **Z/311** on the 23rd, which resulted in one enemy aircraft being destroyed and two damaged. The Beaufighters also took their toll. Altogether, of 89 enemy aircraft encountered, 13 were destroyed, and 15 damaged; 61 combats were without observed result.

There was again activity by enemy supply ships in the Bay, and considerable effort was diverted to attacking them. Attack at 350-450 miles' range, and generally on information lacking in the necessary precision, presents a very difficult problem of time and space. One outward-bound tanker was damaged and forced to shelter in a neutral port, this being the third occasion on which it had attempted to get to sea, only to be frustrated by aircraft of the Command.

A combined torpedo bomber and fighter attack by aircraft resulted in claims that one merchant vessel of 7,000 tons, one of 1,500 tons and an escort vessel were hit, in addition to claims in other actions of hits on one merchant vessel of 3-4,000 tons and one of 2,000 tons. In all, 89 individual sorties took place, resulting in claims in respect of nine enemy vessels.

The year will be running to its close as this issue comes off the presses, and it may not be inopportune to look back for a moment on the progress made in the last 12-18 months. The necessary calls from overseas have led to many dreams of wealth in aircraft being dashed to the ground and most Units, and Training in particular, have found, like the Virgilian bees, that much of their work has been for others. None the less, sufficient has remained to leave its mark on the enemy, to provide the essential information and, above all, to make the power of the air felt upon the U-Boat. An offensive policy begun in June, 1941, drove the U-Boat to the then limits of aircraft range, and its continuation throughout 1942, extended this to 600 miles and beyond. The fear engendered has resulted in a large measure of safety being accorded to convoys, as described elsewhere in this issue. The technical advances have been far-reaching, if not spectacular. The introduction of Torpex, the 25 ft. setting, the Leigh Light, are the outward and visible signs of technical progress which has been set in motion. Training commitments have grown and represent an increasingly important responsibility—where there were six O.T.U.s and schools in June, 1941, today there are twelve. Then the aim was 81 crews per month: today it is 276 crews per month.

The practical problems of anti-submarine warfare have received even closer scrutiny than hitherto, and the introduction of the system of crew interrogation at Headquarters has gone far to cement mutual understanding, to create confidence and to build up a fund of information on operational questions. Both on this and other subjects, the Operational Research Section have turned the search-light of scientific analysis. In addition to enunciating theory and deductions from operational experience, our scientists have also made material contributions. White Camouflage, the Low Level Bombsight and the use of the shallow setting are among the developments they have proposed and fostered.

Nothing in war can be static. 1942 has seen greater progress than perhaps has taken place in any period of time since the outbreak of war. The achievements of the captains and aircrews, the Stations and the Groups, in the practical matters of war have exerted a marked influence on the war at sea and the maintenance of our sea communications. Air power has shown itself to be of outstanding importance in the control of sea communications and an essential element in the exercise of sea power. Another milestone on the road has been passed, but others lie ahead; the journey is by no means finished nor has the level ground yet been reached.

The total flying for October—44,114 hours, a decrease as compared with September (48,324 hours), was divided into:—

Operational, 14,971 hours (September, 16,526 hours), and non-operational, 29,143 hours (September, 31,798 hours). The category non-operational includes training, whether in O.T.U.s and Schools or in Operational Squadrons, and miscellaneous flying. The figures exclude flying by units operating with, but not belonging to, Coastal Command. On an all-inclusive basis, the operational flying in October totalled 17,344 hours.

I.—ANTI-SUBMARINE

Anti-Submarine Operations in November

The recent operations in the Western Mediterranean have involved the movement of large numbers of U-Boats down to these waters and, as a result, operations in the Western Approaches have been quieter than in October (*see* Chart 1). Only three ships out of a total of 16 sunk east of 45° W. were inside 600 miles from Coastal Command bases in the North Atlantic; all belonged to the Convoy SC 107. (*See* p. 10.)

On 1st November, sweeps to the south of Iceland by four U.S.N. P.B.Ys. (Catalinas) resulted in four sightings of U-Boats and two attacks. On the 5th, SC 107 came into the area covered by Coastal aircraft from Iceland, after a series of attacks following the convoy almost from the Newfoundland coast. Two Liberators of 120 Squadron provided close escort from 1108 to 1958, and one of them sighted three U-Boats and attacked two; one of these attacks appears to have been very successful. The convoy was then in about 58° 30' N., 33° 00' W. and, as a result of these attacks and of aircraft protection on subsequent days, reached home without further loss.

No other mass attacks on convoys developed during the month within range of land-based aircraft, although two U-Boats were sighted and attacked on sweeps round the Convoys SC 108 and SC 109, on the 15th and 25th respectively.

Offensive operations against U-Boats in transit north of Scotland led to three sightings but no attacks.

In the Bay of Biscay heavy air escort has been given to the "Torch" convoys, in addition to the usual patrols in the Bay. No sightings were made by the aircraft actually escorting these convoys, but two (both followed by attacks) were made by aircraft looking for their convoy or

on passage. In addition, 16 sightings, leading to 10 attacks, resulted from the usual Bay patrols.

In all, Coastal Command aircraft based on the United Kingdom and Iceland have made 35 sightings and 20 attacks. This rather low number has been compensated by the 112 sightings and at least 66 attacks obtained from Gibraltar and North Africa; four of these attacks led to obvious sinkings, and several more (not yet assessed) appear extremely promising.

Of the 35 sightings of U-Boats made in the area covered by Coastal Command, excluding Gibraltar and North Africa, six were followed up by hunts involving one sortie each, the average time of search being three hours; no second sightings resulted.

Shipping Protection

The shipping passing through the Coastal Command area (excluding Gibraltar), and the aircraft protection given to it amounted to:—

	<i>Number of sailings.</i>	<i>Number protected.</i>
Naval Forces and Convoys..	66	54
Independents.. .. .	95	12

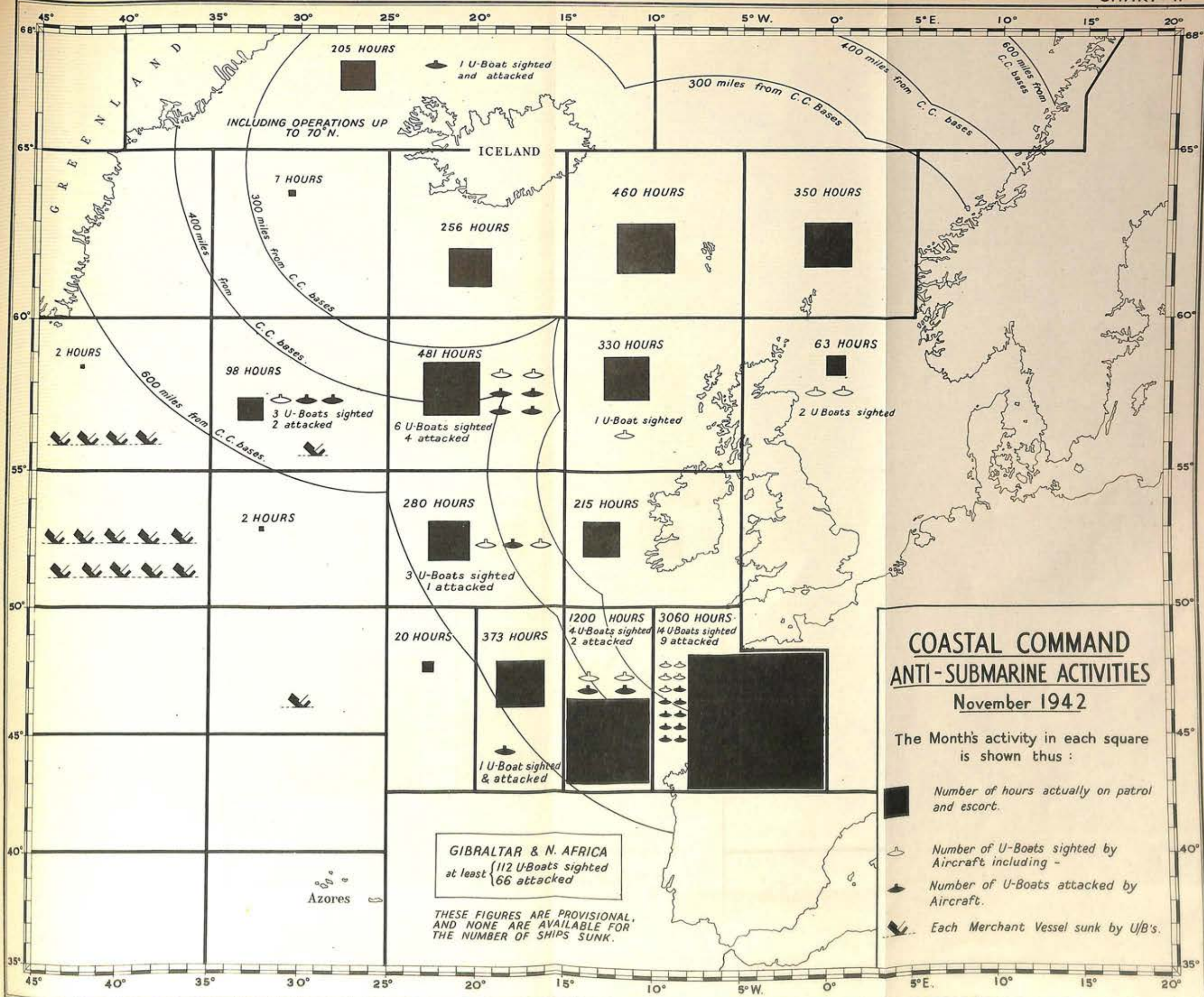
This protection was given by 324 sorties, as follows:—

	<i>ESCORTS</i>		<i>SWEEPS ROUND CONVOY TRACKS.</i>
	<i>Met</i>	<i>Failed to meet</i>	
Convoys and Naval Forces ..	98	55	152
Independents ..	19	0	

Analysis of Operations

The table shows the extent and results of Coastal Command's anti-submarine activities during November (excluding Gibraltar and North Africa), in terms of the different types of operations. Hunts, offensive sweeps and anti-submarine patrols are classed together as Offensive Operations.

	All Anti-Submarine Escorts.	Offensive Operations.			Chance.	Coastal Command Total on Anti-Submarine work.
		Around Convoy Tracks.	Bay of Biscay.	Elsewhere (mainly between Scotland and Iceland).		
Sorties	117	152	765	304	—	1,338
U-Boats sighted	6	3	16	8	2	33
Average sorties per sighting	20	51	48	38	—	41
Hours actually spent on patrol, omitting passage time.	454	833	4,526	1,577	—	7,390
Average duration of patrol ..	4 hours	5½ hours	6 hours	5½ hours	—	5½ hours



Sightings and Attacks by Squadrons, November.

Aircraft based on the United Kingdom or Iceland:—

Squadron.		Sightings.	Attacks.
59 Liberators	St. Eval	4	4
84 U.S.N. P.B.Ys. (Catalinas)	Iceland	6	4
120 Liberators	Iceland	3	2
172 Searchlight Wellingtons	Chivenor	1	1
206 Fortresses	Benbecula	1	1
220 Fortresses	St. Eval	1	1
224 Liberators	Beaulieu	1	1
304 Wellingtons	Dale	1	0
404 Beaufighters	Dyce	1	0
405 Halifaxes	Beaulieu	5	2
423 Sunderlands	Lough Erne	2	0
(One on air/sea rescue duty.)			
502 Whitleys	St. Eval	4	3
612 Whitleys	Wick	2	0
10 O.T.U. Whitleys	St. Eval	2	1
P.R. Squadrons		1	0
		35	20

Aircraft based on Gibraltar and the Western Mediterranean (subject to revision):—

Squadron	Sightings.	Attacks.
179 Searchlight Wellingtons	5	2
210 Catalinas	10	4
233 Hudsons	32	17
500 Hudsons	44	31
608 Hudsons	17	12
Meteorological Transit	3	0
	1	0
	112	66

Recent Attacks on U-Boats

Debris in the Explosion Mark

U 597

Liberator H/120 was on passage to a convoy south-west of Iceland on 12th October, when at 1223 hours it sighted a wake 50° on the starboard bow eight miles away. The pilot turned to starboard, and approached down sun, identifying a 517-ton U-Boat travelling at ten knots 15 miles from the convoy. Diving to attack from the U-Boat's port quarter at 15° to the track, six Torpex depth-charges were released from 75 ft. while the U-Boat was still on the surface; two more depth-charges hung up. The U-Boat was completely covered by the stick both in line and range, from bows to stern. During the explosion of the first depth-charge right on the stern, three large and several small pieces of metal were thrown up in the air, and one large oval piece of metal flew past the Liberator's rear turret (Plate 3). As Nos. 3 and 4 depth-charges were exploding amidships close up to the starboard side, the U-Boat shuddered and lifted out of the water, leaving the deck clearly visible, with the water pouring off it. As the spray subsided, the conning-tower and one periscope appeared in the middle of the disturbed area; they hung there for about seven seconds, and then sank vertically with no forward movement. When the spray had settled, a white cylindrical object was bobbing up and down in the disturbance. Soon afterwards a patch of oil appeared at the leading edge of the explosion mark, and a greenish-grey cylinder studded with bolts, measuring about a foot in diameter and projecting about five feet out of the water, was seen floating in this oil; it was still there when the aircraft left half an hour later. Probably this was an airtight part of the exhaust system. Photographs confirm nearly all this visual evidence and show large air bubbles breaking surface. Judging by the amount of wreckage and oil, this very good approach and excellent attack were fully rewarded. (56° 50' N., 28° 05' W.)

Wreckage and Oil Prove Damage

Catalina G/202 from Gibraltar was on patrol in the Atlantic on 19th October, when a surfaced German U-Boat was sighted five miles off at

1612 hours. It had a gun forward of the conning-tower and a cannon at the after end of the bridge. The aircraft dived to attack from the U-Boat's port beam; as it approached, the U-Boat opened fire with light flak from the bridge, following up with the main gun forward of the conning-tower. The Catalina took slight evasive action by turning to port, finally attacking from the U-Boat's port quarter with eight Torpex depth-charges while the U-Boat was still on the surface. The stick exploded across the U-Boat about 20 ft. abaft the conning-tower; four depth-charges were seen to explode on the port side. At the time of the attack two men were still on the conning-tower, and about four manning the cannon. The port blister-gunner fired 200 rounds at point-blank range, scoring hits on the hull, the conning-tower and the crew of the cannon. When the spray settled, the U-Boat had disappeared, leaving a patch of oil about 100 ft. across, and two pieces of wreckage, one of which appears in a photograph as a square box-like object. This wreckage, together with the oil, is definite proof of damage, how serious it is impossible to say. (40° 16' N., 21° 27' W.)

A Searchlight Attack

Wellington B/179, when patrolling south-east of the Shetlands at 2250 hours on 21st October, obtained a Special Equipment contact on the port beam at a range of five miles, but this disappeared almost at once. The pilot continued on the same course for four minutes, and then turned back on the reciprocal, but no contact was obtained when the Special Equipment was switched on over the estimated position of the previous blip. Accordingly, at 2309 the aircraft resumed its creeping line ahead search, and at 0106 obtained another contact five miles dead ahead. The pilot lost height from 3,000 ft. as fast as possible and homed at 180 knots, switching on the searchlight at a range of a mile and a half whereupon a U-Boat was seen surfaced. It was at once attacked from the starboard beam with four Torpex depth-charges, and the rear gunner saw four explosions, two on each side of what appeared to be the white bow wave or wash of the U-Boat. Two flame floats and two practice

bombs were dropped at the same time as the depth-charges. Two minutes after the explosion, a patch of oil about 60 yards across was seen; this spread and was still visible when the aircraft set course for base at 0125 hours, so that it could not have been merely depth-charge residue, which fades after four or five minutes. No other evidence could be observed, except that for two minutes air-bubbles came up in the centre of the oil-patch. (53° 59' N., 00° 56' W.)

Many Oil Patches

At 1217 on 24th October, **Whitley H/10 O.T.U.** was flying in 20 miles' visibility over the Bay of Biscay, when a U-Boat was sighted three miles away on the starboard quarter; it may have only just surfaced, for the decks were awash. The pilot immediately turned to starboard, and then to port, but the U-Boat dived when the aircraft was still a mile away, so he circled to starboard. During this turn, however, the U-Boat's periscope and conning-tower reappeared, so the aircraft continued to circle and attacked from its starboard quarter with four T.N.T. depth-charges fitted with nose and tail units, less than five seconds after the U-Boat disappeared again. The depth-charges straddled the track just ahead of the swirl, between the conning-tower and the stem, and must have exploded at lethal depth. About half a minute later the bows of the U-Boat lifted above the water, followed immediately by three-quarters of its length apparently on an even keel. It began to roll heavily, but at that moment the rear-gunner's view was obscured by the aircraft, and nothing more was seen of the U-Boat. Three minutes later many patches of thin oil, varying from two to six feet in diameter, were seen on the surface where the explosions had occurred, over an area of 100 ft. across. These oil patches were still visible nearly an hour later. It is evident that the U-Boat was thoroughly upset and suffered damage to the fuel tanks. (47° 49' N., 13° 02' W.)

Another Searchlight Attack

Wellington A/172 was flying over the Bay of Biscay at 0120 hours on 27th October, when a Special Equipment contact was received 4½ miles on the starboard bow. At a distance of about a mile and a quarter the U-Boat was sighted visually and at half a mile it was picked up with the searchlight. It was a 517-tonner, with a cannon aft on the conning-tower. The aircraft attacked head on, on the reciprocal of the U-Boat's tracks, with four Torpex depth-charges, which exploded between the bows and the conning-tower, completely enveloping everything forward of the conning-tower in spray. The rear gunner raked the deck with 200 rounds. On the second run, made from the starboard beam three minutes after the first, the U-Boat was found lying stationary 2½-3 lengths ahead of the explosion marks. It opened fire with its cannon, and the Wellington's rear gunner replied with 300 rounds. After this no more was seen of the U-Boat, and no further S.E. contacts on it could be obtained. (45° 30' N., 10° 55' W.)

A Lost Opportunity

An excellent opportunity of sinking a U-Boat was lost by a Hudson pilot because of a mistaken belief that his depth-charges would not prove

lethal while it remained fully surfaced, though in fact they were of Mark XI, the whole object of which is to ensure complete efficacy by shallow explosion. The pilot had sighted the U-Boat from 8 miles. Since it showed no intention to dive, and he anticipated that the crew might be manning their guns, he attacked only with his guns, though he passed over its whole length at a height of about 25 ft. Many hits were registered on the deck and bridge, but none of the crew appeared. By the time the aircraft had completed its circuit the U-Boat had dived, and the second attack was made with four depth-charges ten seconds after the conning-tower's disappearance. The stick was correct for range, but there is insufficient evidence as to line. A minute and a half later a patch of thin oil appeared just ahead of the explosion mark, followed by a patch of small oil-bubbles. Half a minute after this about 15 ft. of the U-Boat's bows broke surface at an angle of 45° some distance ahead of the explosion mark, but soon disappeared again at the same angle without any forward motion. The evidence of the oil and the reappearance of the bows indicates that the explosions were very near the U-Boat and badly upset its trim, but no serious damage can be claimed. (59° 10' N., 17° 59' W.)

U-Boat Hits Back

Hudson W/233 was flying just below cloud over the Mediterranean, between Algeria and the Balearics on 1st November, when on emerging into a clear patch a wake was sighted ten miles off, at 1145 hours. The aircraft at once turned towards it, and on closer approach identified a U-Boat, with one gun fairly close ahead of the conning-tower, proceeding at 12 knots. Four Torpex depth-charges were released from 150 ft. in an attack from the U-Boat's port quarter at an angle of 20° to the track, 20 seconds after it had disappeared. The tail-gunner saw the depth-charges drop on the line of the U-Boat's advance 75-80 yards ahead of the swirl, but thought the centre of the stick overshot. Immediately after the explosion the U-Boat surfaced on the same mean course, but steering was erratic, and the aircraft, which had circled ready for a bomb attack, approached up track and released an A/S bomb, which exploded 20-30 yards off the U-Boat's starboard bow. While the U-Boat was on the surface, it fired at the Hudson with cannon and machine-gun, the aircraft replying with 500 rounds from the turret and one burst with 100 rounds from the front guns. The aircraft was hit in the tail-plane by cannon-shell, and shortly after the bomb attack was obliged to set course for base. On paper both these attacks were out of lethal range, the bomb falling out of damaging range as well, but the fact that the U-Boat reappeared on the surface suggests that the depth-charge attack did sufficient damage to make it impossible for the U-Boat to continue diving. (37° 35' N., 02° 22' W.)

An Almost Certain Kill

U.S.N. P.B.Y. H/84 was patrolling north of Iceland on 5th November at 1120 hours, in visibility five miles, when a 517-ton German U-Boat was sighted four miles away on the port bow. The crew of the aircraft thought they could see "U.10" painted on the conning-tower. The aircraft turned to attack, and simultaneously the



SUNK
US97

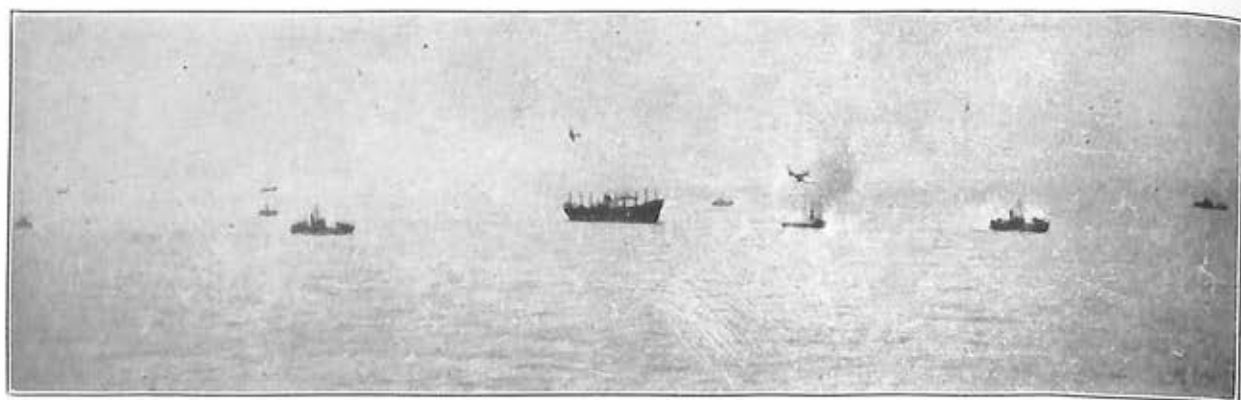
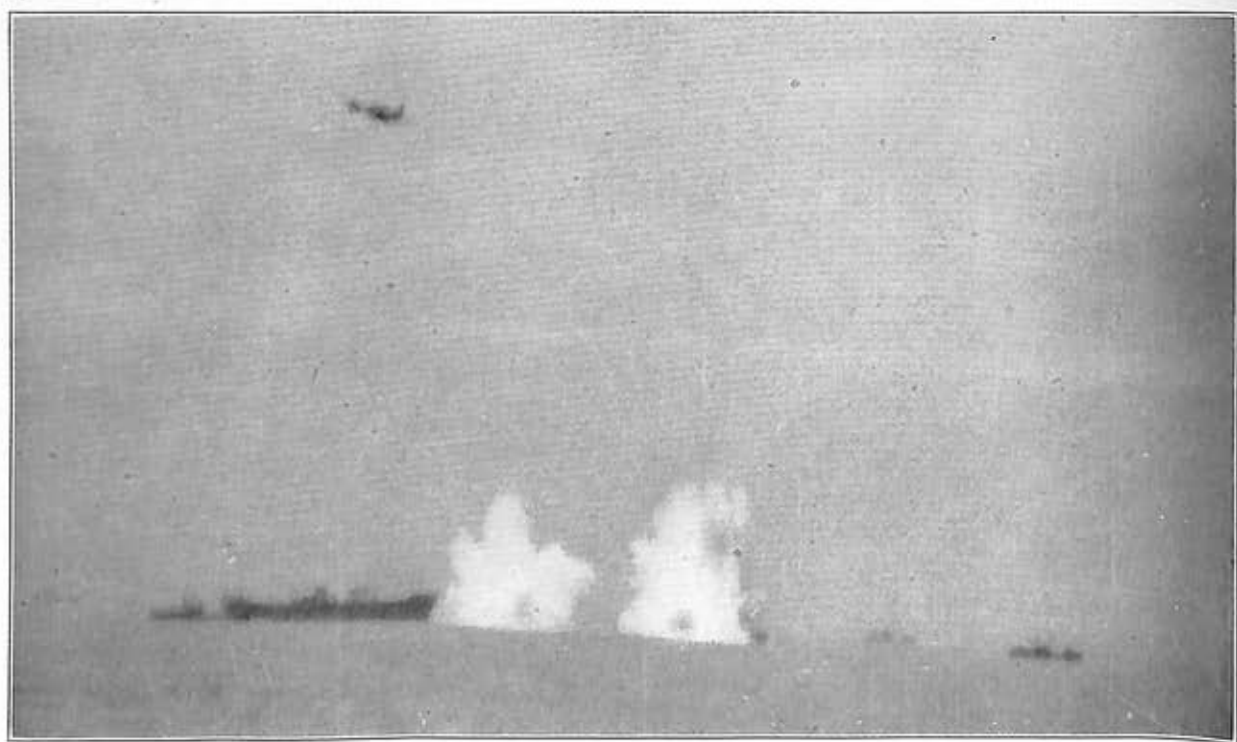
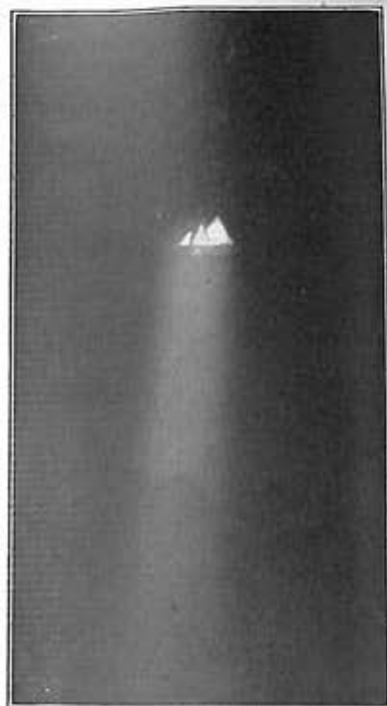
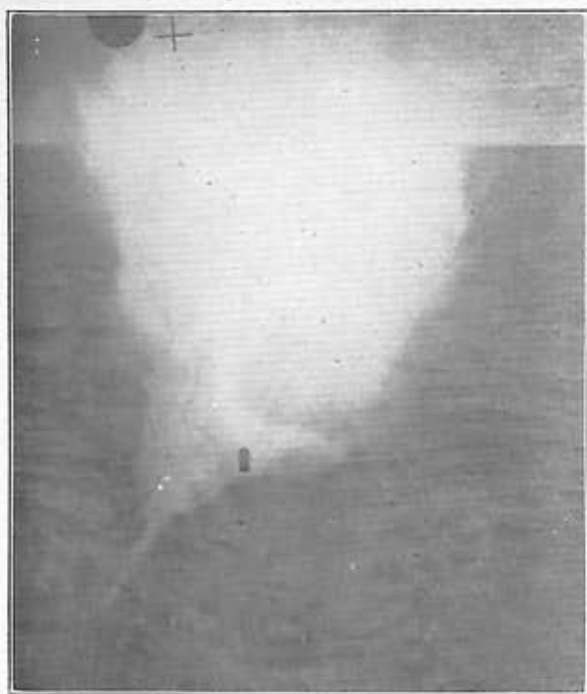


SANLDR
T M BULLOCK
(BOTH ATTACKS)

Attacks on U-Boats by H 120.—(Top) Pieces of metal flying off during explosions, October 12th (see page 5). (Bottom) From photographic analysis, about 17 ft. of the stern is visible, the remainder being covered by a completely lethal straddle. November 5th. Almost 3 minutes later an air bubble 6 ft. in diameter appeared; it expanded into a patch 30-40 ft. long and persisted for at least 8 minutes.

US9
D. H. G. 127

Bottom
Bubble



(Top left) **Depth-charge advance under water** (see page 11) ; attack on U-Boat by S 53 off South America, October 9th.
 (Top right) **French Tunnyman caught in beam of Leigh searchlight** (172 Squadron) (Middle and bottom) **Beaufighter**
attack on a convoy off the Dutch coast (see page 15) ; a torpedo hit was claimed on the large vessel, another on a
 smaller vessel, and a hit or very near miss with bombs on the tug (254 Squadron).

U-Boat turned at right angles to port. The aircraft finally attacked down track on reciprocal course, releasing from 125 feet, two 650 lb. and two 325 lb. depth-bombs, which accidentally fell in a salvo, while the U-Boat was still on the surface, though its decks were almost awash. The eight or nine men who were in the conning-tower when the bombs were released either jumped or were washed overboard. The U-Boat was entirely hidden by the spray of the explosions for a length of about 40 ft. abaft the conning-tower, and when the spray subsided it had vanished. Seven live crew remained in the water, together with quantities of wood splinters, oil and unidentified objects, which were floating in the explosion mark. The oil covered an area about 200 ft. across, and appeared in quantity about one minute after the explosion. There seems little doubt that this attack succeeded in destroying the U-Boat. (67° 40' N., 18° 32' W.)

Countering Evasive Tactics

On anti-submarine patrol in the Mediterranean at 1520 hours on 6th November, two days before the landing of Anglo-American forces in North Africa, **Hudson U/500** sighted an Italian submarine 12 miles away, north-west of Oran. The pilot dived to attack, and as the aircraft approached, the submarine took violent evasive action under full helm on the surface, opening fire on the aircraft rather inaccurately with a light A/A gun on its upper deck abaft the conning-tower. The submarine was zigzagging so rapidly that the pilot thought a depth-charge attack would be too inaccurate. Accordingly, he carried out two separate bomb attacks from 2,000 ft., releasing one 100 lb. A/S bomb each time. During these attacks the rear gunner fired 30 rounds at the submarine, and claims hits on both the conning-tower and the crew manning the A/A gun. The first bomb could have caused no damage, because it fell 40 yards astern, but the second was so unpleasantly close—six yards astern—that the submarine evidently decided it had better escape by diving. Half a minute after it submerged, the Hudson attacked again with four Torpex depth-charges, which fell 300 yards ahead of the swirl, and though too shallow would undoubtedly have given the U-Boat's crew a severe shaking. (36° 33' N., 00° 25' W.)

An Under-water Sighting

The first known case of a U-Boat being picked up at a distance, when well under water and showing no periscope, occurred when **Hudson U/500** was patrolling off the Balearics on 7th November, the day before the Algerian operation began. During the morning, when some 60 miles from a naval force, the pilot saw a periscope, which disappeared before any attack could be made. He circled for 5-10 minutes, and then carried out baiting tactics for 20 minutes. Returning, he circled the position for a further quarter of an hour, and then sighted two miles away the silhouette of a U-Boat proceeding just below the surface in a westerly direction. This observation was made when flying at 2,500 ft. in 2/10 cloud, base 1,500 ft., sea calm and maximum visibility. The aircraft attacked from the U-Boat's port bow, three Torpex depth-charges being released (one hung up) from 100 ft. (C47433)

at 1125 hours, when the U-Boat was just below the surface, presumably at periscope depth. The stick exploded with its centre about 20 yards on the U-Boat's starboard bow. Immediately afterwards the U-Boat suddenly rose to the surface, and the pilot at once attacked with his one 100 lb. A/S bomb, which exploded alongside the now surfaced U-Boat, half-way between the bows and the conning-tower. The immediate result was that the stern disappeared under water, and the bows rose up at an angle of 60° clear of the water. Some 8-12 ft. of the bows remained above water at this angle for four or five minutes, and then slid below the surface with no forward movement. A succession of air bubbles, 5 ft. across, rose to the surface continuously for ten minutes, after which the aircraft was obliged to return to base for lack of fuel. There is no question but that this U-Boat was seriously damaged, and there is good reason to hope that it may have been destroyed. (30° 08' N., 02° 15' E.)

A Probable Kill

Liberator C/59 was patrolling over the Bay of Biscay on 10th November, when an inward-bound U-Boat was sighted at 0907 hours, seven miles away on the starboard bow. The Liberator lost 5,000 ft. in 62 seconds, and though the captain decided to attack at 30° to the track, he could not turn in time because of the very high speed. He finally managed to pull the aircraft over, and went in to attack from the U-Boat's port beam, releasing six Mark XI Torpex depth-charges from 100 ft., while it was fully surfaced. On the approach some half-dozen members of the crew were on or near the bridge and they opened fire from a machine-gun mounted right in front of the conning-tower. The Liberator's rear gunner opened fire as the aircraft passed over the U-Boat, but saw nobody on deck. He considered the U-Boat was straddled by the stick, two depth-charges falling short, No. 3 bouncing off the after-part, and the rest falling beyond it. The aircraft did a tight climbing turn to port, and attacked again, 45-60 seconds after the first attack, on the reciprocal track from the U-Boat's starboard beam, just as it was submerging. The remaining six depth-charges were released from 100 ft. while part of the conning-tower was still above water, and fell across the U-Boat's line of advance, 25-30 yards ahead of the conning-tower. The Liberator then circled to observe results, and saw a patch of light blue oil-bubbles covering about one-sixth of the area of the second explosion mark; they were first observed a minute or two after the second attack. In addition to the usual depth-charge scum, there were some large black pieces of debris, 1-4 ft. long, near the oil-bubbles. Two minutes after the second attack the bows appeared above the surface, gradually rising at an angle of 60° until some 15 ft. of the U-Boat was protruding. It advanced at about one knot, and remained in this position for six minutes, while the aircraft circled and machine-gunned it at close range with all available guns. At 0916 hours the U-Boat finally settled down to a more even keel, with the bows just above water and one foot of the conning-tower also above the surface. By now it had lost all way, and gradually sank below the surface at the same angle. The aircraft was present for a further 71 minutes, but saw no more. The

oil-bubbles and debris that followed this attack, together with the reappearance at a steep angle, indicate serious trouble, and the slow disappearance still bows up may mean such loss of control as to result in eventual foundering. In this case

the pilot was quite right not to carry out ~~homing~~ procedure; with first-class attacks it is more important to keep on the scene so as to be able to note and photograph significant after-results. (46° 27' N., 08° 43' W.)

The Employment of Aircraft in Convoy Protection

The effectiveness of aircraft used offensively as a means of ensuring the safe passage of convoys has been a matter of known fact for many months past. Experience has shown, and it is borne out by the charts opposite page 9 of the August, 1942, number of the *Monthly Anti-Submarine Report*, that such action can drive out and virtually neutralise the U-Boat within the range of aircraft, provided that the latter are used in the best manner to exploit their inherent advantages. In the words of a recent article:—

“It is not difficult to see why submarines fear aircraft more greatly than they fear surface craft. In the case of the surface craft, it is usually the submarine which brings off surprise, and owing to its ability to dive and its high speed on the surface, the submarine has a very good chance of evading the counter-attack. When faced with aircraft, however, the speed and manoeuvrability which enable the submarine to avoid the surface vessel are entirely inadequate.”

There is nothing particularly new in this, as an enquiry into convoy safety and sinkings during the last 18 months will show, but in order to illustrate the point, the cases of five recent convoys have been chosen for analysis. Their track charts are given in Charts 2-6.*

HX 206. (Chart 2)

This convoy left Canada in the early part of September, 1942, and the voyage was uneventful until Sunday the 13th, when a report was received of the probable presence of a U-Boat shadowing the convoy. It was hoped, however, that action by one of the escort vessels had prevented contact being obtained. The convoy was then approximately in 56° 00' N., 30° 00' W.

Whether or not this particular U-Boat was put off the scent, subsequent events proved that the existence of the convoy was suspected. During the hours of daylight on the 13th, an offensive sweep of three Catalinas (73 U.S. Squadron) from Iceland was laid on between 0645 hours and 1850 hours to cover the area ahead of the convoy between 57° and 59° N. and 22° and 26° W. At 1430 one Catalina sighted a U-Boat at 57° 33' N., 22° 00' W. An attack was made without positive result, but it put down the U-Boat and probably deprived it of any chance of carrying out an interception. This sighting indicated that in all probability September 14th would be a critical day. Further, during the night of the 13th/14th at least two U-Boats were believed to be within 10 miles of the convoy. In retrospect, all the symptoms were present of a gathering concentration, and the fact that four U-Boats were

known to be in the area of the convoy on the 14th does not preclude the possibility of their actual numbers having been higher.

It was therefore decided that the addition of a close escort to the offensive sweeps planned would be justified. Accordingly, one Catalina (73 U.S. Squadron) was detailed for this duty, while two further Catalinas (73 U.S. Squadron), two Hudsons (269 Squadron) and one Liberator (120 Squadron) carried out offensive sweeps ahead of the convoy throughout the day of the 14th.

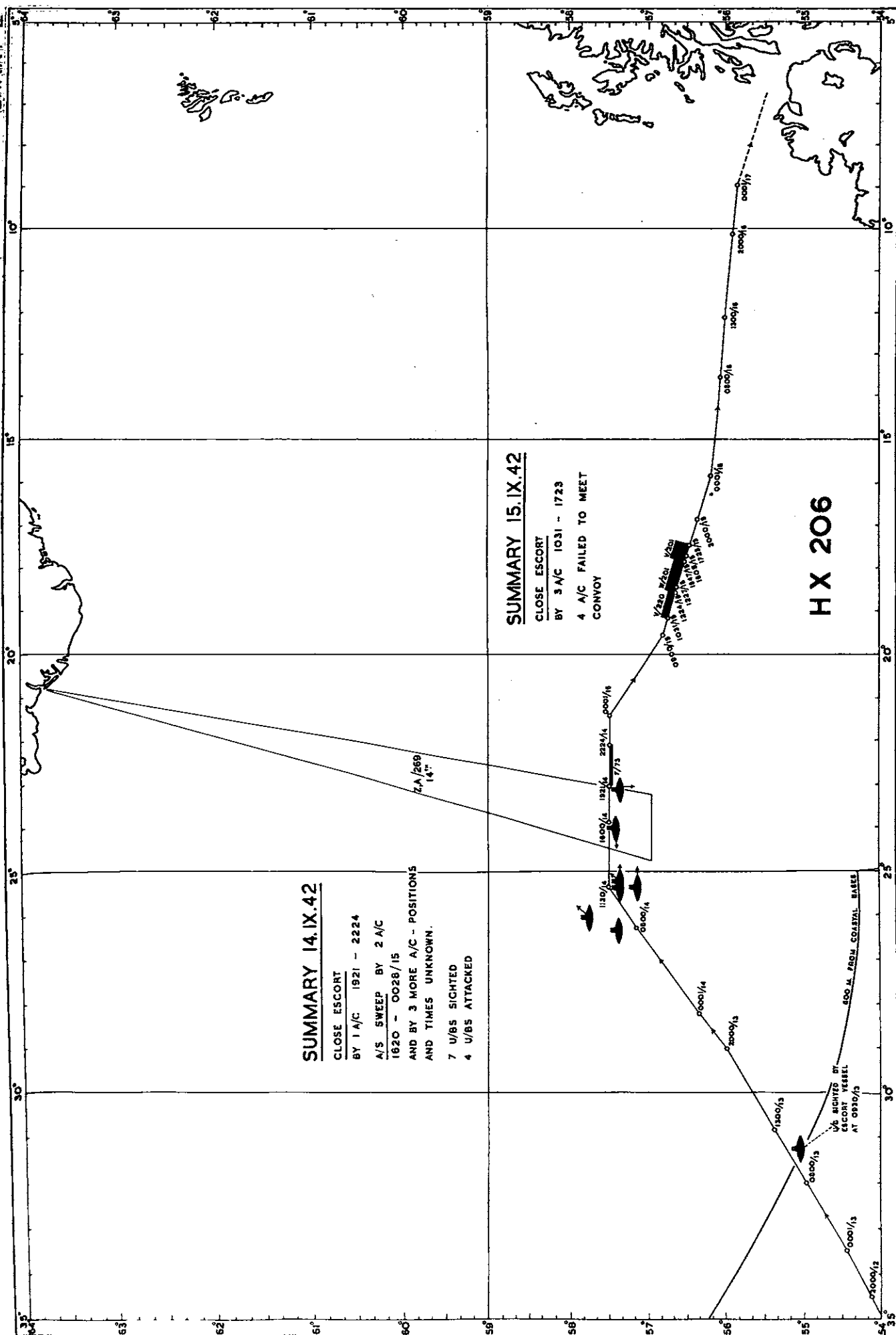
The actions which resulted showed clearly that a correct appreciation had been made. It transpired that there were at least four U-Boats present, two on either bow of the convoy. Sightings were obtained by the Catalinas at 0925, 0950, 1100, 1300 and 1404 hours. The first three U-Boats sighted submerged before an attack could be made, the fourth was attacked after 60 seconds and the fifth remained on the surface—five men on deck are believed to have been hit with machine-gun fire. During the attack another U-Boat was sighted two miles distant. At 1840 the Liberator sighted a U-Boat in position 57° 24' N., 25° 07' W. and made a good but inconclusive attack.

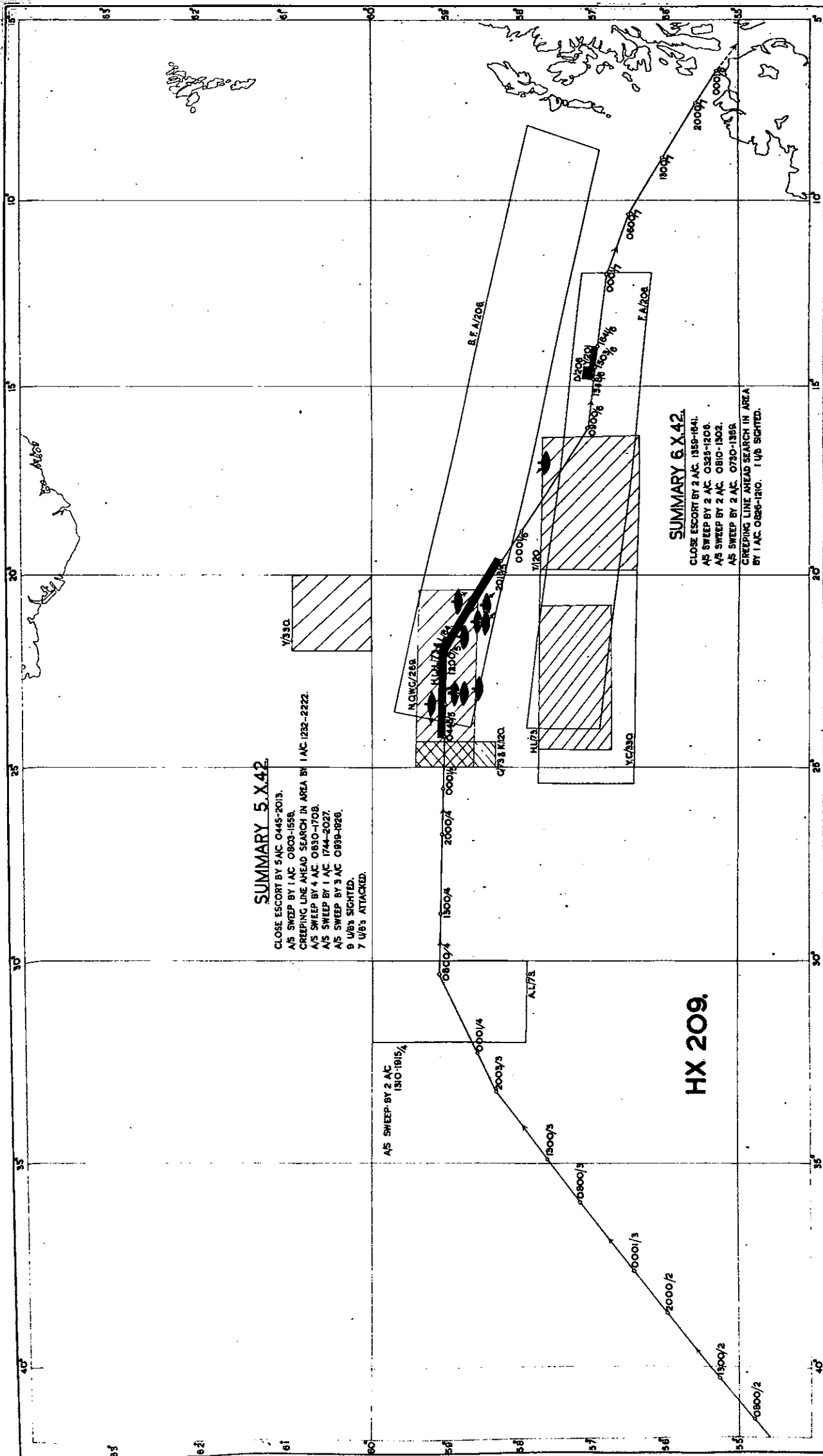
This action prevented a heavy attack on the convoy from materialising, but during the night there was evidence of some U-Boats still in the neighbourhood of the convoy. One contact was obtained by an escort vessel and an attack was made. 15th September opened with very adverse weather conditions and three aircraft failed to contact the convoy. A fourth was homed on to it by 1031 hours, and continuous escort was maintained with two further aircraft until 1723 hours. This successful homing and escort removed the last vestiges of threat and the convoy arrived safely in port two days later without loss after it had once come under air cover.

This action brings out the following points which are worth noting:—

- (a) Offensive action, even if, as in this case, it does not result in sinkings, is capable of breaking up a concentration in or approaching the convoy area.
- (b) The proper use of air cover enables the S.N.O. Escort to dispose his escort vessels to provide the highest protection for the convoy in those areas where they are likely to be most effective. This is a matter of considerable importance where the surface escort is relatively light.
- (c) Great value attaches to homing procedure and to communications between the escorting aircraft and the S.N.O. Convoy.

* Close escort by aircraft is indicated by a thick bar on the otherwise thin line of the convoy's route. Offensive sweeps by aircraft are shown as rectangles, with the Squadron letters and number attached whenever known. All U-Boats sighted are marked by solid symbols, to some of which an arrow is added to indicate the course at time of sighting. The approximate position at which each merchant-vessel was torpedoed is given by a symbol of a sinking ship.





SUMMARY 22.IX.42

V/120 FAILED TO MEET C/V BUT
SIGHTED SCATTERED UNITS
5 FURTHER SORTIES FAILED TO MEET C/V
2 U/B'S SIGHTED
1 U/B ATTACKED
CONVOY BADLY SCATTERED APPROX.
ROUTE IN DOTTED LINES

SUMMARY 23.IX.42

V/120 ESCORTED 0800-1352
D/73 1206-1255
F/73 1615-1740
1 A/C FAILED TO MEET C/V
1 A/C ON A/S SWEEP AREA NOT GIVEN
1 U/B REPORTED BY S/V
1 U/B SIGHTED BY A/C
1 U/B ATTACKED BY A/C

SUMMARY 25.IX.42
(NO FLYING)

SUMMARY 26.IX.42
J/1220 ESCORTED 1126-1150
2 A/C FAILED TO MEET C/V

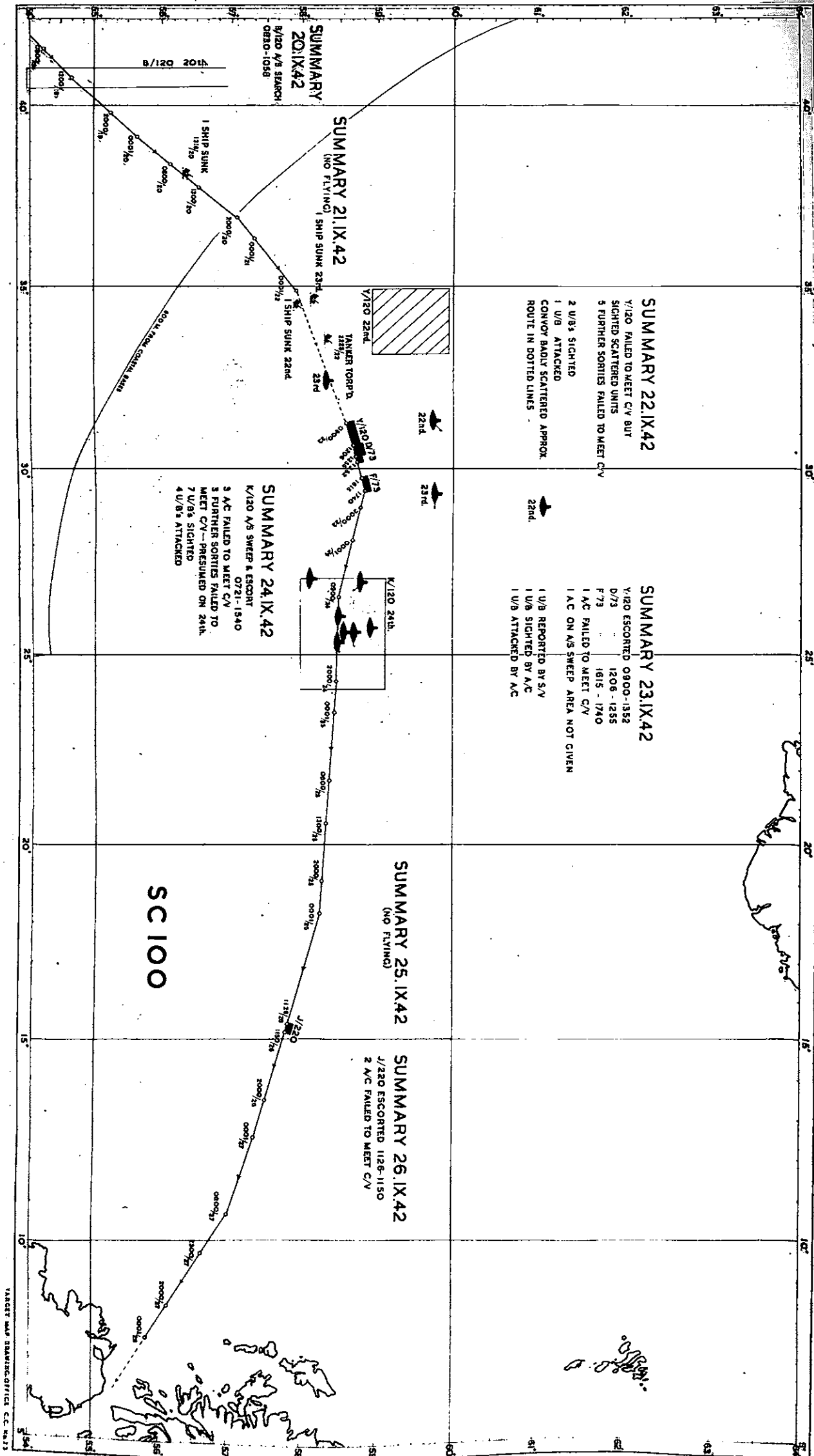
SUMMARY 21.IX.42
(NO FLYING)

SUMMARY
20.IX.42
B/120 A/S SEARCH
0830-1058

SUMMARY 24.IX.42

K/120 A/S SWEEP & ESCORT
0721-1540
3 A/C FAILED TO MEET C/V
3 FURTHER SORTIES FAILED TO
MEET C/V—PRESUMED ON 24th.
7 U/B'S SIGHTED
4 U/B'S ATTACKED

SC 100



- (d) As in most instances of convoy attacks, U-Boat concentrations and attack were rapidly built up. The reply to this is a continuous offensive directed against the U-Boat in transit or in its patrol billet with the intention of destroying or at least delaying, so that the timing of the attack miscarries and the U-Boat fails to reach the area and make contact before the convoy has passed.

HX. 209 (Chart 3)

HX. 209 came into an area of probable danger on the evening of 3rd October, and a sweep between approximately 58° and 60° N. and 30° and 32° W. was carried out by two Catalinas (73 U.S. Squadron) from Iceland without incident on the 4th. A Liberator (120 Squadron) was also despatched as escort but failed to meet.

No U-Boat put in an appearance, although there was an uneasy feeling that 5th October would be critical. The action taken to guard against this may be summarized as follows:—

- (a) Five Catalinas (four of 73 U.S. Squadron and one of 84 U.S. Squadron) maintained close escort from 0445 until 2013 hours from Iceland.
- (b) Four Hudsons (269 Squadron) maintained an offensive sweep in the convoy area from 0830–1708 from Iceland.
- (c) One Catalina (330 Norwegian Squadron) swept to the north of the convoy between 0803 and 1558 hours.
- (d) Three Fortresses (206 Squadron) maintained an offensive sweep between 0939 hours and 1926 hours.
- (e) One Liberator (120 Squadron) carried out a search between 1232 hours and 2222 hours.
- (f) One Catalina (73 U.S. Squadron) swept the area between 1744 and 2027 hours.

A total of 15 sorties was made with the following results:—

Sightings of U-Boats	10
Attacks	7
(one officially assessed as Known Sunk—269 Squadron).	

Patrols were laid on during the following day and one isolated sighting was made. It was patent, however, that the attack had been effectively broken up by air action. The convoy reached port on 8th October having suffered no losses from U-Boat action whilst under air cover.

SC. 100 (Chart 4)

Exceptionally bad weather conditions characterized the attack upon this convoy, and resulted not only in the despatch of aircraft being impossible until 22nd September, but also in the convoy being forced to heave-to and become scattered. Consequently, when it was possible to send out aircraft, considerable difficulty was experienced in meeting it.

This convoy may have been shadowed before the Western air escort were forced to leave it: in any case there is evidence that at least two U-Boats were in contact with it on 19th, 20th and 21st September. One vessel was sunk on the 20th between 35° and 40° W, two on the 22nd between 33° and 35° W., and one on the 23rd in the same area.

Two Catalinas (73 U.S. Squadron) and one Liberator (120 Squadron) were sent out as close escort from Iceland on the 22nd, but all failed to find the main body of the convoy. A second Liberator (also 120 Squadron) established touch with part of the escort force at 1035 and, at their request, was instrumental in rounding up a section of the dispersed convoy during the three hours it could remain in the area. This took place in the vicinity of 59° 24' N., 33° 59' W.

One of the Catalinas found four stragglers during the morning, and in the early afternoon sighted a U-Boat in position 59° 48' N., 31° 19' W., course 045° true and 30 miles north-east of the stragglers. The U-Boat submerged and was attacked ten seconds later; it resurfaced to submerge subsequently stern first. One Liberator when returning to base sighted a U-Boat which was put down before an attack could be brought off. U-Boats continued in contact with the convoy and sank two ships as noted above.

On the following day, the 23rd, two Catalinas (73 U.S. Squadron) and one Liberator (120 Squadron) escorted the convoy between 0900 hours and 1800 hours in position approximately 58° 30' N., 30° 00' W. Although without question U-boats were still close to the convoy, no sightings were made. A search for stragglers was made in response to the S.N.O.'s request and one merchant vessel was shown the way to the main body.

The events of 23rd and 24th September show clearly how, although close escort may prove a very present help to the convoy in times of trouble, offensive action is necessary to break up the potential source of danger. On the 24th a Liberator (120 Squadron) on an anti-submarine sweep sighted U-Boats in the convoy area at 1257, 1334, 1510, 1519 and 1543 hours. These were attacked with depth charges, A/S bombs and machine-gun fire, one at least being probably seriously damaged. In one of the two remaining incidents the U-Boat was forced to submerge and a destroyer and a corvette were directed to its position. One Catalina attacked a U-Boat near the convoy at about 1858, and a second at 1958 sighted a U-Boat at conning-tower depth in position 58° 56' N., 25° 24' W., five miles from a straggler.

This offensive action had its effect. It broke the pack cohesion and from the evening of 24th September until the convoy arrived in port on 25th September, no further sightings were made, nor did any attacks materialize.

The experience of this convoy is a particularly instructive one, some of the points to note being:—

- (a) The sinkings which took place on the 22nd and during the night of the 23rd, during the absence of aircraft;
- (b) The value of close escort on the 23rd, as a defensive measure, but its inability decisively to break the threat hanging over the convoy;
- (c) The conclusive action of the 24th which meant the final abandonment of the U-Boat attack;
- (d) The degree of co-operation between the aircraft and the escort in shepherding a scattered convoy and in directing surface vessels to profitable areas of search;

- (e) The importance of homing procedure and the need for perseverance in adverse weather conditions; one Liberator on 22nd September carried out the procedure for three hours without success, although his track later showed him to have been within 50 miles of the probable position of the convoy;
- (f) The ability of aircraft to operate in bad weather, as well as their limitations in this respect, and to sight and attack despite the sea and air conditions—one attack was made when a 60 m.p.h. gale was blowing.

In the interests of brevity notes upon the remaining two convoys will be condensed. Study of the track charts will supplement the written word.

SC. 104 (Chart 5)

SC. 104 was probably first sighted by U-Boats on 11th October within 300 miles of Newfoundland. Close escort was provided during the day periods from 6th to 8th October and 10th to 12th October, after which it ceased. On the night of the 12th/13th three ships were sunk and again on the 13th/14th six more, sinkings taking place between 53° and 55° N. and 42° and 45° W. Further attacks on the 14th/15th were beaten off by the surface escort.

Weather conditions were very bad throughout and it was not possible to send out aircraft until early on the 15th, when SC. 104 was approximately 960 nautical miles from Lough Erne and 660 nautical miles from Iceland. The summary of events is as follows:—

- (a) On 15th October one Liberator (120 Squadron) swept the convoy area between 1147 and 1753 hours, and made two sightings and two attacks. A second Liberator on close escort failed to meet the convoy, 1400–2039 hours.
- (b) On 16th October one Liberator (120 Squadron) carried out a close escort from 0900 hours to 1355 hours and put down one U-Boat immediately on arrival. A second failed to meet, but sighted and attacked a U-Boat to the north of the convoy.
- (c) Catalinas (73 and 84 U.S. Squadrons) carried out offensive sweeps to the northward of the convoy between 0840 and 1226, making three sightings and two attacks.
- (d) One Catalina (73 U.S. Squadron), one Catalina (330 Norwegian Squadron) and three Hudsons (269 Squadron) also swept areas to the north of the convoy, of which details are unknown, between 1403 hours and 2045 hours.
- (e) On 17th October, four Catalinas (73 and 84 U.S. Squadrons) swept areas north of the convoy between 0843 and 1843 hours. One Liberator swept the convoy area between 0739 and 1742 hours, while a second (0843 to 1738 hours), which failed to meet the convoy, was operating in the convoy area.

The convoy arrived on 21st October, having suffered no casualties since it came under Coastal

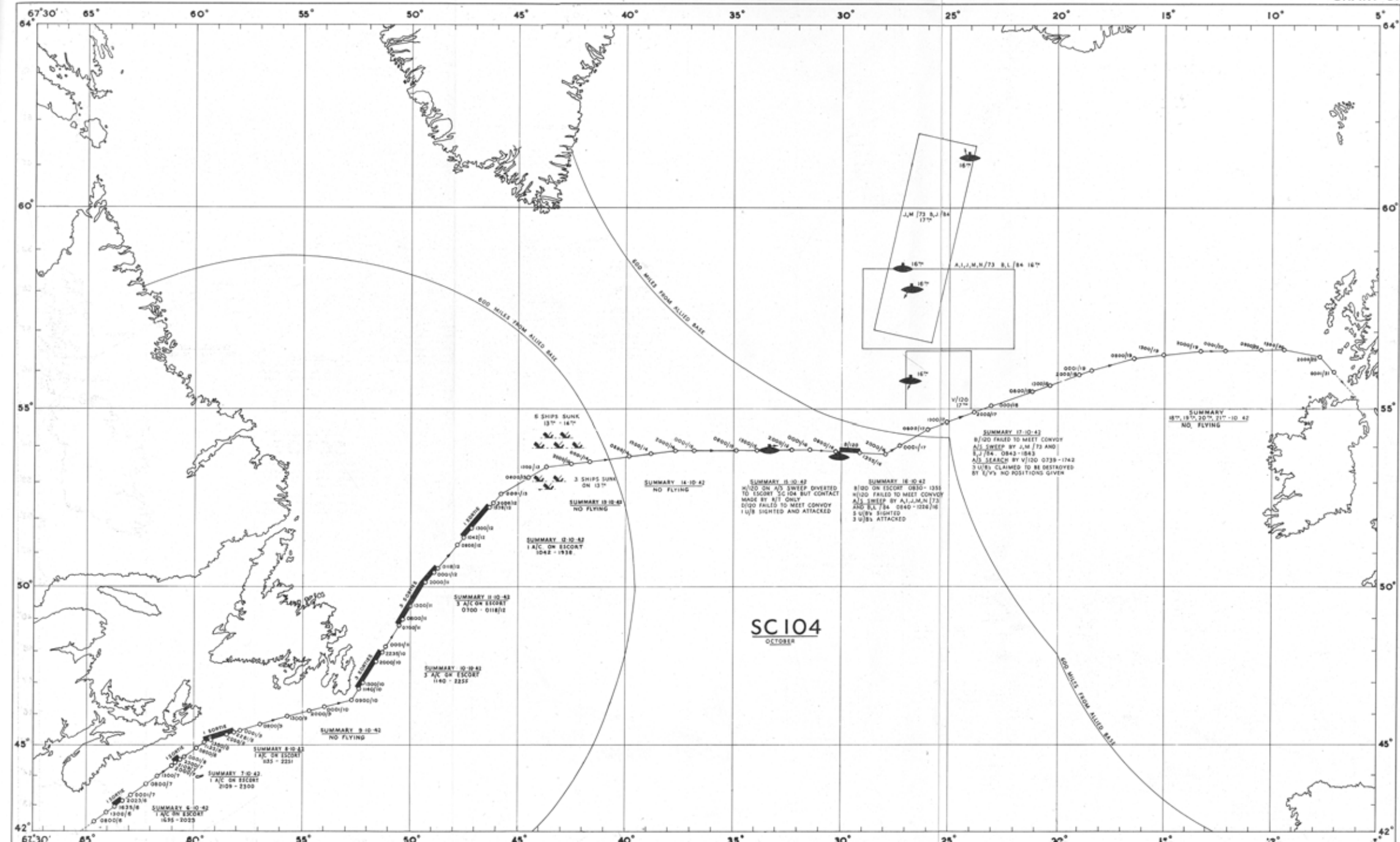
Command cover on the 15th. The main lesson to be learned from it is the proper distribution of available resources—the air to break and hamper contact already obtained (15th October) and to attack U-Boats converging on the convoy area, the surface escort to provide offensive close escort. In this instance the latter was particularly successful, three U-Boats being claimed as sunk, two by ramming and one by other means.

SC. 107 (Chart 6)

SC. 107 was picked up by U-Boats off Newfoundland at least as early as 29th October during the early stages of her voyage. Close escort resulted in two air attacks on U-Boats on the convoy route, while a single anti-submarine sweep produced a sighting followed by an attack (which was abortive for technical reasons) some distance off it. A returning aircraft also made a fortuitous sighting and attack considerably ahead of and away from the convoy. This was insufficient to break the contact so that even before the convoy was 400 miles from the Canadian shore sinkings began. Between 2nd November and the morning of the 5th, 16 ships in all were sunk, and the U-Boats were still in touch. The following was the sequence of events, the convoy at the time being some 700 nautical miles from Iceland:—

- (a) Two Liberators (120 Squadron) maintained close escort from 1108 to 1958 hours on the 5th, making three sightings and two attacks. While final assessment is awaited, there are strong grounds for believing that one U-Boat was sunk, while the second attack was also promising.
- (b) Two Catalinas (84 U.S. Squadron) swept an area north of the convoy on the 5th.
- (c) On the 6th, two Catalinas (84 U.S. Squadron) provided escort between 1350 and 1538 hours and between 1645 and 1815 hours respectively, while seven Hudsons (269 Squadron) carried out offensive sweeps between 1047 and 1611 hours.
- (d) On the 7th one Catalina (84 U.S. Squadron) provided close escort between 1444 and 1600 hours, while four Hudsons of 269 Squadron, and three Fortresses of 206 Squadron from the United Kingdom, carried out sweeps in the area. In addition, one Catalina (84 U.S. Squadron) and one Hudson (269 Squadron) failed to meet.
- (e) Further sweeps were carried out on the 8th by three Fortresses (220 Squadron) from the United Kingdom, and two Hudsons (269 Squadron), the convoy arriving on 11th November, once more without loss after it had been reached by Coastal Command aircraft.

One possible criticism of this operation is the large-scale protection given after it was well within the 400-mile line, which proved an uneconomical use of aircraft, as the U-Boat pack had clearly dispersed. It is possible, however, that a small proportion of the effort may have been in aid of the SCL(A) 107, although this would apply to the northern rather than the western patrols.



SC 107

N.B. DETAILS OF ESCORT PROVIDED BY EASTERN AIR COMMAND FROM 27-10-42 - 2-11-42 ARE VERY APPROXIMATE.

ON 57 & 6T ICELAND RESUME IS NOT CLEAR AS TO WHETHER ESCORT IS ON SC07 OR SC107

General Principles

One final comment may be made, which applies to all convoys but which is most clearly exemplified in the cases of SC. 104 and SC. 107. The Master of a ship sailing in SC. 104 reported after arrival:—

"Air escort was provided from the other side, and the convoy was escorted to a distance of about 400 miles out from the American coast, but no air escort was met on this side."

This is an instance of an all-too-frequent misconception.

Close escort serves to keep the U-Boat at bay, but can rarely be depended upon to break contact or prevent shadowing. When it is withdrawn, or at night, attack will mature and the

safety of the convoy will rest solely on the protection which surface craft can afford. Offensive sweeps aim at preventing the U-Boats ever getting together in sufficient numbers or at the right time to attack. If they succeed in penetrating the convoy area—as in the order of things will frequently occur—this must be accepted as a partial failure to achieve the aim and close escort must be applied. But at the same time this must be reinforced by the offensive element in the highest proportion that the availability of aircraft and the minimum necessary to the absolute safety of the convoy will allow. In principle, interception must be sought as far away from the convoy as prudence will permit; and where this is concerned, those who direct operations must balance the needs of the individual situation, without unduly taking counsel of their fears.

On Spacing Depth-Charges

From time to time healthy criticism and queries reach Coastal Command Headquarters from various squadrons and stations. Most of these are to do with weapons and methods of attack. One of the most recent has to do with the apparently meagre results of good attacks of the Class A type on U-Boats. As is well known, this class comprises those U-Boats which at the moment of release are either fully surfaced, partly submerged or have only disappeared for 10 seconds or less. The depth setting for detonation of 250 lb. Torpex depth-charges is standardised at 25 ft., because for depth it is lethal in all Class A attacks provided the depth-charge is within 19 ft. of the U-Boat's pressure hull in plan.

There are two great uncertainties. (1) Is the lethal radius of a Mark VIII Torpex depth-charge 19 feet? (2) Has the pilot dropped his stick so that *at the moment of detonation* the depth-charge is within this distance in plan from the U-Boat's pressure hull?

(1) needs only a few words. The technical experts assure us that this figure is correct. It has been queried many times, but the experts are unanimous in upholding this lethal radius from the depth-charge.

(2) needs many words. Depth-charges, if dropped from 100 ft. actual when the pilot thinks and aims as if he were at 50 ft., hit the water in quite a different place from where he intends. If they are dropped at very high speeds or from less than 50 ft. or with aircraft's nose up, they will play ducks and drakes for short or long distances and in surprising directions. Even if behaving correctly in all respects, after impact they advance under water about 36 ft. (Plate 3), not always directly along the line of drop, before reaching detonation depth. Even then, there may be slight variations in the respective pistols, so that in an otherwise even stick No. 4 will detonate a fraction before, say, No. 1. Finally, Micky Mouse is not infallible and spacing itself may not be absolutely uniform.

All these divergences are not so important in a stick of six or eight depth-charges which are spaced fairly close together, but in aircraft such as Hudsons, which only carry four, every depth-charge must behave perfectly, or a non-lethal hole in the stick results. This may be quite large enough (each depth-charge having such a small lethal range) to permit the U-Boat's pressure

hull to remain unscathed although straddled from visual evidence of the position of the general explosion.

The pilot's and crew's estimation of the position of entry and/or explosion can be seriously inaccurate, even with fully surfaced U-Boats. This is a fact. At 50 to 75 ft. it is difficult in any attack which is not up and down the U-Boat's track to tell whether depth-charges fell straddling the line of advance. It is still more difficult to do so when the depth-charges explode, unless those on the far side of a still visible U-Boat detonate before those on the side nearest to the aircraft. The camera is the only certain judge.

The camera should be regarded as the pilot's friend. It is true that many times the photographic evidence contradicts the crew's visual evidence. That is no reason to dislike the camera; often it has proved that what was an inaccurate attack on the circumstantial evidence was, in fact, a straddle. If camera evidence is available showing normally spaced depth-charges straddling a visible part of a U-Boat, that U-Boat will be considered at least probably Damage A, even without oil, debris or other after effects.

Visual or photographic evidence of debris is, of course, very valuable, and in cases of first-class attacks the baiting procedure should be dispensed with in order to scrutinise the vicinity as long as possible for the "bits." Naturally, it is more satisfying for the crew to see unmistakable evidence, but U-Boats *can* be mortally hurt with little or no debris, certainly not visible from an aircraft and which, likewise, is not shown up on photographs. Therefore do not be disgusted if you do not see a shattered wreck resurface after your accurate attack, but remember that, using a rather clumsy and sometimes erratic weapon with a tiny lethal range released on one man's judgment and estimation of distance, reported as to position by another man with few, if any, yardsticks, you must not assume your "accurate" attack to be accurate enough for you to blame the weapon every time.

Apart from major effects, but nearly as important, are the so-called secondary effects of depth-charge explosions on the U-Boat. However close the detonation, the water hammer blow is seldom capable of blasting a large area hole in the pressure hull. This type of blow produces splits of length

and gape depending on the proximity of detonation. Quite an extensive split can be kept under control just long enough to exhaust the aircraft's P.L.E.; much damage can be inflicted to external tanks, auxiliary machinery, electrical circuits, fittings, switchboards, cells, etc., which do not result either in immediate resurfacing or immediate foundering, but which might end hours or days later, in the loss of the U-Boat. Above all, there is the morale effect of a close attack about which you all have learnt in other articles or memoranda and which plays a constant theme note in all submarine crews' lives be they German, Italian or our own. It plays and has played a

dominant note in the case of the diluted, half-trained and sometimes scratch crews of the over-expanded U-Boat service. A close attack is never wasted, however disappointing to you the visual after effects may be.

Remember that, ceaselessly, there goes on the design and development of better weapons. Also remember that the present methods and weapons, inadequate though they may seem to you, have driven the patrolling U-Boats out to a 500-600 miles radius from our air bases, made the U-Boats' journey on passage to and from their bases a nightmare and prevented pack attacks on convoys within air range.

If a U-Boat opens fire

Success in any form of combat, be it armed or unarmed, is very largely dependent upon intelligent anticipation of the enemy's next move. This is particularly important when tackling the wily U-Boat from the air. The object of this article is to present a few ideas to aircraft crews which may enable them to anticipate for themselves what the enemy's next move may be and how they should apply suitable counter-measures when a U-Boat engages them by gunfire.

Naturally, any U-Boat which is so damaged that it cannot dive will man its guns in defence, but there have also been cases, particularly among Italians, of commanders electing to fight it out on the surface instead of diving, and this tendency is likely to grow more and more widespread as the destructive effects of the latest depth-charges become better known. For the submarine's fire, even if it scores no hits, will at least make it more difficult for the aircraft to press home a well-placed attack; and in any case it is nicer to defend yourself than wait passively for your enemy to do his worst.

Consider the weapons available to the enemy. He may have one or two 3-in. or 4-in. guns which in local control may be used to put up a barrage, but not a very effective one, at about 1,000 yards. He will have one, possibly two, 20-mm. cannon and up to three light machine guns. This may seem a formidable array, but actually the most commonly met types of U-Boat, the German 500- and 700-ton class, cannot use their heavy guns at high angles as they are designed for offensive use against merchant vessels.

What we are chiefly up against then is the 20-mm. cannon backed up at close range by machine-gun fire. The cannon is mounted on a circular open platform in rear of the conning-tower with an all-round arc of fire, save for the low angle restriction on forward bearings imposed by the bridge superstructure plus personnel on the bridge platform who may have their heads in the line of fire. Light machine guns can be mounted on each side of the bridge to fire on their respective sides and one could be mounted

in front of the bridge to fire over an effective arc from right ahead to 90 degrees either side.

It will be appreciated that when in moments of intense excitement all their guns are trying to fire at the one aircraft at the same time, life on the bridge of the U-Boat may be somewhat hazardous. An example is provided by the unfortunate Italian midshipman who popped his head out of the conning tower hatch to see what all the row was about and promptly lost it. His headless body fell down into the Control Room to provide a gruesome reminder of the encounter for the rest of the patrol.

The moment of greatest danger for an attacking aircraft is when it is flying straight and level at 50 ft. towards the U-Boat, offering a no-deflection shot. The effectiveness of the U-Boat's fire under these conditions will depend entirely upon the amount of armament the aircraft can bring to bear on the run in.

It may be argued that .303's are of little use against a 20-mm. cannon because of the latter's superior range and penetrating power. It is unlikely, however, that the cannon will be accurate at ranges in excess of 800 yards—at which range a .303 will most effectively kill unprotected personnel, all we require in this case. (In fact, if the sighting difficulties can be overcome, a .303 strike will kill at twice this range.) Turret guns are usually harmonised at 400 yards, but the bullet drop in travelling an extra 400 yards is only eleven feet, to offset which we have a vastly superior density of fire.

There is one very important point which is generally overlooked in the excitement of action, namely that if a U-Boat engages with gun or cannon fire she is obviously not going to dive. If the U-Boat is not going to dive there is no longer any need to attack in the shortest possible space of time. The aircraft can break off the attack before getting dangerously close, then fly round the U-Boat at about 800 yards range and bring all guns to bear. These tactics usually produce a high mortality rate among the gun crews on the upper deck, resulting in a sudden decision on the part of the U-Boat captain to *zum Teufel gehen*, i.e., "get to hell out of it," leaving the aircraft with a "sitter."

II.—OTHER OPERATIONAL FLYING

Attacks on Enemy Shipping, September—November

Biscay Area

Activity here increased during the past three months, the types of traffic remaining as before, i.e.:—

- (1) Iron ore cargoes from Spain to France, together with
- (2) general cargoes from Spanish and Portuguese ports, and
- (3) the increasingly important blockade running to and from the Far East.

The first type is being maintained to an increasing extent by the small coaster type vessels plying between Bilbao and Bayonne, as most of the larger vessels that used to go on to Bordeaux to unload have been withdrawn and passed up the Channel into the North Sea. As a result, there are now probably only two of the larger vessels left in this trade, the German *Scharlachberger*, of 2,844 tons, and the Spanish *Kauldi*, 3,157 tons, which sails under the Spanish flag. It is probable that a southbound vessel attacked on 26th November by M/59 a few miles from Bayonne, with unknown result, was the former of these two ships returning to Bilbao to pick up another cargo. With this exception, nothing has been seen of the vessels engaged in this trade, which is not unexpected as they invariably hug the coast, and move as far as possible by night.

The second class of traffic, in cargoes of a general nature, continues to be carried to Bilbao, thence to Bayonne in small Portuguese and Spanish vessels. These, like the iron ore ships, hug the coast, and would probably be indistinguishable from the local traffic.

As for the blockade running, this has increased in both volume and importance, a number of vessels having left or arrived at Bordeaux during the three months. Arrivals totalled three vessels, which have been indentified as the German *Tannenfels*, 5,567 tons, *Dresden*, 7,840 tons, and *Kulmerland*, 7,363 tons. The last was sighted and subjected to a number of attacks throughout the 5th, 6th, 7th and 8th November, by aircraft of Nos. 502, 311, 304 and 59 Squadrons, and by aircraft of No. 10 (Bomber) O.T.U., while approaching and while entering the Gironde. Her presence later on in Bordeaux suggests that no substantial damage was inflicted. The other two vessels reached Bordeaux unobserved a few days before this incident, probably during a spell of bad weather. It is notable that of some 15 ships that have run the blockade since the beginning of this year, no less than 12 have been sighted by our aircraft, which seems to show that bad weather is necessary to enable a surface vessel to slip through our network of patrols undetected.

At the same time as the *Kulmerland* was approaching Bordeaux, two other ships were leaving that port. Both were spotted and attacked by aircraft drawn from Nos. 502, 59, 461, 224 and 407 Squadrons, as well as from No. 330 Squadron (U.S.A.) and No. 10 (Bomber) O.T.U. But in both cases the last sighting showed that marked progress had been made towards the open Atlantic, so there is unfortunately no reason for

supposing that either suffered damage. Photographs enabled these vessels to be identified as the *Annaliess Essberger*, 5,173 tons, and the *Kota Nopan*, 7,277 tons.

At the very end of November, aircraft of 10 (R.A.A.F.), 311 and 405 Squadrons sighted and attacked a vessel escorted, when first seen, by two *Elbing* class destroyers and two other escort vessels on a westerly course; from poor photographs the merchant vessel has been identified as the Italian *Cortelazzo* 5,252 tons.

Previous to this episode there had been another flurry of outward bound vessels in the early part of October. Of the four ships that left Bordeaux at that time, three, the German *Burgenland* 7,320 tons; *Belgrano*, 6,095 tons, and a *Silvaplana* type vessel of 5,000 tons, were seen by our aircraft, and the *Belgrano* seems to have suffered superficial damage in the ensuing attacks. She was reported to have visited the Spanish port of Ferrol, immediately after these attacks, where she remained for several days before disappearing. As reported in the previous issue, aircraft taking part in these operations were drawn from Nos. 10 (R.A.A.F.), 461, 304, 502 and 51 Squadrons.

In addition to merchant vessels trying to leave German-occupied territories for other enemy countries in the East, there have been signs that some enemy-owned tankers may intend to do so too. One particularly persistent vessel, probably the ex-Norwegian *Krossforn*, which is believed to have been renamed *Spichern*, 9,323 tons, has been sighted and attacked three times by our aircraft, and while she was forced back to port on both of the first two occasions, she has been reported as having arrived in a Spanish port, in a damaged condition, following the third encounter. There seems to be no doubt that it was an attack by S/172 in the early morning of 11th November that has concluded, for some time, the present series of attempts by this vessel to escape abroad.

The following are a few examples of what the arrival in Europe of a blockade runner of the 6,000-ton class means:—

If the cargo were 4,000 tons of rubber, it would equip four armoured divisions with all their needs for a year. Recent reports suggest that considerable quantities of rubber have been arriving in Germany lately and it is even reported that the proportion of real rubber in tyres has risen from 5 per cent. to 30 per cent. Whether or not these percentages are correct, an analysis of captured enemy aircraft tyres shows that the proportion of natural rubber has, in fact, increased recently.

Another interesting example is the effect on the German margarine ration. The arrival of 5,000 tons of vegetable oil is enough to maintain the ration for 14 days, and such a cargo would be about a half or a third of a normal tanker's capacity.

There is one aspect of all the above sightings which it is well to remember. Obviously it would be best if we could sink these blockade runners. For various reasons, that has so far

been a difficult feat, but because we may sight and not sink one, it does not mean that we have failed in our task. Photographs taken during the encounter may enable the vessel to be identified; the enemy's programme can then be estimated, and in the case of outward bound vessels, a description and orders for a look-out can be signalled to the fleets and air forces of our allies, scattered over the seven seas. It is a long way from Bordeaux to Kobe, and interception is always a possibility, if the ship is known to have broken out. Two of the ships mentioned as having been sighted by aircraft were in fact later intercepted by surface craft. The *Annaliess Essberger* was found by naval forces off Freetown, a fortnight after the first sighting, and scuttled herself to avoid capture. A hunt for the *Cortelazzo* was laid on, the day of the sighting, and after a chase she surrendered, but the weather proved too bad to take her in prize and she had to be sunk.

Little is known about the sailing times and routes of the blockade runners, but recent sightings suggest that inward bound vessels make landfall on the north coast of Spain, and proceed fairly close inshore until they are picked up by their escort. Outward bound vessels, on the other hand, seem to be routed through the middle of the Bay, and it may be no coincidence that they appear to set out at about the same time as an inward bound ship is due to arrive. Escorts seem to pick up and leave their charge in the neighbourhood of 6° W., and consist of *Elbing* class destroyers, T.B.s, minesweepers, or armed trawlers. It is also likely that a sperrbrecher acts as escort at the beginning (or end) of the voyage while the immediate coastal area is being negotiated.

Channel Area

This area has remained comparatively inactive, but there have been a few incidents of interest.

As mentioned above, further withdrawals have been made from the fleet of larger iron ore vessels engaged on the Bilbao-Bordeaux trade, and those vessels concerned have followed the example of the earlier ones, and moved from the Biscay area to the North Sea in easy stages from one port to another. The *Mombaldo* made the journey early in October, and the *Drepanum* followed later in the month. The *Leesee* is the latest to attempt the voyage, and her presence at Brest on 15th November, together with a large number of escort vessels, suggests that she too may have passed up the Channel.

The movements of two vessels of an unusual type, at the beginning of September, gave rise to some speculation. These were the whale oil factory ships *Ole Wegger* and *Solglimt*, both of about 12,200 tons.

The former had been in Cherbourg for many months, but on 7th September moved to Havre, and thence up the Seine to Rouen, where, as far as is known, she remains. A few days earlier the *Solglimt*, which had been at Nantes for a considerable time, started moving, and by stages made her way to Cherbourg, where she arrived on the 9th. It is not known what role was intended for these two ships, nor why they were suddenly brought out of retirement at the same time. The most likely intention is that after having loaded at a Seine port, they were to

have proceeded up Channel to a North Sea destination, but Bomber Command Bostons hit *Solglimt* to such effect, a few days after her arrival at Cherbourg, that the programme has had to be modified. She at least will not be able to proceed usefully for several months.

Several other ships moved up the Channel, including one of the *Neumark* raider type, that had been in Havre, and a 380-foot merchant vessel which had also been in that port. The latter was attacked by a Hudson of 320 Squadron on 17th October, off Gris Nez, a direct hit being scored, and a few days later reconnaissance revealed that she had been beached within a few miles of the scene of the attack.

In the reverse direction a heavily escorted ship moving down Channel on 11th/12th October was attacked by surface forces, and the fact that nothing further has been seen of her suggests that she was sunk.

Hook-Elbe Area

Weather during September and October was abnormally bad, and no doubt caused many delays to, and irregular running of, the convoys on this route.

All the indications point to a continuation of the majority of departures from the Hook around 1000 hours; escorts have remained unchanged in number at about five patrol vessels, and frequently a sperrbrecher. Speeds continue to average 8 knots.

One of the best known of the sperrbrechers on this route, as noted in the previous issue (No. 6) was seen in October by a Beaufighter of 236 Squadron being towed stern first, with a considerable part of its bows missing, obviously blown off by a mine. An occurrence such as this is a considerable embarrassment to the enemy just now, as owing to the very heavy mining that has taken place in these waters, he can ill afford to lose the services of even one of these vessels. It is probable that in some cases convoys will be noticed with additional minesweepers preceding them, until a substitute has been found to replace this ship.

Westbound convoys still seem to aim at reaching the Hook in the afternoon, and only in exceptional cases, and then probably due only to weather, does there seem to be any movement down the southern half of the Dutch coast at night.

Balloons continue to be flown by a good proportion of merchant ships, and a report suggests that in some cases they are being moored to the ship by two cables, one from the stern, and the other from amidships or forward, but no visual confirmation of this development has been obtained.

Reconnaissance of the Dutch and German ports has been exceptionally scanty, so that the sharp reduction in the amount of shipping seen in the Waalhaven at Rotterdam, on the most recent cover, cannot be taken as more than an indication that there may have been a falling off in imports to that port. Such a development at this time of year would not be surprising; mining, crew, and dockhand difficulties, may have been contributory causes. A substantial increase in the barge content of Ghent, illustrates the trend of these vessels to be returned to normal commercial

General Principles

One final comment may be made, which applies to all convoys but which is most clearly exemplified in the cases of SC. 104 and SC. 107. The Master of a ship sailing in SC. 104 reported after arrival:—

"Air escort was provided from the other side, and the convoy was escorted to a distance of about 400 miles out from the American coast, but no air escort was met on this side."

This is an instance of an all-too-frequent misconception.

Close escort serves to keep the U-Boat at bay, but can rarely be depended upon to break contact or prevent shadowing. When it is withdrawn, or at night, attack will mature and the

safety of the convoy will rest solely on the protection which surface craft can afford. Offensive sweeps aim at preventing the U-Boats ever getting together in sufficient numbers or at the right time to attack. If they succeed in penetrating the convoy area—as in the order of things will frequently occur—this must be accepted as a partial failure to achieve the aim and close escort must be applied. But at the same time this must be reinforced by the offensive element in the highest proportion that the availability of aircraft and the minimum necessary to the absolute safety of the convoy will allow. In principle, interception must be sought as far away from the convoy as prudence will permit; and where this is concerned, those who direct operations must balance the needs of the individual situation, without unduly taking counsel of their fears.

On Spacing Depth-Charges

From time to time healthy criticism and queries reach Coastal Command Headquarters from various squadrons and stations. Most of these are to do with weapons and methods of attack. One of the most recent has to do with the apparently meagre results of good attacks of the Class A type on U-Boats. As is well known, this class comprises those U-Boats which at the moment of release are either fully surfaced, partly submerged or have only disappeared for 10 seconds or less. The depth setting for detonation of 250 lb. Torpex depth-charges is standardised at 25 ft., because for depth it is lethal in all Class A attacks *provided* the depth-charge is within 19 ft. of the U-Boat's pressure hull in plan.

There are two great uncertainties. (1) Is the lethal radius of a Mark VIII Torpex depth-charge 19 feet? (2) Has the pilot dropped his stick so that *at the moment of detonation* the depth-charge is within this distance in plan from the U-Boat's pressure hull?

(1) needs only a few words. The technical experts assure us that this figure is correct. It has been queried many times, but the experts are unanimous in upholding this lethal radius from the depth-charge.

(2) needs many words. Depth-charges, if dropped from 100 ft. actual when the pilot thinks and aims as if he were at 50 ft., hit the water in quite a different place from where he intends. If they are dropped at very high speeds or from less than 50 ft. or with aircraft's nose up, they will play ducks and drakes for short or long distances and in surprising directions. Even if behaving correctly in all respects, after impact they advance under water about 36 ft. (Plate 3), not always directly along the line of drop, before reaching detonation depth. Even then, there may be slight variations in the respective pistols, so that in an otherwise even stick No. 4 will detonate a fraction before, say, No. 1. Finally, Micky Mouse is not infallible and spacing itself may not be absolutely uniform.

All these divergences are not so important in a stick of six or eight depth-charges which are spaced fairly close together, but in aircraft such as Hudsons, which only carry four, every depth-charge must behave perfectly, or a non-lethal hole in the stick results. This may be quite large enough (each depth-charge having such a small lethal range) to permit the U-Boat's pressure

hull to remain unscathed although straddled from visual evidence of the position of the general explosion.

The pilot's and crew's estimation of the position of entry and/or explosion can be seriously inaccurate, even with fully surfaced U-Boats. This is a fact. At 50 to 75 ft. it is difficult in any attack which is not up and down the U-Boat's track to tell whether depth-charges fell straddling the line of advance. It is still more difficult to do so when the depth-charges explode, unless those on the far side of a still visible U-Boat detonate before those on the side nearest to the aircraft. The camera is the only certain judge.

The camera should be regarded as the pilot's friend. It is true that many times the photographic evidence contradicts the crew's visual evidence. That is no reason to dislike the camera; often it has proved that what was an inaccurate attack on the circumstantial evidence was, in fact, a straddle. If camera evidence is available showing normally spaced depth-charges straddling a visible part of a U-Boat, that U-Boat will be considered at least probably Damage A, even without oil, debris or other after effects.

Visual or photographic evidence of debris is, of course, very valuable, and in cases of first-class attacks the baiting procedure should be dispensed with in order to scrutinise the vicinity as long as possible for the "bits." Naturally, it is more satisfying for the crew to see unmistakable evidence, but U-Boats *can* be mortally hurt with little or no debris, certainly not visible from an aircraft and which, likewise, is not shown up on photographs. Therefore do not be disgusted if you do not see a shattered wreck resurface after your accurate attack, but remember that, using a rather clumsy and sometimes erratic weapon with a tiny lethal range released on one man's judgment and estimation of distance, reported as to position by another man with few, if any, yardsticks, you must not assume your "accurate" attack to be accurate enough for you to blame the weapon every time.

Apart from major effects, but nearly as important, are the so-called secondary effects of depth-charge explosions on the U-Boat. However close the detonation, the water hammer blow is seldom capable of blasting a large area hole in the pressure hull. This type of blow produces splits of length

and gape depending on the proximity of detonation. Quite an extensive split can be kept under control just long enough to exhaust the aircraft's P.L.E.; much damage can be inflicted to external tanks, auxiliary machinery, electrical circuits, fittings, switchboards, cells, etc., which do not result either in immediate resurfacing or immediate foundering, but which might end hours or days later, in the loss of the U-Boat. Above all, there is the morale effect of a close attack about which you all have learnt in other articles or memoranda and which plays a constant theme note in all submarine crews' lives be they German, Italian or our own. It plays and has played a

dominant note in the case of the diluted, half-trained and sometimes scratch crews of the over-expanded U-Boat service. A close attack is never wasted, however disappointing to you the visual after effects may be.

Remember that, ceaselessly, there goes on the design and development of better weapons. Also remember that the present methods and weapons, inadequate though they may seem to you, have driven the patrolling U-Boats out to a 500-600 miles radius from our air bases, made the U-Boats' journey on passage to and from their bases a nightmare and prevented pack attacks on convoys within air range.

If a U-Boat opens fire

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There is one aspect of all the above sightings which it is well to remember. Obviously it would be best if we could sink these blockade runners. For various reasons, that has so far

been a difficult feat, but because we may sight and not sink one, it does not mean that we have failed in our task. Photographs taken during the encounter may enable the vessel to be identified; the enemy's programme can then be estimated, and in the case of outward bound vessels, a description and orders for a look-out can be signalled to the fleets and air forces of our allies, scattered over the seven seas. It is a long way from Bordeaux to Kobe, and interception is always a possibility, if the ship is known to have broken out. Two of the ships mentioned as having been sighted by aircraft were in fact later intercepted by surface craft. The *Annaliese Essberger* was found by naval forces off Freetown, a fortnight after the first sighting, and scuttled herself to avoid capture. A hunt for the *Cortelazzo* was laid on, the day of the sighting, and after a chase she surrendered, but the weather proved too bad to take her in prize and she had to be sunk.

Little is known about the sailing times and routes of the blockade runners, but recent sightings suggest that inward bound vessels make landfall on the north coast of Spain, and proceed fairly close inshore until they are picked up by their escort. Outward bound vessels, on the other hand, seem to be routed through the middle of the Bay, and it may be no coincidence that they appear to set out at about the same time as an inward bound ship is due to arrive. Escorts seem to pick up and leave their charge in the neighbourhood of 6° W., and consist of *Elbing* class destroyers, T.B.s, minesweepers, or armed trawlers. It is also likely that a sperrbrecher acts as escort at the beginning (or end) of the voyage while the immediate coastal area is being negotiated.

Channel Area

This area has remained comparatively inactive, but there have been a few incidents of interest.

As mentioned above, further withdrawals have been made from the fleet of larger iron ore vessels engaged on the Bilbao-Bordeaux trade, and those vessels concerned have followed the example of the earlier ones, and moved from the Biscay area to the North Sea in easy stages from one port to another. The *Mombaldo* made the journey early in October, and the *Drepanum* followed later in the month. The *Leesee* is the latest to attempt the voyage, and her presence at Brest on 15th November, together with a large number of escort vessels, suggests that she too may have passed up the Channel.

The movements of two vessels of an unusual type, at the beginning of September, gave rise to some speculation. These were the whale oil factory ships *Ole Wegger* and *Solglimt*, both of about 12,200 tons.

The former had been in Cherbourg for many months, but on 7th September moved to Havre, and thence up the Seine to Rouen, where, as far as is known, she remains. A few days earlier the *Solglimt*, which had been at Nantes for a considerable time, started moving, and by stages made her way to Cherbourg, where she arrived on the 9th. It is not known what role was intended for these two ships, nor why they were suddenly brought out of retirement at the same time. The most likely intention is that after having loaded at a Seine port, they were to

have proceeded up Channel to a North Sea destination, but Bomber Command Bostons hit *Solglimt* to such effect, a few days after her arrival at Cherbourg, that the programme has had to be modified. She at least will not be able to proceed usefully for several months.

Several other ships moved up the Channel, including one of the *Neumark* raider type, that had been in Havre, and a 380-foot merchant vessel which had also been in that port. The latter was attacked by a Hudson of 320 Squadron on 17th October, off Gris Nez, a direct hit being scored, and a few days later reconnaissance revealed that she had been beached within a few miles of the scene of the attack.

In the reverse direction a heavily escorted ship moving down Channel on 11th/12th October was attacked by surface forces, and the fact that nothing further has been seen of her suggests that she was sunk.

Hook-Elbe Area

Weather during September and October was abnormally bad, and no doubt caused many delays to, and irregular running of, the convoys on this route.

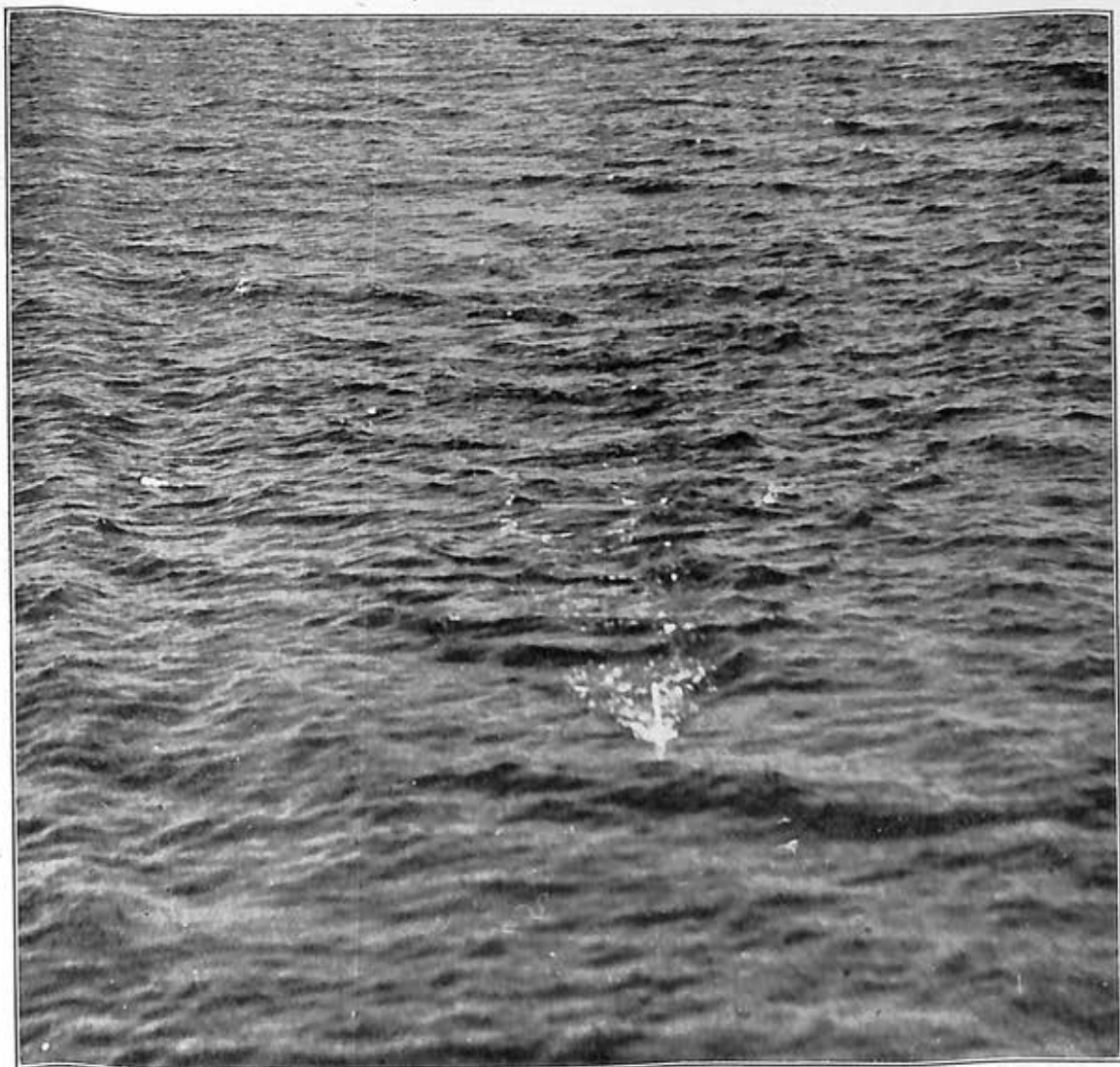
All the indications point to a continuation of the majority of departures from the Hook around 1000 hours; escorts have remained unchanged in number at about five patrol vessels, and frequently a sperrbrecher. Speeds continue to average 8 knots.

One of the best known of the sperrbrechers on this route, as noted in the previous issue (No. 6) was seen in October by a Beaufighter of 236 Squadron being towed stern first, with a considerable part of its bows missing, obviously blown off by a mine. An occurrence such as this is a considerable embarrassment to the enemy just now, as owing to the very heavy mining that has taken place in these waters, he can ill afford to lose the services of even one of these vessels. It is probable that in some cases convoys will be noticed with additional minesweepers preceding them, until a substitute has been found to replace this ship.

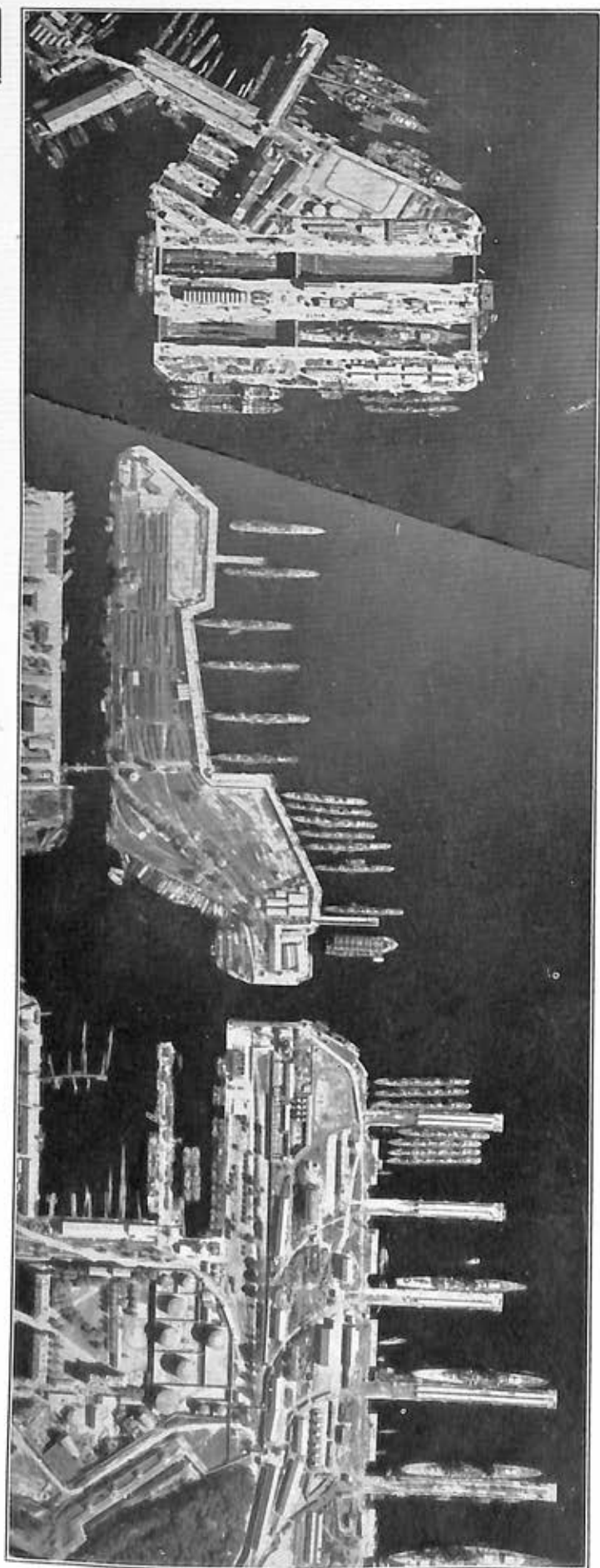
Westbound convoys still seem to aim at reaching the Hook in the afternoon, and only in exceptional cases, and then probably due only to weather, does there seem to be any movement down the southern half of the Dutch coast at night.

Balloons continue to be flown by a good proportion of merchant ships, and a report suggests that in some cases they are being moored to the ship by two cables, one from the stern, and the other from amidships or forward, but no visual confirmation of this development has been obtained.

Reconnaissance of the Dutch and German ports has been exceptionally scanty, so that the sharp reduction in the amount of shipping seen in the Waalhaven at Rotterdam, on the most recent cover, cannot be taken as more than an indication that there may have been a falling off in imports to that port. Such a development at this time of year would not be surprising; mining, crew, and dockhand difficulties, may have been contributory causes. A substantial increase in the barge content of Ghent, illustrates the trend of these vessels to be returned to normal commercial



True and False Periscope Wakes.—(Top and middle) Periscope wakes of H.M.S. *Graph*: the bubbles and foam formed by the periscope quickly fade off to the back: outside this white V, the bow ripples form a broader V. (Bottom) These supposed wakes were attacked by depth-charge, and persisted through the explosion mark, which is inconceivable with a U-Boat. They were probably caused by air bubbling out of a wreck: there is always enough surface drift to cause foam to tail away. They are much too long and foamy for a periscope wake at any speed, and end too abruptly.



Ex-Battleship *Condorcet* (still afloat)

Battleship *Provence*

Aircraft-carrier *Commandant Teste*

Dry docks (now flooded) containing :—

Four Submarines | Battle-cruiser *Dunkerque*

Two tankers | Two *Aigle* or *Guépard* class Contre-torpilleurs (still afloat)

Three *Aigle* or *Guépard* class Contre-torpilleurs

Le Fantasque class Contre-torpilleur

Volta class Contre-torpilleur

Eight Destroyers :—
Five *Le Hardy* class
Three *Simoun* or *Alcyon* class
(One of each still afloat)

Aigle or *Guépard* class Contre-torpilleurs

Tigre class Contre-torpilleurs
(Two still afloat)

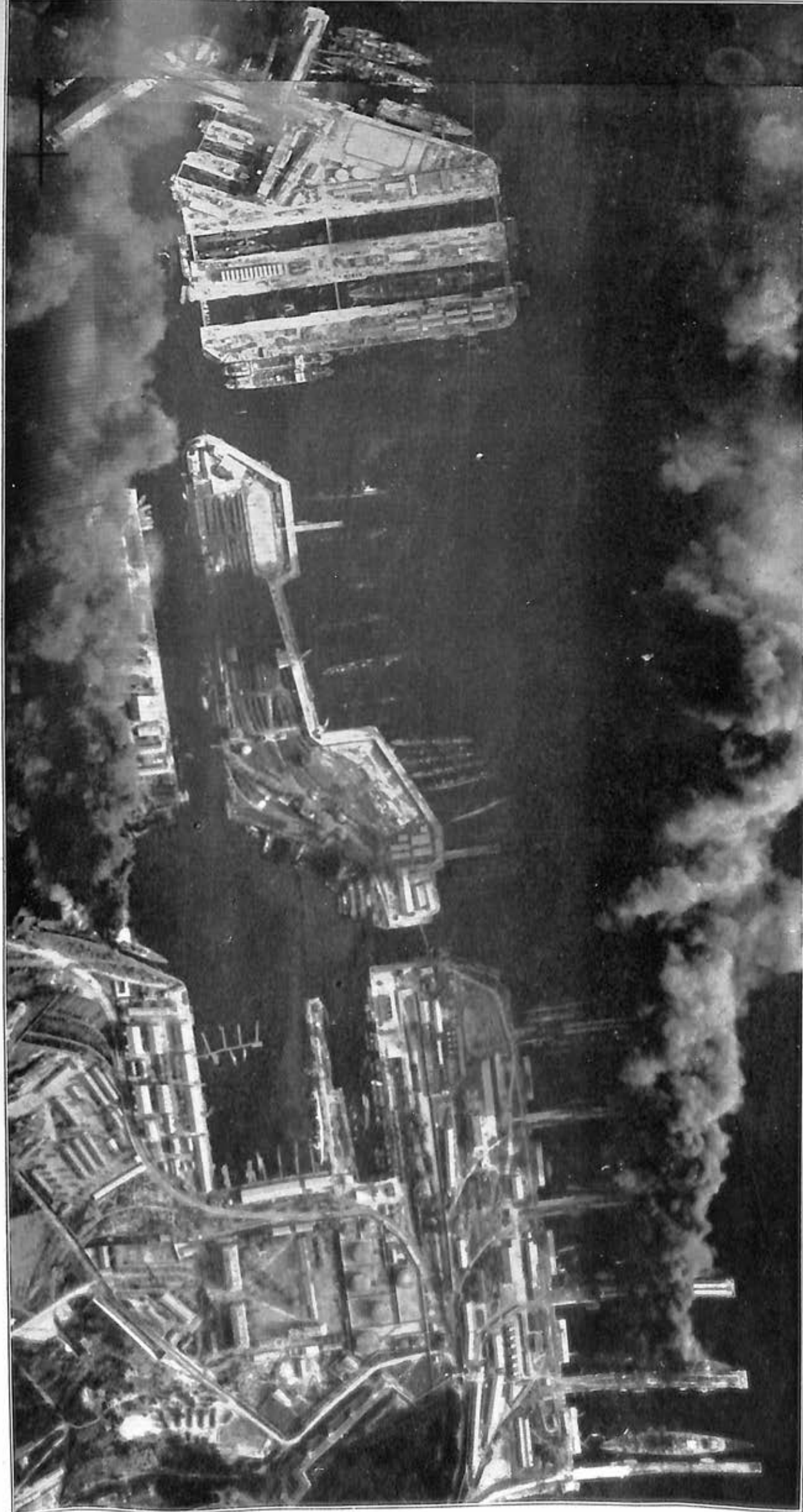
La Galissonnière class 6-in. Cruiser

Algérie class 8-in. Cruiser

Suffren class 8-in. Cruiser

Battle-cruiser *Strasbourg*

Toulon before and (opposite) after the Scuttling : P.R.S. photographs, of Nov. 26th and 28th, which cover the main area of the naval port. The great majority of the larger vessels lay on the waterfront, and are identified in the margin. They now rest on the bottom, submerged to a greater or less extent with the few exceptions noted, in which no damage shows. The *Suffren* class cruiser near the foot of the photographs is on fire, as well as partially submerged; another *Suffren* cruiser in the inner dock is afloat and on fire.





North Russia (240 Squadron) (Top) Russians welcoming Catalina's crew ashore (Middle)
Catalina on Lake Lakhta (Bottom) Typical scenery north of Archangel

use, for the brittle state of the enemy transport system necessitates the utmost utilisation of every possible means to tide over the next few critical months.

Out of a number of attacks in this area, one of the most notable was that carried out on 20th November by Beaufighters—13 of 236 Squadron armed with bombs, and 9 of 254 Squadron armed with torpedoes, and 2 more as ordinary fighters. In addition an escort of 12 Spitfires of No. 12 Group had been intended, but failed to make contact with the general formation.

The target was a southbound convoy reported in the forenoon by a 12 Group Jim Crow, but the Beaufighters probably attacked a different convoy. It consisted of only one large merchant vessel very high out of the water, and probably incomplete, being towed by a tug, and escorted by at least five armed trawlers, a weight of escort normally afforded to a complete convoy (Plate 3). A hit by torpedo was claimed on the large vessel (which was almost certainly one of 8,000 tons that had been fitting out in the Minerva Haven at Amsterdam), another on a smaller vessel, and a hit, or very near miss, with bombs on the tug. Those aircraft that did not carry bombs or torpedoes shot up the escort vessels with cannon fire.

Norway Area

Little fresh information has been obtained about shipping in this area. The southward movement of some of the large naval units, and the departure to the Mediterranean of a number of units of the Luftwaffe, will have eased the supply situation in the extreme north, with a resultant reduction in the number of northbound voyages. Other evidence, however, suggests that commercial traffic from Narvik is likely to grow in importance.

This indication has been derived from the figures of the iron ore exports from Narvik during the past three months, and from the movement into the North Sea of the iron ore carriers referred to earlier, of which several have already been reported trading between Rotterdam and Norwegian ports.

As regards the first, exports from Narvik have recently shown a progressive increase (while there has been a tendency for a decrease in the exports of ore shipped from Swedish ports), and work that has been in progress on the ore quays there suggests that still further increases are envisaged.

Should this be the case, the need for extra ships, of the specialised type necessary for ore carrying, is explained.

The enemy's desire to increase his iron ore exports from Narvik may be due to the slowing down of shipments from Sweden, entailing a reduction of about 750,000 tons by the end of 1942, in consequence of attacks by Russian submarines and mining in the Baltic. Secondly, the season of the annual freeze up of the North Swedish ports is approaching, and the tempo of Germany's war industries necessitates the maintenance, as far as possible, of her iron ore supplies, which increased exports from Narvik may help to ensure. But the seizure of North Africa will deprive Germany of 300,000 tons a year, so there is likely to be considerable leeway to make up.

An interesting feature of the military supply fleet, has been a tendency for smaller vessels to be used; whereas in March the average tonnage of the vessels employed was around 2,500, by September it had fallen to 1,600 tons. This tendency seems to be spreading, and it appears that every effort is being made by Germany, to acquire small vessels from both Finland and Sweden, for freight carrying.

A small number of attacks has taken place along the Norwegian coast, and an unusually high percentage has been successful. Details of the earlier ones have already appeared. During November at least two vessels of around 3,000 tons were hit by the torpedoes of 489 (Hampden) Squadron; one of them, hit by aircraft on 25th, must have suffered severely, if the violent flash and shower of sparks can be taken as affording any guide.

Assessments of Attacks, August–October

Results of attacks on enemy shipping, as assessed by the Air Ministry and Admiralty Committees, are now available till the end of October. They are as follows:—

	Sunk or total loss. Ships: tons	Seriously damaged. Ships: tons	Damaged. Ships: tons
August ..	—	—	*3½ of 13,500
September ..	1 of 4,500	—	9 of 32,038
October ..	1 of 4,000	1 of 2,000	3 of 10,473
Total ..	2 of 8,500	1 of 2,000	15½ of 56,011

Totals since
1st March, 55 of 157,424 55 of 136,349 147½ of 512,375
1941.

* Half credited to Bomber Command.

A Coastal Command Expedition to Russia

The success of the Coastal Command patrols at the time of the P.Q.17 convoy to Russia in July led to a decision to provide even better aerial protection for the P.Q.18 and, rather incidentally, for the outgoing Iceland-bound Q.P.14. Realising that if any torpedo-bombers had been stationed in North Russia, they could have been effectively used against enemy capital ships on that occasion, it was decided to move two Hampden squadrons to Russia as a threat to any sortie by major German naval units from Northern Norway. If this was not enough to deter the enemy from using his capital ships to intercept the convoy, we should have a good chance of sinking some of them by a torpedo attack.

To provide the reconnaissance needed to enable our force to strike in time, a P.R.U. detachment was also sent to Russia, so that not only could the north Norwegian fiords be watched continuously, but the information would readily be available to the Senior R.A.F. Officer on the spot. In addition, P.R.U. aircraft operating from the United Kingdom covered those Norwegian harbours that were out of range of the Spitfires based in Russia. The reconnaissance provided by the P.R. aircraft would not, of course, extend to a complete cover, nor could they shadow enemy surface ships which put to sea.

It was necessary, therefore, as with P.Q.17, to send enough flying boats to establish cross-over

patrols off the Norwegian fiords so as to cover the courses which the enemy ships would have to sail to intercept the convoys. It was thus hoped to ensure that enemy surface ships did not leave the fiords unobserved and unshadowed, and to give early warnings of their movements to our submarines on patrol. A further role of the flying-boats was to provide anti-submarine escort to the convoys when east of 15° E., and especially to ensure that the escort vessels switched from convoy to convoy successfully during the period when these were passing each other. How these operations were planned and executed may be seen from Chart 7.*

To achieve these aims, 13 Catalinas of 210 Squadron, 32 Hampdens of 144 and 455 Squadrons and four P.R.U. Spitfires were despatched to bases in North Russia, the whole force being under the command of a Group Captain as Senior R.A.F. Officer. In all, the protection of these two convoys employed more than 100 aircraft of 13 different squadrons, based on Russia, Iceland and the United Kingdom. Their 269 sorties (171 operational) occupied 2,320 hours' flying time, of which 184½ hours were spent over the convoys. Almost half the sorties were made by Catalinas. Eight U-Boats were sighted and two attacked. Eventually most of the P.Q. Convoy reached Russia safely. Only one ship was lost in the later stages of the journey, which were covered by our Catalinas based in Russia. This particular ship was a victim of air bombing. The Q.P. Convoy lost no ships in the Russian area, and escaped more lightly thereafter.

At first, cross-over patrols were maintained from Iceland and Scotland, but when the distances became too great they were flown either in transit or else from Russia. No sortie was, in fact, attempted by the major German naval units in Norway, though the *Köln*, *Scheer* and *Hipper*, with four destroyers, moved up to Alten Fiord during the passage of the convoy: the *Tirpitz* remained at Narvik. No strikes were therefore made by the Hampdens, which were only employed on a reconnaissance in force on 14th September.

The maintenance personnel, torpedo and photographic equipment for the Hampdens and Spitfires were sent on ahead by the U.S. cruiser *Tuscaloosa*, arriving on 23rd August at Vaenga on the Kola Inlet. The Catalinas, however, were required to operate from Sullom Voe before flying transit sorties to North Russia, so their maintenance party was flown to Lake Lakhta near Archangel in Catalinas detailed for transit (Plate 7). These included aircraft of 422 Squadron, R.C.A.F., one of which remained and took part in the operations.

The original plan for the disposition of the force in Russia was to base the Hampdens and Spitfires at Vaenga, an aerodrome on the east side of the Kola Inlet, and the Catalinas at Lake Lakhta, a Russian Naval Air Service base near Archangel. As soon as the S.R.A.F.O. arrived, however, he decided that the communications with Lakhta were so bad as to make it necessary to operate the flying-boats from Grasnaya, 3 miles higher up the Kola Inlet than Vaenga. This base had the additional advantage of being 400 miles nearer the patrol area; it was, however, so close to the

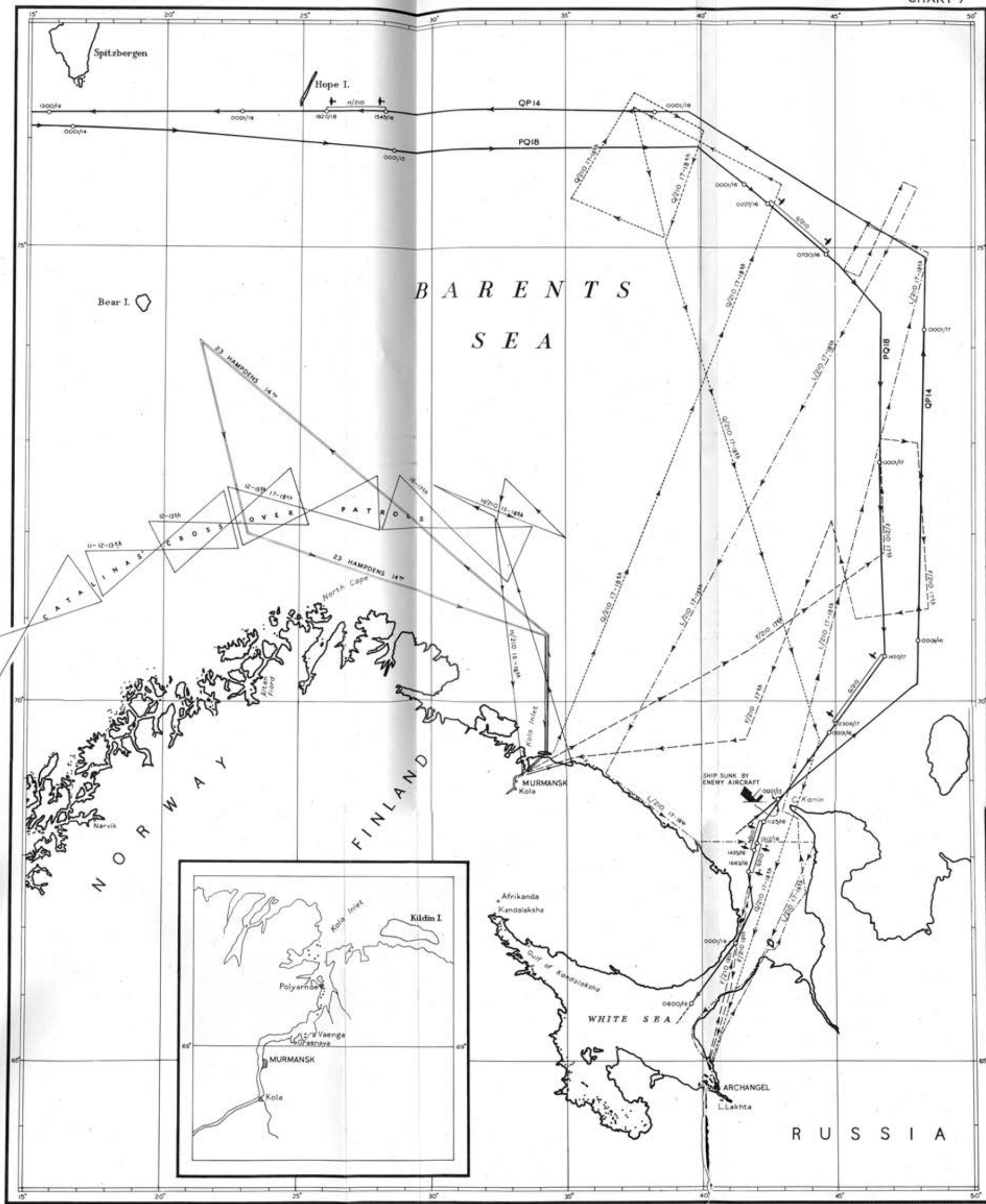
enemy front line that frequent air raids were to be expected, but it was decided that the risk must be accepted. Lakhta was still used as a rest base, and for escort duties on the final stages before the arrival of the convoy. The S.R.A.F.O. set up his headquarters at Polyarnoe, 8 miles downstream on the other side of the Kola Inlet, where the S.B.N.O. had his headquarters, together with the most reliable meteorological service in that part of Russia.

The Russians had fighters, long range reconnaissance-bombers and a small number of torpedo-bombers in the area, which were given details of our plan of interception each day, and arrangements were made for the Russian torpedo-bombers to take off at the same time as the Hampdens if a strike became necessary.

To give them sufficient margin of fuel, the Hampdens were routed to Afrikanda aerodrome, which lies north-east of Kandalaksha, on the gulf of that name in the White Sea. They left Sumburgh on the evening of 4th September, and 23 out of 32 reached Afrikanda or other aerodromes in North Russia safely. Two others reached Russia but ran out of petrol; one of them made a "wheels up" landing in a soft mossy field near Khibini (67.33 N., 33.10 E.) and was slightly damaged; the other force-landed on some tree stumps and became a total loss. Both crews were unhurt. A third Hampden was unfortunately shot down by Russian fighters at the mouth of the Kola Inlet, one of the crew being killed: there was an air raid in progress and the Russians did not recognise the Hampden, which was flying outside the prescribed corridors. The six aircraft which failed to reach Russia all crashed in Norway or Sweden.

Continuous anti-surface ship patrols were maintained by the Catalinas from 11th September until the Q.P. convoy was west of 15° E., with the sole exception of the night of 13th/14th September. This was the result of a chapter of accidents. Many of the aircraft which were diverted from their transit patrols to land at Grasnaya did not receive their diversion, and proceeded as originally instructed to Lake Lakhta. This left Grasnaya with only one aircraft (A/210) available for the patrol, and that long overdue for inspection, so that one engine refused to start. It was impossible to get a replacement from Lake Lakhta, for it could not be raised on W/T. The crew worked all night changing plugs, and with the help of the Russians got their aircraft off at dawn. The patrol had, of course, to be shifted further out to sea so as to intercept any of the enemy that might have left Alten Fiord. In fact it was so far from the coast that if the enemy had been sighted, the Hampdens could not have got off in time to intercept them from a first sighting report. Accordingly, the S.R.A.F.O. decided to send out all the 23 Hampdens available that morning on a reconnaissance in force. This decision was reinforced by other facts. The dawn photographic reconnaissance was obscured by cloud, the *Tirpitz* was known to be on the move, and the convoy would have been in a particularly vulnerable position. The Hampdens went out to the farthest possible position on the probable track of the German force, returning along it until

* Close escort by an aircraft is indicated by a thick bar on the otherwise thin line of the convoy's track. When aircraft were sent as escort but failed to meet the convoy, their routes are shown by broken lines. The double line indicates the track of the Hampdens' reconnaissance in force.



they reached the Catalina patrol area. The Russian torpedo-bombers co-operated in accordance with the arrangements already made. All the Hampdens returned safely after 7½ hours patrol, having sighted nothing. They were refuelled with the utmost despatch and in spite of an attack on the aerodrome, were ready for action again the next morning. The afternoon P.R.U. sortie showed that the enemy ships were still in Alten Fiord.

Escort to P.Q. 18 began on 3rd September from the United Kingdom, and continued until the 12th. There was then a gap of three days until Catalinas could be spared from the crossover anti-surface-ship patrols, and from the 16th to the 19th, when the convoy arrived in the White Sea, two Catalinas accompanied it as close escort. From the 18th onwards, aircraft were released to escort Q.P. 14. During the passage of P.Q. 18, a U-Boat shot up Catalina Z/330, whose crew were rescued by H.M.S. *Marne* (as described in previous issue, page 3). Catalina U/210 on escort to Q.P. 14 dropped a salvo of depth-charges across a U-Boat's centre; two appeared to fall within 6 feet of it. Three-quarters of a minute after the explosion, a great upheaval of water occurred in the disturbed area and the tail rose and hovered, slid under, rose again, rolled over and finally slid below. Another Catalina on close escort tried to intercept enemy aircraft of various sorts (chiefly Ju. 88's and He. 111's) making for the convoy, but failed to bring any to combat, as they were all too intent on their allotted tasks. During a combat between Catalina A/210 and an Ha. 138, both aircraft were damaged, the enemy broke off the engagement in spite of superior speed and armament.

The Hampdens and Spitfires were handed over to the Russians before our party returned on 22nd October.

During the period of the operations, there were daily air raids or alerts at Vaenga and our minds would have been easier if we had had camouflage nets for the aircraft; the odd branches used persisted in blowing off. But at first the enemy paid more attention to the half of the aerodrome occupied by Russian aircraft and Spitfires, while the Hampdens at the other end were dispersed 150 yards apart, so that very little harm was done to British personnel and equipment. One P.R.U. Spitfire had its main spar and tank injured; the Russians wheeled it away to repair it. Later on a single raid damaged 12 of the Hampdens, two men received splinter wounds and a Russian fighter crashed into the officers' mess, so that many officers lost a good deal of their kit.

Of all the difficulties encountered, communications, both internally and with the United Kingdom, were by far the greatest. This was due almost entirely to the W/T black-out which is liable to descend without warning north of 60° N. Good communications are essential for the control of aircraft, and in the absence of W/T it was necessary to rely on the Russian telephones, which at their best were not good. This made communications difficult in the extreme; for instance it often took over an hour to ring up Grasnaya from Polyarnoe *via* Vaenga, a distance of about 10 miles. The situation was not helped by the Russian operators' habit of cutting off at any pause in the conversation. Field telephones

(C47433)

with plenty of wire would have been of the greatest assistance.

The roads were almost uniformly very bad, both round Archangel and at the Kola Inlet. Motoring from Archangel to Lake Lakhta after dark one evening, the car twice went off the wooden tracks deep into mud, and the wooden tracks had to be rebuilt each time to get the car back up on to them. The transport problem was in every way acute and reduced our operational efficiency; the Russians could spare very little for us, and it would have paid to bring our own transport of all kinds. No one can wait on a bare aerodrome in that climate, and shortage of bowlers caused long delay.

The Russian food was found monotonous but palatable, though it did not compare with British rations. The extra rations sent out proved a most useful supplement. The hutments were well heated, all ranks had sheets and blankets on their beds, and only the sanitary arrangements left something to be desired. Headnets would have been welcome to keep off the mosquitoes and black fly; the anti-mosquito ointment was almost useless. Health was generally good, apart from an epidemic of itch (*tinea cruris*) but minor cuts gave a lot of trouble, especially since there was a shortage of small needles and material for sewing them up.

The Russian interpreters had a very good command of English—incidentally, the wife of one of them was fighting at the front as a Senior Lieutenant. Everybody was very courteous and pleasant; the atmosphere was most cordial, and all ranks got on excellently with the Russians. Russian discipline was good and their morale high. The senior ranks were especially co-operative, and General Kuznetzov in particular did all he could to help. The junior officers seemed rather frightened to take decisions, but if a matter was brought before a senior officer, things moved very quickly.

One or two of the many examples of Russian co-operativeness may be cited. We wanted to move the W/T set at Vaenga nearer the operations room allotted to our force, to a site which would give better results. The local C.O., however, seemed to think that the erection of a hut on the aerodrome would spoil the camouflage. The S.R.A.F.O. therefore approached General Kuznetzov at 2100 hours, and he made a short telephone call. The next event as far as we were concerned was that our N.C.O. in charge of the W/T at Vaenga was roused at 0200 hours next morning and told that the hut was erected, when would the W/T set and aerial be put up?

The Russian powers of improvisation coupled with their capacity for hard work seem to be the main factors in their efficient maintenance system. They stopped a petrol leak in one Catalina which our own personnel had failed to check. They cheerfully undertook to repair a broken Hampden which had made a belly landing. The Catalina which had been shot up in combat with a Ha. 138 was brought up the slipway at Grasnaya in eight minutes from the time of shutting off the engine, and subsequently repaired. Once the word "go" was given, the Russians went on working till the job was done. If they were a little slow in starting at times, they soon made up for that by their staying power.

In conclusion, the task of the expedition was made relatively easy by the excellent co-operation of the British personnel, both R.A.F. and R.N., whose uncomfortable privilege it is to remain in North Russia for the winter. They say, by the way, that kapok-lined "Tropal" coats are useless in cold weather; snow freezes on them making them so stiff that movement is severely hampered; and the wind blows up underneath them; besides, in a gale the wearer finds himself being blown

over. Of course metal fasteners should be avoided at all costs in winter. Our felt hats tend to be too small, while those made of sealskin freeze to the forehead and won't come off without the skin. Leather boots are useless against cold, though very good in the mud of spring and late summer; but the tongue is so wide that its folded edges press on the foot unless at least two pairs of thick socks are worn.

Air Fighting

In Section III of issue No. 5 of the *Review*, under the heading of "A Compliment," was a brief note on the changed situation in the Bay of Biscay, wherein the increased chances of Air Fighting by Coastal Command aircraft was touched upon.

Briefly summarised, it was explained that our A/S patrols in that area had caused such interference with the U-Boats' programme that the enemy put He. 115's there to try and check it. Our successes against the 115's led to the use of Ar. 196's, and later, as these also were found inadequate, of Ju. 88 fighters in growing numbers.

The latest development seems likely to be the employment of the enemy's best fighter, the Fw. 190, possibly using Ar. 196's as bait, in areas relatively close to the coast.

In other words, the air war in this area has developed along the usual lines. There is reason to believe, however, from combat reports and other evidence, that the crews engaged on intercepting our aircraft in the Bay are, in the main, inexperienced; some of them may even be drawn from Reserve Training Units. They show little determination to press home their attacks, and even in superior numbers often do not attempt to attack aircraft which are known to have heavy defensive armament. If attacks are made, they are broken off, frequently at 500 yards range. A good example of their inexperience is given by their break-aways, which have hitherto been almost always on the beam or to a position above, thus giving our turret gunners and beam gunners a good shot.

But we have not had a vast experience of air fighting ourselves in Coastal Command, so we should take stock of the situation, and see if we are using our tools in the best way.

Fighting Control

In modern air combats, Fighting Control is one of the important factors to consider. Fighting Control is essential in order to:—

- (i) conserve ammunition;
- (ii) enable the pilot to take appropriate action;
- (iii) in the case of simultaneous attacks, ensure that all attacks are dealt with.

In most Coastal Command aircraft, fighting control is normally carried out by the Observer or the Second Pilot from the astro hatch. In some aircraft, however, the position of this hatch does not permit of all-round control, and the duties of controller must at times pass to some other member of the crew. For instance, in the Liberator, which flies in a nose-down attitude, the astro hatch is situated so far forward

of the trailing edge of the wing, that a controller in that position cannot see all attacks from astern and below. The rear turret gunner, the navigator, and the top gunner may each be required to assume control, perhaps only momentarily, perhaps for longer periods. The two latter may be able to see beam attacks which are invisible to other fire positions.

This complication introduces the need for considerable training and practice, to avoid congestion in the inter-com., and more than one member of the crew being in control at any one moment. It is a matter demanding the most careful study and thought.

The need for Fighting Control also involves the need for meticulous attention to the maintenance of the inter-com. at the highest pitch of efficiency and for rigid drill in its use.

Evasive Tactics

Another requisite in Air Fighting is a thorough knowledge of the best evasive tactics, for it is clear that circumstances may arise in which it is more than merely justifiable to run away.

If an attack is made by a single enemy aircraft, steep diving turns in towards the attack usually prove effective. This gives the enemy a difficult deflection shot, and only allows him to get in a short burst. In a recent combat with a Ju. 88, a Wellington escaped damage in several attacks as long as it was able to turn in, and only sustained hits when it was no longer able to do so.

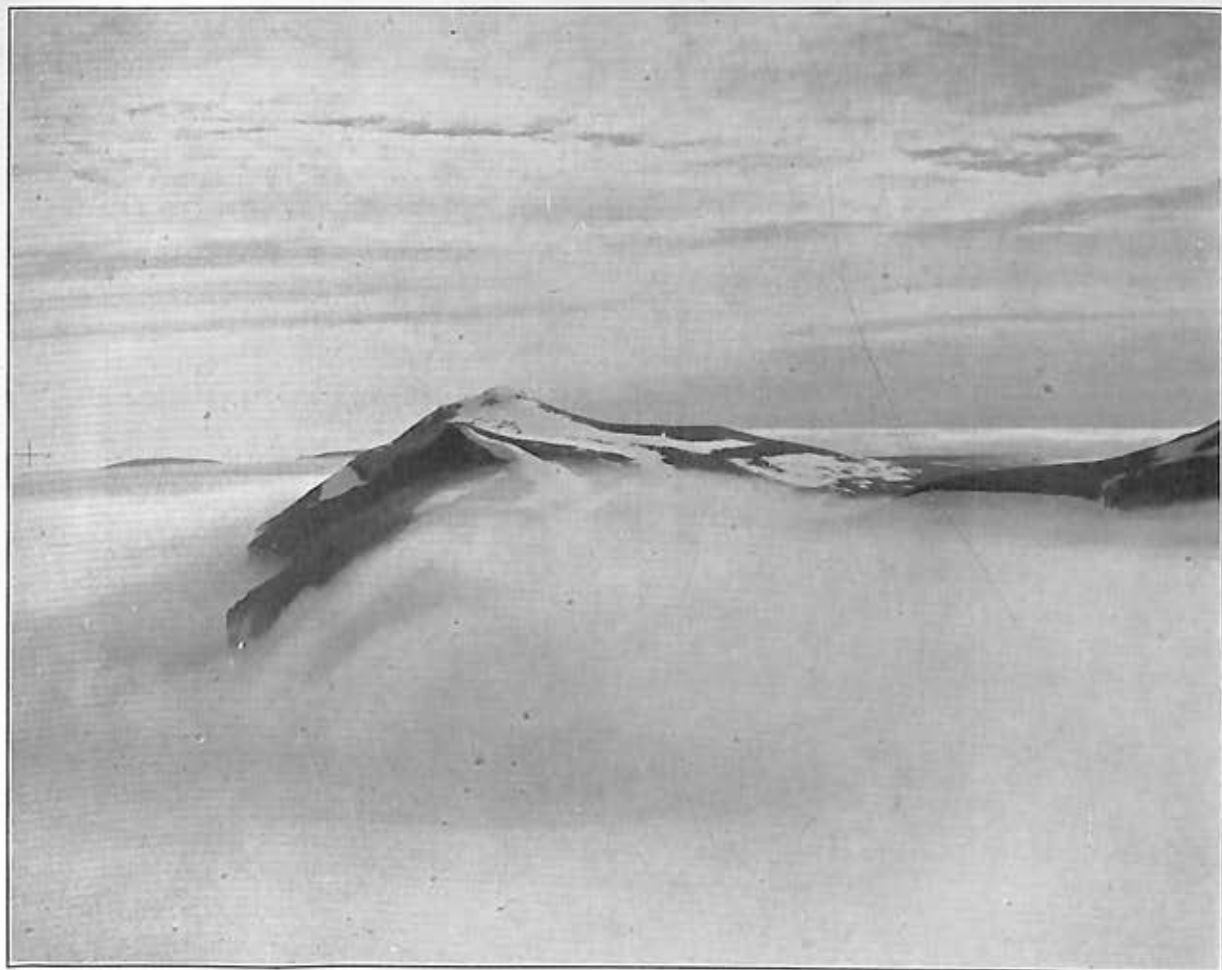
In the case of a diving attack, a climbing turn should be made, still in towards the direction of attack.

In short, provided that no more fighters are likely to come in to attack, and that there is no question of petrol shortage, the tight turn is the best evasive tactic. If, however, there is any likelihood, either of there being more than a single fighter, or of there being insufficient fuel to reach home, the "corkscrew" should be adopted. In the first place, it allows of maintaining a straight mean course instead of turning in circles, which brings the bomber towards safety and takes the enemy fighter away from it.

Should a head-on attack be made, use every effort to edge in towards the fighter as he tries to get into position. If the attack develops, a diving turn when at a distance of 600 yards is recommended, as this gives the fighter a difficult deflection shot, while enabling one's own front gunner to get in a reasonable burst.

If attacked by more than one aircraft, always "corkscrew," without exception.

The "corkscrew" consists of a diving turn through about 30 degrees, losing about 500 feet,



Bear Island, photographed on an ice reconnaissance flown for the routing of convoys to Russia (210 Squadron).



Landfalls and Landmarks in Norway (see page 19). (Top left) Egersund lighthouse, painted pink and white (42 Squadron). (Top right) Utsaer lighthouse, painted dull red (608 Squadron). (Bottom) Aalesund (42 Squadron); compare a photograph like this with a map before you take off - it will help you to recognise the features quickly when you get there

followed by a climbing turn of the same extent in the opposite direction, gaining 500 feet. The manoeuvre must be done as violently as possible, and must be kept up, although it is tiring, from the moment the fighter gets within 600 yards range until there is no more danger of attack. It gives the enemy pilot difficult deflection shots in two directions, as he has to aim above and in front during the climb, and below and in front during the dive. It can also be carried out comfortably at maximum cruising throttle-settings.

In countless practice air-fights, experienced pilots of the Air Fighting Development Unit, although knowing that this evasive manoeuvre was going to be adopted, have found it exceedingly difficult to get in a good burst.

The "corkscrew" clearly cannot be done at sea level, but the tendency for pilots to go down to sea level and merely weave is no longer considered a good evasive tactic. Indeed, A.F.D.U. is strongly against it. Although just at first the enemy may find it difficult to keep his sights on, he will soon be able to time the manoeuvre and anticipate its direction. In addition the shot-splashes afford an excellent check on his shooting, and allow him to adjust his aim.

Therefore, when attacked by more than one fighter, always corkscrew, and, as it is not particularly easy, practice it continually.

One or two points for gunners. Open fire as soon as you think the fighter is going to open up: getting a burst in first just makes all the difference; it may well put the fighter off his aim, provided you shoot reasonably well. Always aim at an engine: the pilot of a modern fighter is almost completely protected by armour and bullet-proof windscreens. But even the Hun has tended to neglect the armour protection of that most vital part of his engine, the fuel injection

system. Above all, study air-gunnery, think air firing and practise any form of shooting on every possible occasion. As any Fighter Command pilot will tell you, you will never know all there is to be known about air fighting. It is an art rather than a science, and practice is never a waste of time. It is hoped to be able to arrange a small circus of Spitfires to visit all Units, to help them study their own fighting tactics and work out their own problems.

One more word. Nobody, of course, likes to throw away good bombs or depth-charges, which ought to be used against the enemy. But you may just not make that friendly cloud, or your aircraft may not handle just as easily, if you are carrying your war load. So if you judge that the safety of your crew and aircraft may be at stake, don't hesitate to jettison, if that is likely to enable you to get home to carry more bombs or depth-charges on other days.

While it must remain as a general truism that attack is the stronger form of war, remember that it is the function of certain aircraft to attack surface and under-water craft, and these are not therefore fitted for indiscriminate attack on enemy fighters in superior numbers. They must evade so as to attack their proper targets later. Now in the particular problem of the Bay, any fighters you may meet there except Ju. 88's have also their own P.L.E. problems, so that if you have to evade, make your course out to sea rather than, necessarily, towards your own nearest land. It may well force the enemy to break off combat far earlier. If he insists on following you, a moment may arise when you can consider turning on him and forcing him into a fight, with the knowledge that even if you don't shoot him down, you may delay him so that he has not enough fuel to get him home.

Coastal Flying in Norway

The Norwegian Coast, awe-inspiring in appearance, is a pleasant country to tour, but not the most comfortable area to cover on operations. From a navigational point of view, the coast-line is difficult to cope with and you are often baffled when coming upon a cluster of islands giving way to mountains and fiords in the background, especially if you are flying as low as 50 ft. Making a good landfall is easier if the navigator is well trained in taking drifts while flying low over the sea. Unfortunately, the weather is seldom favourable, and the few occasions when you can stop and have a good look around do not allow you to get to know the whole coast from Aalesund south to Kristiansand, so it helps if you can get some of the salient pictures in the back of your mind. Since you are making your observations from a low altitude, points to concentrate on are the shapes of hills and the characteristics of various lighthouses, so that when you are suddenly presented with a strip of coast in front of you, you can say "that's so and so: we turn right here." Plate 9 gives examples of the sort of images and notes to carry in your head.

On approaching the coast, you want to watch out for the fishing boats, which have sometimes been seen as much as 50 miles off shore. There may well be a German patrol-boat amongst them, or a fishing boat manned by quislings, which can easily send a wireless message—"Three Beauforts

(or Hampdens) approaching; be ready to receive them." If you have to pass over them on the way in, make an alteration of course when you get out of sight, so as to strike the coast at a different point. One pilot on operations over Norway used to flash "V" at all the fishing boats he encountered, and if they did not make a suitable reply, he shot them up, but you should remember that if you do come down in the water, one of these boats might be your only hope of rescue.

The weather over Norway plays funny tricks, probably owing to the situation of high ground near the coast. You may often be flying in favourable weather, such as 10/10ths cloud at 800 ft. and before you know where you are, suddenly come out into blue sky and find a fighter waiting for you. If the weather is favourable, and you intend to explore the leads for a possible target, you want to make quite sure you know the exact channel you are entering, and that it has an outlet to the open sea at the other end. It can be most uncomfortable finding yourself running into a wall of rock, especially as some fiords are so narrow that you cannot turn a modern aircraft in them, and have hills so high on either side that you cannot climb over them in the short space of time available.

This low flying through the leads can be a most exciting pastime, and sometimes you get an encouraging wave from a friendly Norwegian.

But the German gunners, who are cunning in these parts, have been known to wait for an aircraft to come into a flak concentration area. Just when you think everything in the garden is lovely they open up with everything and you have to try and get out. The lower you are, the better it is. German gunners have, before now, placed their flak positions half way up the side of a fjord and, when trying to depress their guns sufficiently to hit a British aircraft, shoot at each other across the water.

When operating at night, it is quite common to see lights appear as if they were being switched

on to help you find your way. These lights rather resemble navigational buoys for guiding ships through the leads, and might well be shown by the Norwegian population trying to help you find the target, but pilots following these lights have been known to run right into flak ships. Consequently, they should be treated with caution. In winter, when the ground is covered with snow, practically the only way of finding out where you are at night is by knowing the shape of inlets and fiords, and it is a good idea to study the map intensively before take-off, and commit as many of these shapes as possible to memory.

Navigation in and around Iceland

The mention of "Iceland" to navigators who have not experienced flights in high latitudes usually conjures up a dismal picture of frozen wastes and jagged mountains, where compass needles swing aimlessly upon their pivots in an idle attempt to stand on their heads. The bitter experiences of some air crews have been magnified in the popular mind, until there is a tendency to believe that compasses, without which navigation is impossible, are comparatively useless when flying near that island. Rumours are often false, and this is no exception. Aircraft have operated quite efficiently from Icelandic bases since they were first occupied, and trouble has only arisen when the special precautions necessary in all high-latitude flights have not been observed.

Iceland lies between 63° and 67° N., and because it is so much nearer the magnetic pole than, for example, the United Kingdom, it must be remembered that the horizontal magnetic force, which gives magnetic compasses their directional qualities, is quite considerably less, as evidenced by the fact that the angle of magnetic dip is approximately 10° more than that experienced in the British Isles. For this reason, a perfectly normal aircraft compass becomes sluggish in action, and appears reluctant to define directions as quickly in Iceland as it would further south. This behaviour is in no way peculiar to Iceland, but is noticeable in all high latitudes. Yet it is for this very failing that Iceland has acquired such a bad reputation.

Experience goes to show that if the following points are remembered both by navigators and by pilots when flying in the neighbourhood of Iceland, their only cause for real concern lies in the effects of magnetic storms, which are occasionally experienced, but whose frequency has been over-emphasised. The first safeguard to take is to make quite sure that the magnetic compass used is perfectly serviceable, so that it may take full advantage of the reduced horizontal magnetic force of the earth. The tests for pivot friction, deterioration of compass fluid, magnetic moment and general serviceability are fully described in the relevant manuals, and now that compass adjusters are becoming more available to squadrons it should be unheard of for compasses not to be accurately swung and kept in perfect condition. If appreciable deviations are left uncorrected instead of being removed, any reduction in the earth's horizontal magnetic force will increase the deviations resulting from magnetism in the aircraft. It is, therefore, no wonder that some aircraft whose compasses were originally badly

swung in the British Isles have experienced trouble when proceeding to Iceland.

The second precaution should be for the navigator invariably to check every compass course by means of the astro-compass, which is easy to use and infallible, provided the sky is clear enough to see a heavenly body. When using the astro-compass, it is important for the pilot to fly as steadily as possible, preferably by using his automatic controls, and for several readings to be taken.

Courses flown by aircraft operating from Iceland are frequently more northerly or southerly than easterly or westerly, and for this reason we should expect trouble. The acceleration error, sometimes called the northerly turning error, is a very important consideration the further north the aircraft flies. Quite small turns or rolling movements of the aircraft will permit the compass needle to be appreciably affected by the more powerful vertical component of the earth's magnetic force, so that the compass needle will appear to wander much more than it does elsewhere. To avoid chasing what seems to be a will-o'-the-wisp compass, pilots should fly as straight and level as they can, and when making turns are advised to use the directional gyro for some time after the turn, so as to allow the compass to settle on its correct heading. More often than not, when the compass needle is found to be indicating that the aircraft is off course, it will have been due to turns and/or rolling (on northerly courses) or to pitching (on easterly and westerly courses). Before raising the alarm, therefore, every pilot must ask himself, "Am I climbing or diving? Am I turning? Am I wing-low? Have I been doing one or more of these things in the last few minutes?" He will usually find that concentration on accurate flight for a few minutes will dispel any irregularities which the compass may have suffered.

Magnetic storms and peculiarities of local variation in and around Iceland are known to exist, though accurate and recent evidence is somewhat lacking, and it would therefore be unwise to overlook their existence on the ground that their effects are largely indeterminate. Local peculiarities can be avoided by flying not lower than about 5,000 feet over land, or 2,000 feet when within 20 miles of land. Magnetic storms are ionospheric disturbances associated with sun-spots, and vary considerably in intensity. Those of shortest duration are often the severest, but at most do not deflect the compass needle

in Iceland more than 10°. In Britain their effects are only slight. The usual storm lasts between one and three days, and may deflect the compass needle only 3° or 4°. Magnetic storms are accompanied by auroras visible by night, and cause severe wireless interference, which is usually a much greater inconvenience to the airman than the effect on the compass. Sun-spots occur in an eleven-year cycle, and sometimes last longer than the 27 days the sun takes to

rotate upon its axis. For this reason it is possible for meteorologists, from a study of sun-spot activity, to predict magnetic storms a month in advance, as the same spots may be there for a second time round. In time it may be possible to give a more accurate warning of their approach.

Provided that these limitations of magnetic compasses in high latitudes are appreciated, the bogey of operating in and around Iceland can be fairly exploded.

III.—SPECIALIST AND GENERAL ARTICLES

Second Thoughts on Planned Flying and Planned Maintenance

First thoughts on Planned Flying and Planned Maintenance (*Coastal Command Review*, No. 6, p. 27) sought to divest the subject of its frills and furbelows and to leave it, if not naked, at least so clear as to show its form and outline. No doubt this literary strip-tease failed as signally to excite the reader as the usual dim performance of the music-hall stage does the habitué of the front row stalls. Perhaps the reaction has been, "If that's all it amounts to, then why this bother?" But the closer one approaches the subject, the more complications arise: in much the same way as the simplicity of the strip-tease artiste on the stage may well prove to be something quite different if one gets involved in supper after the show.

For though, basically, Planned Flying and Maintenance is simple, a large number of varying factors have to be taken into account both by the Air and Technical Staffs. These may be most conveniently analysed under several broad headings:—

- (a) Planning the Plan.
- (b) The Flying or Air Staff Plan.
- (c) The Maintenance Plan.
- (d) The Maintenance Plan in operation.
- (e) Some other considerations.

Planning the Plan—The Flying Plan

The plan contains two elements, the Flying Plan and the Maintenance Plan.

The Flying Plan is obviously a matter for the Air Staff, but the calculation of the effort which can be maintained from the available resources can only be determined after consultation with the Maintenance Staff.

In the ideal world of the dreamers who dream dreams, which unfortunately so rarely come true, the total effort of the Air Force as a whole would be precisely foreseen and allocated. In war at least, this is not possible in great detail, though block planning can be and is carried out. In fact, it would be of doubtful advantage unless it also embodies a flexibility which enables advan-

tage to be taken of the changing face of war. In peace-time it is more feasible, provided that the value of flexibility is not overlooked, as to a certain extent it was by the Germans in 1940-41.

But if such planning cannot conveniently be carried to its logical conclusion, it is certainly practicable to plan within the allotment of aircraft to a smaller formation such as a Command. The output of effort can be resolved firstly into the broad categories of Routine Patrol, Escort and Patrol, and Strike Squadrons. These can be broken down into a classification of types from the operational requirement point of view—so many squadrons of long range or medium range patrol and reconnaissance aircraft; the strength of effort in terms of anti-shipping, torpedo and fighter aircraft.

Their geographical location in the area of the Command, their permanence or likelihood to be called upon to make rapid moves, and the probability of at least some of them having to make frequent detachments can be assessed, if not for all time, at least for some months ahead.

This will enable a picture to be drawn up of what Air Staff would like to have in order to meet anticipated commitments and in doing so, of course, some reasonable rule of thumb figure of effort obtainable would be used.

The final plan is bound to be a compromise between what is desired and what can be achieved, since it is very improbable that the resources will be available to meet all requirements. When aircraft are so numerous that no employment can be found for the output of the factories and surpluses pile up to the embarrassment of the producers, then, provided the maintenance facilities and the supply of aircrews could keep pace, without doubt the air war will be won. Further, the Flying Plan is largely dependent upon the action of the enemy, and because of this will need frequent adjustment, revision and bringing up to date. It must also look forward and anticipate the increasing output, and consider its employment when delivered.

The Flying Plan is therefore a balance of commitments and actual or potential resources. It is one part of the joint plan to make the best of these resources. The Flying Plan is framed by Air Staff on information which they may not be prepared to disclose and will be stated in terms of effort required from a given force of squadrons.

Planning the Plan—The Maintenance Plan

It is one thing for Air Staff to say what they want; it is quite another whether the Maintenance Staff can in fact provide it.

The Maintenance Staff have to consider the squadrons type by type, since clearly some aircraft are more easily serviced and less susceptible to wear and tear and deterioration. The age of the aircraft and their probable duration in service are relevant considerations. Where the aircraft wastage is high, and aircraft are replaced at short intervals by new ones, not only will the maintenance load be low but also troubles due to aging will be largely non-existent. Most people at some time or another have argued the question of whether (in the happy days of such possibilities) it is better to buy a new car every year or keep it for five or six years: and the answer lies in the initial cost (*i.e.* probable durability) of the car and the amount of use that it will be put to in a given time. Beyond a certain point, it will need frequent attention and constant expenditure until the time is reached when it becomes more trouble and expense than it is worth. Much the same is true of aircraft—the older they get beyond a set limit the more servicing will they need, and although they may still be airworthy they will have to have increased maintenance to keep them so.

A final factor of importance is the establishment of personnel allowed or which can be made available. It is unnecessary to say that this controls the work done. The men available, their proper distribution by trades, their individual technical efficiency, the hours of work which can be obtained from them and their working conditions will all go down on the other side of the balance sheet; and then the totalling up and comparison will begin.

The foregoing shows the way the plan is formulated. While the balance is struck by Air Staff as the user, there is a primary responsibility on the Maintenance Staff to advise and to guide the joint plan in all its stages. And in this connection it may be appropriate to quote a dictum which hangs in the office of General Arnold, the Chief of the U.S. Army Air Corps in Washington:—

“It may not always be the best policy to adopt the course which is best technically, but those responsible for policy can never form a right judgment without knowledge of what is right technically.”

The Flying Plan

There is little more to add to what has already been said about the Flying Plan, without going into detail unnecessary for this purpose. In any command it will be conditioned by the role and importance of the work of that command in the war effort at the time of formulation. To-day the emphasis may be on the Mediterranean, to-morrow on India or South Africa. At one time the Fighter effort may transcend the Bomber or vice versa. Whatever else, flexibility is an essential element,

since mobility and the power to concentrate in widely separated areas is one of the greatest advantages of air power.

The Maintenance Plan

The Maintenance Plan is built up on records of experience with the type of aircraft and similar methods of operation. When a new type is introduced, or radically new operating conditions are encountered, the best that can be done is to plan by analogy. This will be expensive at first, since if efficiency is to be maintained provision will have to be on a more liberal scale than events may prove essential. Without this, hold-ups may occur—and at best, some trouble will be experienced from this cause, since accurate forecasting of necessities is rarely complete.

This points to the dependence of maintenance on proper records which will enable the Maintenance Staffs to keep a clear picture of the position in each squadron in the command. For present purposes these are:—

- (a) For Air, Supply and Maintenance Branches:
 - (i) The Mayfly—which is a definite statement of serviceability at a known time each day.
 - (ii) The Static—which shows similarly the degree of unserviceability and the reason for it.
 - (iii) The Flying Record—which shows the rate at which aircraft are being used up and which enables the incidence of inspections and overhauls to be estimated and correlated with the work of the Repair Units and the output of the factories.
 - (b) For Maintenance Staff:
 - (i) Casualty records, and their reasons.
 - (ii) Records and reasons for failures to complete operations.
 - (iii) Monthly flying times per squadron.
 - (iv) A Combined Monthly Chart for three current months giving a graphic daily representation of—
 - (a) Total operational flying hours, for the whole Command.
 - (b) Total strength of operational aircraft for the whole Command.
 - (c) Total serviceable operational aircraft for the whole Command.
 - (d) Total unserviceable operational aircraft for the whole Command.
 - (e) Total major inspections of operational aircraft for the whole Command.
 - (f) Total minor inspections of operational aircraft for the whole Command.
 - (g) Total awaiting spares of operational aircraft for the whole Command.
 - (h) Total unit repairs of operational aircraft for the whole Command.
- (All this is deduced from the Mayfly, Static and Training Returns.)

As noted above, the Maintenance Plan is influenced by the types of aircraft concerned and their employment. A Halifax is a different matter to a Beaufighter, a Patrol Squadron to a Strike

Squadron. And there are variations between similar types. The Wellington G.R., Leigh Light or Torpedo-carrying Squadrons require different equipment, different maintenance, and different personnel at least in some respects, to deal with them. The niceties and special requirements of each must be carefully graded and balanced.

Working conditions will influence output of effort to a marked extent. The provision of hangars, blackouts and reasonable comfort, as well as adequate equipment will not only lead to more effort per man per working hour—and during the winter the utilisation not only of the night but the full hours of daylight—but it will also permit of shifts being worked if the man-power situation allows and jobs to be finished off the same day and not left over.

The technical efficiency of individual tradesmen is apt to be a source of anxiety, complaint and excuse on every station. It is to be expected that after three years of war, of technical development and rapid expansion, the standard would not be what it was; nor can the blame be put on the Schools of Technical Training which can no more turn out 100 per cent. skilled tradesmen than the O.T.U's can produce aircrews who have nothing more to learn. Every Unit must be an advanced training unit as well as an operational one; and a spirit of "training while you work" will turn out more useful workmen with increasing experience and growing confidence. It lies within the power of the more skilled to bring along the weaker members of the team and to infuse in them some of their own knowledge and keenness.

The importance of the welfare and physical well-being of the ground staff—the responsibility of the squadron and station commander, is another consideration of scarcely less importance. Good food, recreation, reasonable living quarters and understanding discipline, will lead to a state of contentment and the will to greater endeavour. While hardship in varying degree must be accepted in wartime and the peace-time standard of comfort is rarely likely to be reached, sustained effort cannot be maintained in an atmosphere in which such considerations are neglected.

The establishment and strength of the Unit must be a governing factor. It can be taken as axiomatic that the amount of work to be got out of any unit is in direct proportion to the number of staff carried, and is closely related to their proper distribution by ranks and experience in the various trades. The first statement calls for no elaboration; as far as the second is concerned, it goes without saying that an establishment deficient of, say, electricians will bring the work of the whole to a standstill. When the flying plan breaks down, or the flying effort falls below the expected, the first inquiry should be as to the position of the personnel strength. The cause may not lie in this, but since we are dealing with a human organisation it is more than possible that the failure is due to a deficiency in the human element.

The relationship of strength (and incidentally establishment) to the work to be done, requires thought and assessment. It is the duty of the Unit Commander to represent to his Group, and so upwards, his weakness, so that adjustment can be made or the contract, in terms of flying,

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altered. It is essential from a staff point of view to get early intimation of this, because if it is sufficiently widespread and grave the whole man-power distribution of the country may become involved and have to be re-oriented. At the same time an excess of man-power over the needs must be declared, for potential effort is running idle and must be moved to more profitable areas. Parochialism is always shortsighted, at times dangerous. Whatever may be desirable in times of peace, flexibility of man-power in war is the touchstone of industrial efficiency.

The question of the ideal strength of a Squadron in aircraft and men is pertinent. Aircraft will naturally vary according to type and operational function. The small ones, such as the Beau-fighter or Mosquito, because of their shorter range and smaller size, can be held in greater numbers. Larger types, for example the Wellington or Liberator, not only need greater attention, but will, if they are to be serviced rapidly, require a greater number of men than can be got together on one aircraft at one time. The small squadron or flight is costly in overheads—the large one means centralisation and dependence upon a few senior officers. The Germans have favoured the latter, partly owing to the natural racial tendency to regimentation and partly owing to a lack of trained sub-leaders, and while the result may be open to some controversy, it at least has serious drawbacks.

The answer is bound to be a compromise, and perhaps the criterion is the number of men whom the Commanders can handle and deal with directly. Where the Squadron is concerned, the limit would seem to be in the region of 500. This provides the Economic Unit capable of managing 9 to 24 aircraft according to type, and providing flexibility combined with sufficient inherent strength to withstand the vicissitudes of war and the incidence of sickness, leave and drafting.

The Maintenance Plan in Operation

It has been said that the joint plan is the outcome of a study of squadron experience, and that with a new type of aircraft this has to be found by trial and error. To do this pre-supposes the keeping of accurate records. No provision is made for this in Squadrons at present, although where this has been done experimentally the results have established its value. These records must cover:—

- (a) The actual time an aircraft is (i) flying, (ii) fully operationally serviceable and awaiting flying, (iii) under major and minor inspection, repair or awaiting spares, and (iv) awaiting inspection or repairs.
- (b) The hours spent by men of all trades on unproductive duties;
- (c) The part played by aircrews while not flying; and
- (d) If practicable, a job card for each man.

The reason for requiring these is self-evident except for (c). This pre-supposes the introduction of a system of employment of aircrews part-time on their aircraft or equipment, which is perhaps revolutionary and may only be of restricted application. It has advantages in that while it could be to a certain extent productive it would

also familiarise aircrews with their aircraft, knowledge of which would prove invaluable when on active service away from their base and perhaps in a district (e.g., North Russia) where ground assistance is limited. If this were to be adopted, it would come in as part of the Squadron Training Scheme and would be applied variously with different types of aircraft.

Non-flying aircraft will fall into two categories—those On Maintenance (*i.e.*, being actively worked upon) and those Awaiting Maintenance (*i.e.*, held up for spares, men, etc.). The object of the Engineer-in-Charge is to preserve a smooth turnover, and if those Awaiting Maintenance exceed some 10 per cent., this is a clear indication that the plan is out of phase. Either more ground staff must be drafted into the squadron, or the number of sorties must be reduced.

A smooth running servicing organisation is bound up with the rapid supply of spares. The importance of this in peace time was fully appreciated by certain motor manufacturers, and Fords in particular, when bringing out a new type, used to equip their agents with spares before the car was put on the market. In war, this is less easy. Damage through enemy action may occur in parts not normally likely to fail; consignments of spares may be sunk; shortages due to wrong estimation of requirements and numerous other causes may arise.

On the other hand, stores are only too often available at the maintenance units or even on the station, but owing to lack of attention to the administrative side and failure to realise the vital part they play in squadron serviceability, they are overlooked. It is, therefore, an elementary necessity that station stores are kept up to establishment in spares and that the squadron engineers put in their demands as soon as known and in proper form. A few days' delay spreads all along the line, until it gets back to the Ministry and the producing factory, where perhaps weeks have elapsed during which a crisis has been built up in the squadrons, and no action has been taken to ease it. The spares question is difficult

enough, without avoidable aggravations from outside.

One word about the gentle art of robbing the already unserviceable aircraft. As the school-boy said, "It is a very present help in time of trouble, but an abomination in the sight of the Lord." It is a fundamentally unsound practice which in the end creates widespread trouble. It can only be done at the cost of ultimate inefficiency. There are exceptions to every maxim and there are times when recourse to it is justified or, indeed, inevitable. But it is not a step to be taken lightheartedly and without due consideration, and its use should be watched and kept well in check by those who supervise the broader fields of maintenance.

The last point to be touched upon is the time taken for major and minor overhauls and repairs. Knowledge gained by experience, backed by records, will enable this to be standardised and rendered uniform. It will also show whether inspections laid down are really necessary or can be extended with safety. If this is possible, a saving in man-power immediately becomes possible; and therefore it is the duty of group and station engineers to watch this carefully and put up their recommendations. This applies to any improvements in the system either as a whole or locally.

The foregoing deals with a number of points perhaps rather discursively, each obvious in itself but yet often lost sight of in the pressure of the moment. The application of Planned Maintenance is at present in an experimental stage; much of it is still being thrown back and forward in the courts of argument. But also much of it is plain common sense, which can be put into practice without waiting for the introduction of the matured scheme. It is for this reason that it is put forward at this stage, so that the discerning engineer, equipment and squadron officers, as well as those at Groups and Commands, can take action to improve the present situation. If nothing else, it may serve to stimulate thought on a subject which cannot be considered and reconsidered too often.

Squadron Training

"I eat my peas with honey,
I've done it all my life,
It makes the peas taste funny,
But it keeps them on my knife."

Whatever else, the writer of this stanza was practical; we may not approve his table manners, but at least we must admit that he was faced with a difficult problem and found a solution to it.

War is essentially a practical matter, whether looked at from the point of view of hand to hand combat or operational planning; the problems are complex and their solution often depends upon improvisation and making the best use of such facilities as are available. The ideal solution is rarely the one which is ready to hand, and success often depends on the ability of the individual to make the best use of what he has at his disposal.

But the value of plans, equipment, gadgets or what you will, is proportional to the efficiency with which they are used. The best armed fighter is relatively ineffective in the hands of a pilot who cannot shoot or fly with reasonable accuracy; the most potent depth-charge is no better than the next if it falls 100 ft. from the U-Boat;

faulty navigation may lead to the highly trained crew failing to reach the target and their skill being of no avail. And so training is as practical as any other subject. This is as true now as it was in the last war. Ball, McCudden and Mannock, to mention three of the most outstanding names, possessed no super-human attributes. They were average pilots; they had a "good eye"; they had courage and determination, qualities which are not exclusive. But they added to this the will to train themselves up to the highest pitch and they spared neither time nor effort to achieve this.

In those days equipment was very rudimentary; now, training devices, both existing and "round the corner" are numerous. Synthetic devices, submersible targets almost as convincing as the U-Boat itself, camera guns, teachers and towed targets, provide a galaxy of aids to training, which were not dreamed of in the old days. Some are indispensable; most are desirable; but there

is a very real danger that they may either not be used to the full advantage or that if the box of tricks is not complete, it may be assumed that training must come to a standstill. In point of fact, tactical problems are basically simple and, in the final analysis, training to meet them only calls for a minimum of aids. The depth-charging of a U-Boat, for instance, is not a question of hitting a moving target, but of putting the charges accurately at a distance from a fixed mark—the swirl—this distance having been estimated from an appreciation of the circumstances of the sighting and the U-Boat's behaviour. Training for this most difficult operation is, therefore, a matter of judging distance; of applying the estimated distance immediately and accurately; and of proper manipulation of the releases and any bomb sight which may be installed. An actual submarine or a submersible target is not to be despised as a means of bringing reality into training and of putting a high "finish" on to air crews; but their absence does not mean that no training can be carried out without them.

A survey of the training activities of squadrons in the Command shows a tendency for the latter to fall into one of two categories: (a) those in which squadron training is taken seriously and driven ahead, and (b) those in which excuses are apt to be made to justify this not being done. Nor is the standard of training, as between groups, on a uniformly high level. Further, there is without doubt a definite connection between the squadron which shows up well on operations and the squadron which also shows up well on training. The difference can often be expressed as a personal equation and may be not infrequently ascribed to a deficiency in the human link which runs between the Group Training Staff, the Squadron Commanders, the Flight Commanders down to the Captains of aircraft. If these are not live, training-minded and determined to down difficulties and not to play up to them, there will not only be bad training, but poor operational performance.

It is easy to make broad statements; and to run out a string of pious high hopes. Since this article aims to be practical, here are some practical points which may merit consideration:—

- (a) Is there a group, a station and a squadron training programme which provides a well balanced plan for each unit?
- (b) If so, is it being carried out, not in a half-hearted way but with enthusiasm? Is a check being kept from the group downwards on the progress made?
- (c) Is training being carried out without waste of time? For example, take armament training. A number of aircraft are made available for this. In order to get the best out of them and a short day, each aircraft must arrive on the range as soon as the last has finished its practice. Re-armament calls for a high degree of co-operation between

ground staff and aircrew, between the officer i/c training and the station and squadron armament officers. Familiarity with the range areas and range orders is important. When co-operation is with outside organisations, such as marine craft or the other Services, it is essential that the details should be clearly understood so that no misunderstandings arise. Clear and adequate briefing will avoid exasperating failures. Rigid insistence on punctuality in time of take off, on the target and landing, is an elementary requirement.

- (d) Is the particular exercise not only designed but carried out in the most realistic manner? Are the fighter or A/S tactics as nearly what they actually would be on operations?
- (e) Is the crew drill throughout what you would expect in the face of the enemy? Is everyone keyed up and taking the practice seriously?
- (f) If your Group, your Station, your Squadron lacks really *essential* facilities, is it because you are not aware of this, or if you are aware, because you have not taken and continued to take action to bring their lack to the proper notice?
- (g) If you are a member of the Group Training Staff are you constantly getting round squadrons, helping them with advice, trying to get them what they want and smoothing away their difficulties? Do you know your Squadrons?
- (h) Is full advantage being taken of Affiliations?

If these notes seem to harp on one subject, this should be read as an example. Training in Navigation, Signals, Bombing, Gunnery, Torpedo-practice, all have their place and importance: and it is the duty of those officers who are charged with training to balance them out and inspire the training with their own sense of keenness.

Squadron training is the measure of operational fitness—the squadron or the aircrew which does not train with energy and intelligence, will never stand out nor be feared by the enemy as they should, no matter how hard they strive when the day of action comes. More than ever before, training is the forerunner to successful operations. The initial advances of the Germans and Japanese were in large part due to the effort they put into their pre-war training; the Battle of Britain was a victory towards which training made a real contribution. Not only success, but survival—national and individual—depends upon it. It may at times seem dull, although there is no need for it to be so if properly handled, but it is vital. And one of the definitions of that word is "essential to existence or the matter in hand."

Don't Help the Enemy

For five hours the Sunderland had been searching the area through which it was believed a small enemy force might pass. The weather was not up to much—bumpy with frequent snow squalls and once again the crew were resigned to another

one of those binding, uneventful patrols. Suddenly the rear gunner yelled through the intercom: "Three ships on our port, sir," and there, sure enough, some six or seven miles away, was a large tanker escorted by two smaller vessels

—the very ships they were out to find. The Captain called the Navigator. "There they are" he shouted, "bung out a first sighting report—one tanker and two unknown" and picking up his microphone called the rear gunner—"Good show, Smudge, it won't be long now before our chaps are out to see them to the bottom." But "our chaps" never arrived. The first sighting report did not reach base until over half an hour after the Captain had given the order, and when it did arrive it was corrupt and a repeat had to be requested. In the meantime, the aircraft had had to set course for base, the enemy had altered course unobserved, and once again was permitted to reach his destination unharmed.

Similar incidents to that quoted above occur far too frequently, owing to carelessness and non-observance of the correct method of coding reports. Never a day passes without aircraft of Coastal Command being called upon to make sighting and amplifying reports concerning enemy forces, yet many of the reports which are received are either corrupt or fail to give full and sufficient information as to the enemy's position, course and speed—three vital necessities. Out of many examples of bad coding and their consequences here are two which occurred recently:—

- (i) An aircraft, which was shadowing an enemy force, sent a badly encoded first sighting report, and the Admiral Commanding our own forces was under the impression for more than an hour that he had two separate and distinct forces to deal with. The result was a temporary diversion of our own forces culminating in the escape of the enemy.
- (ii) A tanker was sighted by a Liberator about a hundred miles off the north coast of Spain. She was subsequently sighted by six other aircraft and, to indicate the lack of coding ability, here is an outline of what happened:—

No. 1 Aircraft.—1300 hours, sighted tanker escorted by 4 E/Vs. Sent first sighting report but failed to indicate the approximate course of the ships and also failed to send an amplifying report.

No. 2 Aircraft.—1310 hours, sighted the force and sent first sighting report using Group 425 (position, course and speed of enemy battle fleet and type indicated), but failed to indicate course or speed and also gave a corrupt position. (The self-evident code should always be used except in the case of submarine reports). The amplifying report was wrongly coded and did not refer to the previous signal.

No. 3 Aircraft.—1600 hours, sighted enemy force and sent the following incorrect sighting report:—

"4DD—1 tanker 1QP—270—ABCD1234." There should be no break between 4DD and 1 tanker. 1QP does not make sense and there is no indication of the bearing and distance of the aircraft from

the force. The signal should have read as follows:—

"1MV4DD160—30—270—ABCD1234"

This aircraft failed to send an amplifying report.

No. 4 Aircraft.—2209 hours, sighted enemy force and sent a first sighting report. This was followed by a message indicating that the force had altered course to 0900. Base requested an amplifying report, but the aircraft did not reply until five hours later.

No. 5 Aircraft.—0640 hours, the following day, sighted the tanker which was no longer being escorted. This aircraft sent a first sighting report, but failed to indicate the course of the enemy and, moreover, his signal received after a request for details was corrupt.

No. 6 Aircraft.—0820 hours, sighted tanker, but the message which was sent was incorrectly compiled and gave the position of the enemy as "10 miles bearing 180°." This was intended to mean "course 180° speed 10 knots."

No. 7 Aircraft.—1000 hours, located and attacked tanker and although this aircraft made two sighting reports, no course or speed was given in either message, and no reply was sent after a request for details.

The tanker was only slightly damaged and managed to reach her destination safely.

Both these reports are genuine. The first indicates the serious consequences of badly encoded messages and the second gives a good illustration of a few of the many unnecessary errors in coding. Most of them are due to carelessness and lack of forethought.

Every pilot, navigator and wireless operator has, at some period of his training, been taught how to use A.P. 1927 (the Naval Aircraft Code and Air Force Code) correctly. No doubt it was considered to be the most boring subject ever encountered and, at the same time, many may have heard P.O. Prune telling his friends that "It's never used on squadrons, anyhow." The war-trained aircrew have not had the benefit of a long training; on the contrary they have had to learn an enormous amount in the minimum of time, and they cannot be blamed if, when they arrive at their squadrons, they are hazy on some of the subjects that they have been taught. It is up to the squadron concerned to put the finishing touches and, although squadrons seem only too ready to improve a man's flying ability, his navigation, his air firing, aircraft recognition, etc., they do not, for some unaccountable reason, try to improve the standard of coding.

It is imperative for aircrew to reach a high degree of efficiency in coding in the class-room before they can hope to draft a correct signal in the air amid continual distractions, and when every minute is vital. On any sortie that is

carried out, contact may be made with the enemy and the Air Officer Commanding or the Naval Staff are anxious to know as fast as it is humanly possible what the enemy force consists of, its position, course and speed and subsequent alterations. An insufficient or corrupt message means loss of time, loss of tempers and what is more

important, it may mean the loss of the enemy. It also indicates bad crew drill and lack of squadron training, and it is, therefore, the duty of every Squadron Commander to ensure that his crews are fully conversant with correct coding procedure and that they don't help the enemy by sending corrupt or delayed reports.

Ability to Fight

"The majority of ground personnel at all Royal Air Force stations at home will, sooner or later, have to serve on a battle front. There every officer's and man's ability to fight may mean to him the difference between life and death."

The truth of these words, spoken by a distinguished officer shortly after the collapse of France, has been underlined in Crete, in Libya and in Malaya. It is now being illustrated afresh in French North Africa, where battle-trained ground crews of Coastal Command landed under fire and took over aerodrome protection. And before us lies the prospect of the Second Front in Europe, the establishment of which is bound to involve very hard fighting, in which all who are present, whatever their primary function, may well have to take part. The invention and development of aircraft, working in conjunction with mechanised land forces, have brought about a state of affairs in which no part of a theatre of war is immune from the chance of land fighting, so that all who wear uniform in that theatre may sooner or later find themselves with a weapon in their hands and an aggressive enemy uncomfortably close.

It has long been characteristic of the British attitude towards fighting on land to assume that the soldier's profession requires little or no training, indeed that any man with a lethal weapon in his hand is *ipso facto* a skilled man at arms. This facile view of military training has cost us dear over and over again in the past. Kipling described it with bitter accuracy when he wrote of some of the troops sent out to the South African war:

"What did ye look they should compass? War-craft learnt in a breath?

Knowledge unto occasion at the first far view of death?"

It is not, however, the object of this article to make a historical survey of the British public's attitude to the profession of arms, but to point out that the totally erroneous view which has been generally held is still shared by a great many members of the Services whose primary function is not fighting, and to discuss the implications of the phrase "Ability to Fight." Much, of course, could be written on this subject, but few will dispute that ability to fight implies three main qualities:—

- Skill in the use of weapons;
- Physical fitness; and
- Discipline.

Their order of importance may be open to argument, but for our present purpose it is immaterial.

Skill in the Use of Weapons

For airmen fighting on the ground, skill in the use of weapons means a knowledge of the rifle, the Sten gun and the light automatic. All these, though comparatively simple, are weapons of precision, which will only produce the desired result if handled with knowledge.

Battle is an exhausting experience, both mentally and physically. Fear is likely to be present in the heart of the bravest, and it requires an exertion of will-power to overcome this natural instinct and apply mind and body to the correct manipulation of weapons. In such conditions no mere "bowing acquaintance" with weapons will suffice. When a man is strained to the utmost, the instinctive knowledge which produces correct action automatically will alone meet the case. The motorist who wants to change gear in a traffic crisis does not say to himself, "First, I place my left foot on the clutch pedal, then I press it down and take the gear lever in my left hand, etc." He acts automatically, correctly and instinctively. Battle is more exacting than a traffic crisis, and requires at least an equal standard of knowledge. This point is so important that it is worth labouring it a step further. In peace-time, recruits being taught to shoot were first instructed how to load, aim and fire their rifles. When they were taken on to a range, however, and given ball ammunition and a target to fire at, it was no uncommon experience for an instructor to find that the recruit was so confused by having ball ammunition in his rifle for the first time, that all the carefully taught rules of aiming and trigger-pressing vanished from his mind, he shut his eyes, snatched at the trigger and missed the target. The atmosphere of battle will have a far more upsetting effect on the nervous system than the novelty of a first experience of a rifle range. It is obvious, therefore, that for battle we need the knowledge that is so deeply ingrained that mistake is impossible. This knowledge can only come from the familiarity which the daily handling of weapons produces. To insist on this daily handling can only be the responsibility of officers and N.C.O.s.

Physical Fitness

No lesson has been more thoroughly pointed during the present war than the supreme importance of physical fitness. Our enemies realised in peace-time that the mechanical age would do nothing to relieve the physical strain on man in battle, and trained accordingly, with results that were really amazing. It is often difficult for a man leading a sedentary life to realise how soft he really is physically, when he is surrounded by a highly organised administrative machine whose sole aim is to see that he is well, sometimes abundantly, fed, and that he has ample opportunities of rest. It is not surprising if, as happened in Malaya, after 24 hours of fighting without food or sleep he is useless as a fighting man. The fact remains that he will often be called upon for this and similar, or perhaps greater, feats of endurance, and with training he can be made equal to them.

The trouble is that many ignorant enthusiasts, realising the urgent necessity of improving the standard of what has come to be known as "toughness," have plunged men fresh from sedentary life into such a violent regime of toughening as to produce rapid breakdown instead of physical fitness. Obviously, the process must be one of gradual training, and the first essential is to decide on the standard to be aimed at; it is useless to expect men in early middle age to attain the same physical standards as Commando troops. There are, however, some basic essentials which must be insisted on if men are not to collapse under the strain of fighting. The first may be termed nerve controls. Hard living will not of itself produce heroes, but the man who lives soft and indulges his appetites indiscriminately will not have the same control of his nerves as the more abstemious liver. A good beginning towards battle fitness can be made by rationing the individual's consumption of alcohol and tobacco. This is a difficult matter, in which perhaps more progress can be made by example and encouragement than by precise rules. Again, before expecting men to cover an exhausting assault course, more practical benefit will be derived from regular daily exercise. If every man employed in an office were made to walk at a sharp pace for 1 hour every day, regardless of weather, a foundation would soon be laid on which it would be possible to build up without fear of breaking down men. The ventilation of offices and living rooms and the avoidance of overheating them are also of importance.

This type of gradual hardening will never be achieved if left to the voluntary efforts of the individual. Once more we come to the officers' responsibility. The individual man is more important than any piece of Government property of which an officer has charge, and it is the officer's most important responsibility to see that this most valuable asset is kept fit and that wastage of man-power is avoided. Large numbers of men enlisted in the Services actually sink in medical category during their service, a sad comment on our powers of man management. Many cases of this deterioration are due to worry rather than to physical causes. Here again, if the officer is doing his duty as the leader of his men, this cause of wastage can be reduced, though perhaps not eliminated. All of us are inclined to think that this vital subject of man management is somebody else's job. If a man is sick, it is a job for the doctor, but if the man's own officer had seen that he took regular exercise he might never have gone sick. Examples of this kind could be multiplied *ad nauseam*, but the whole matter resolves itself into the individual officer's responsi-

bility for every detail which will maintain the men of his sub-unit in the best possible condition to carry out their work.

Discipline

No word in the English language is more misused or more commonly misunderstood than discipline. It usually conjures up the picture of the music hall sergeant-major, bottle-nosed, thick-necked, hoarse-voiced, bellowing rather ridiculous orders accompanied by a stream of profanity. The term is more often than not taken to be synonymous with the rule of the bully. So long as this idea persists, it is little wonder that the paramount necessity of discipline is not accepted. Let us therefore try another conception and think of discipline as the spirit which should inspire the fighting man so that in all circumstances, and if need be at the cost of his life, he will strive to carry out what he knows to be the will of his Commander. Here is an ideal worth striving for indeed, and it is no matter for wonder that those bodies of men who are imbued with this spirit and know it, are proud of the fact, and face their enemy in battle with confidence. Do not laugh at discipline, even if some of its outward manifestations at times appear grotesque and unnecessary, for it is in fact the triumph of the spiritual over the physical. The instinct of self-preservation is perhaps man's strongest instinct; discipline is the power that enables the man not naturally brave to overcome this instinct for the sake of the cause he is fighting for. Let us examine the necessity for discipline a little further. As a preliminary for the test of battle, the fighting man is, or should be, taught throughout his service the supreme necessity of obedience to orders because they are orders. This may sound old-fashioned and obsolete; it smacks of Colonel Blimp. Why the irritating insistence on obedience, day in and day out, in matters which are often admittedly trivial, perhaps unnecessary, certainly unessential? The answer is simple. The conditions of modern battle grow daily more terrifying. In battle instinctive obedience to orders is as necessary as instinctively correct handling of weapons, and for much the same reason. When a man is hungry and exhausted from lack of sleep, when he has witnessed revolting scenes of the destruction of human life, often involving his close personal friends, when his whole nervous system is ready to snap under the strain, then on being called upon to leave his poor shelter and face a more than even chance of death in the open, he may well be glad of the help which comes from that ingrained habit of obedience which compels him to respond to the order at a moment when every natural impulse urges him to remain in his precarious state of comparative safety.

Weapon Failures

An aircraft is not much use for active warfare unless it carries appropriate weapons. Even a Photographic Reconnaissance aircraft has its weapon—the camera. To do its job, a weapon must be so designed and constructed that it will work if correctly operated, and that it will be safe to the user who does this. But even weapons sometimes fail.

Weapon failures fall broadly into two classes:—

- (a) those in which damage is done to the user or his own side, but none to the enemy.

- (b) those in which no damage is done to the target or to anyone else.

If the safety aspect of weapon design were unduly stressed, we should find an unacceptable percentage of failures of the first class. If the safety aspect were too little considered, the second class of failure would occur more often; we know that this class fortunately does not often happen, showing that the safety aspect is given its proper importance, but no more.

The necessary compromise between a weapon's

ability to "do its stuff" and its safety in the hands of a careful and competent user often imposes operational limitations; examples of this are given by the height from which a 250 lb., Mark XI depth charge may be dropped, and the speed and height of release of a torpedo. This is one reason why a list of Do's and Don'ts is issued for every weapon in service. Still, weapon failures of both classes do occur, so let us try and see if we can find out how and why.

An analysis of the first class of failure, in which either the user (or one of his own side) gets hurt shows that in the vast majority of cases, it is due to the personal failure of the user to abide by the rules of Do's and Don'ts. If you press the trigger of an automatic pistol, and shoot a pal in the fleshy part of the leg at a range of 4 ft. 6 in., you will probably be surprised if he only says: "don't you think that was a little careless"; indeed, that reproof might even be thought rather inadequate. It is quoted because it actually happened, although the user was practically certain that the safety catch was up. The pistol was not to blame. If you blow yourself to bits doing things with a bomb in a way that is clearly and emphatically shown in the instructions as being dangerous, you won't be able to thank yourself, and your friends' next of kin probably won't want to—much.

The second class of failure is often much harder to analyse, owing to the difficulty of collecting absolutely authentic information. Many weapons are a bit temperamental, and although development trials are long and exacting, they may fail to bring to light all of a new weapon's peculiarities; moreover, a depth-charge which has fallen in the sea, or a bomb in enemy territory cannot, as a rule, be collected for a detailed investigation as to why it didn't go off. In the same way, one can't always be sure of being able to bring back jammed cannon or machine guns.

The failures may have been due to imperfect design or manufacture, or again they may be due to incorrect preparation, manipulation or tactical use. It is a tribute to the inherent honesty of air and ground crews that so many failures can be recorded as due to a human error. A failure due to "unknown causes" must leave a doubt whether the weapon is as reliable as it had been thought. This doubt closely concerns not only those responsible for producing or ordering the weapon, but also the aircrews to whom it may be a serious worry.

When a failure occurs, due to faulty operation, or preparation, an honest confession of the facts is essential, but it is not enough. What is wanted is that a careful watch should be kept on every detail in connection with every weapon used in action, whether in preparation or in use, so that accurate and detailed information can be assembled and reviewed, if a failure should occur. This is the only way in which failures can be eliminated, and eliminated quickly. Whether the fault is personal or material is in itself relatively unimportant. If it is personal, there may be some improvement in training which will prevent a repetition; if it is in material, there will certainly be some way in which the weapon can be perfected. But if the only story available is quite inconclusive, the trouble cannot be put right, and those who prepare and use the weapon will continue to work and accept risk, only to hand out to the enemy a blow of doubtful power.

Particularly in Coastal Command, where targets are nearly always fleeting, and few opportunities of a second shot are offered, it is absolutely essential that all the admitted complexity of correct assembly of components, of seeing that they are in good working order, of testing, of selecting the right fuses, etc., must be done with meticulous care: and that if one of these complex team-actions results in a failure, it shall be possible to determine with certainty where that failure arose.

But if every member of the teams which prepare and use weapons can form the habit of automatically noting every detail of their job in connection with it, an infinitely more important result will follow. It will be found that the number of failures due to the human element will rapidly decrease. It is undeniable that the whole business is complex, and that, more often than not, this complex chain of actions, or some part of it, has to be done as quickly as possible.

A word of caution is wanted here. Don't allow yourself to confuse "speed" with "hurry." "Hurry" is as much the enemy of efficiency as "speed" is its friend.

If every action is usually and habitually done in the minimum of time, it will be worse than useless to try and "hurry." Worse than useless, because it is precisely the attempt to hurry which is the chief cause of the personal failure. And once it becomes known that you always work as fast as the job can be thoroughly done, there will be less tendency for anyone else to try and hurry you, and you will know that you can't hurry yourself. If you know with certainty that your particular task cannot be completed in less than a given minimum of time (either by yourself or by anyone else), you can calmly and competently quote that time, and allow everyone else in the chain of events to know when their job in the chain will be due to happen. A good aircraft captain, knowing precisely how long it takes for the bomb-doors to open fully, how long it takes and how many separate actions have to be made to select and arm the bombs or depth charges, and how long it should take for the bomb-aimer to get to his sight and get all set for releasing, will manoeuvre so as to allow that amount of time, but no more, before getting to the final approach of his target, so no single member of the aircrew should ever need to "hurry" and thus forget some vital action.

So we can conclude this rapid survey of weapon failures with a short summary:—

- (i) Established weapons rarely fail if everyone knows and does his job with real efficiency.
- (ii) Established weapons and most of those handed out for "Service trials" are safe in the hands of a careful and competent man, but he must study and know the "book of words."
- (iii) A really efficient man will notice and automatically record all his actions relative to a weapon, so that if a failure does occur, he can contribute a clear and concise story of his part in the sequence of actions.

"Yes, We Have No . . ."

The scene is any Mess, in any Command, in any of the Air Forces of the United Nations, in any part of the world. Half a dozen pilots or members of aircrews are gathered together round the fire or on the verandah drinking beer, mint julep, tea or whatever may be their customary beverage. Since a Chinese setting might seem strange to a Western reader, a more ordinary one of this Command has been chosen. But, once again, this conversation might as well have occurred in any other Command or place, or about any other type of operation. Perhaps its theme may also be not unknown in certain German, Italian or even Japanese messes.

Smith : 10 and 102 are out to-night, aren't they ?

Roberts : Yes—strike on a big convoy off the Frisians. Fifteen large M.V.s, plus escorts, Elkhorne told me.

Smith : How many are going, d'you know ?

Roberts : Five or perhaps six, he said.

Jones : Does'nt seem very many. About all they can rake up, I suppose.

Heenan : Hell—only five or six. If it was twenty-five we might begin to do some good. It's about time we put paid to these convoys—and we could if only they—

Station Commander joins them.

Stn. Cmdr. : Well, what's all this ? At it again, Heenan ! If only they . . . what ?—What's gone wrong now ?

Heenan : We were saying that if only they would give us the aircraft we'd just clean up this Hun shipping once and for all. It's about time it was done, Sir. But all we can do is to send out wretched little strikes, hardly enough to tickle up his convoys, let alone blast them out of the sea.

Stn. Cmdr. : I couldn't agree with you more. Nothing I'd like to see better—except winning the war. But I wonder if "they"—those at Headquarters and in the Ministry—are to blame or only just a little far-sighted. I used to be one of them once.

Heenan : Well, we didn't say that it was their fault, Sir—perhaps you came along a bit too soon or we might have !

Stn. Cmdr. : I know you—believe me, you may think that "they" live in the clouds, but for all that their horizon is generally wider than ours down here, despite the fog of London and war : and their picture is a far broader one than one gets looking out over the North Sea.

Let's try and see the way they look at the problem. You'll remember that at the beginning of the war, we had next to nothing in the kitty compared to the Germans, who had been arming for years and had built up a formidable Air force and Army. We were in partnership with France, and did not count upon her collapsing and throwing our joint plans, not only here but in the Mediterranean and the Far East, out of balance. It happened though—and we were left to expand our forces, first to meet the European situation and later a world wide one : we hadn't the strength to be strong anywhere—and yet we

managed to hang on and concentrate what strength we had in the most important places at the time. It often meant letting places go—Greece, the Middle East and later the Far East—but we just did not have the resources to spread over the whole battle front.

Roberts : True enough, Sir. But, then, that was a good time ago. Surely, since, we've got down to the war and rather altered all that—the papers give one that impression anyway.

Stn. Cmdr. : Up to a point, yes. Since those days the country has been producing—producing armaments at no mean rate—ships, naval and merchant, tanks, guns, aircraft ; more per head than any other nation in the world. And yet not enough for ourselves and our allies : for a sizeable proportion has gone to Russia and to China and to others who have had their backs to the same wall as us.

We were beginning to draw level, and then Japan came into the war. That meant a threat to Australia, India and South Africa. It opened up the vast theatre of the Pacific and the Indian Ocean : it brought in another, very numerous and well equipped enemy. Once more we had to spread our resources gathered together to outblitz the Hun : once more we were down to the bare minimum where we needed superiority. Now that we've come to the end of potential enemies at least we know where we stand.

Smith : But we gained America as an ally.

Stn. Cmdr. : Yes : and a very welcome one too. The American Navy has played a vital part in the Pacific and, in the great sea battles there. It has shaken the Japanese grip on the ring of islands which she hoped to make a jumping-off ground for further conquest. Her army, too, at Bataan and Corregidor held up the Japanese longer than the Americans themselves dared to hope for, and forced the Japs to expend effort intended for use elsewhere, after an easy occupation of the Philippines.

But you must remember that America two years ago was in much the same position as we were four years ago. A strong navy, and an army and air force building up—a big potential, but one in the main waiting to be developed.

Heenan : Still, that seems to be under way now if they really are producing all one reads about ?

Stn. Cmdr. : America is beginning to produce all right : a very useful and indeed a stupendous beginning, but one that will seem small when she really gets into her stride. And I've no doubt that she will help us in the future as generously as she has in the past. Then, although their own needs were very great, the Americans did all they possibly could in the difficult circumstances when we were at war and America was a neutral, first by allowing us to purchase, and then through the Lease-Lend Act.

I ran into Hutchings the other day—he used to be E. Officer here, then went to M.A.P., where he lost his identity and became known as Deputy Director of Something or Other. He's just got back from a tour of the American factories and he says there's no doubt as to what they are turning out. Plants like Ford's at Willow Run have scarcely begun to tick over—but he told me that

the 24 Liberators a day will be no myth. It will be all that and more.

Heenan : But even so, we and the Americans have got a good number of aircraft between us. And yet, we here, with the enemy shipping on our doorstep have practically nothing. Why are we always kept short and robbed to make up other people's deficiencies?

Stn. Cmdr. : You're not alone in thinking that. Everyone does—nearly everyone thinks that his job is the most important and that some other fellow is unduly favoured, and has more than he needs. He probably thinks the same about us.

But what applies to the theatres of war applies to the use of aircraft. Somebody—and in practice it's the War Cabinet and the Chiefs of Staff—has got to weigh importance and priority from the national and war effort point of view. It's they who decide whether the bombing of Germany or the U-Boat war, the attack on shipping or the needs of Army Co-operation, supplies to our Allies or putting by reserves for an offensive, count most. They are the tailors who cut the coat according to the cloth and work out the economies and compromises necessary to get the best possible out of the available material. And a pretty tough job it must be. Even if production figures are staggering, war needs are more so.

The battle of Libya was a victory of production as well as a victory of the men who fought it. An overwhelming force was built up—you'll remember it was said the other day that 700 aircraft had attacked one of Rommel's aerodromes. Mr. Roosevelt said that America had contributed more than a thousand aircraft to the Middle East—and that the British contribution of arms was far higher than the American. I don't know, naturally, what the strength of the Air Forces used there was, but

you know how many aircraft it takes to keep one serviceable in the air, and can make a pretty good guess at the total in Egypt alone.

Even if the American production is big there's a lot of uses for it. The Pacific, Australia, India, China, Russia, to say nothing of the Aleutians and her own needs for training. Ours is big too—but then we have similar commitments, and we both have new fronts to consider—North Africa and perhaps more to follow.

Roberts : Certainly the Hun seems to be on about the same spot too. Intelligence showed me a chart of G.A.F. movements the other day. Their fellows seem to be on the Russian front one day and in France the next; or wandering between Norway and Africa as trouble blows up. Regular flying commercial travellers, visiting the most active theatres of war.

Stn. Cmdr. : Oh, yes—they get their problems, and shortage of aircraft is pretty nearly Number One amongst them.

The truth of the matter is that aircraft are a deciding, if not decisive factor, in modern war. We want world-wide air superiority to make sure of winning. To-day it's a threat—a threat which every day is getting nearer reality and one that the Hun is beginning to see and to fear. But even if every factory turns out aircraft and arms at full blast, I doubt whether there will ever be enough aircraft any more than there will be enough ships.

Still, I daresay, Heenan, they'll find one or two more for you to wipe out those Hun convoys with!

And to think that I came here to drink a quiet half pint and forget this blasted war for a few minutes. Roberts, give the bell a push and let's talk about something interesting for a change!