

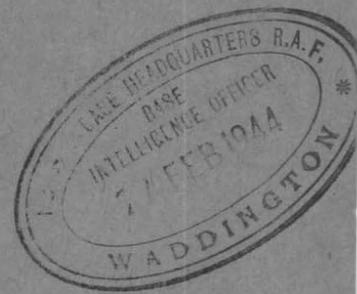


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COASTAL COMMAND REVIEW

January 1944

Vol. III, No. 1

COASTAL COMMAND REVIEW

Vol. III, No. 1—January 1944

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SUPPLEMENT

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This book is secret. No quotations may be made without the authority of the Chief Intelligence Officer, Headquarters, Coastal Command.

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

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

Summary—January, 1944

The Anti U-Boat War in 1944

The December number of the Review summarized the work of the most splendid year in the history of the Command. Coastal was justified in feeling that it had played an important part in turning the corner towards victory. But it would be fatal to sit back on this historic year and allow the past to be enough in itself. The Command has begun the first month of the new year with equal vigour and achievement, and it is a suitable moment in which to contemplate the months before us, to attempt to forecast developments in the U-Boat war, and to stress the measures necessary if we are to keep the U-Boat's neck under the aircraft's heel.

The U-Boat traffic in the Bay is still with us and must continue as long as the enemy has U-Boat bases along the French Biscay Coast. In recent weeks, however, the U-Boat patrols in the Atlantic have been concentrated steadily closer to the western seaboard of Ireland and Scotland, so that the picture once more resembles that of January, 1941. There is one vital difference, however, in that the cautious diving policy now leaves few opportunities for locating and attacking U-Boats on passage or on patrol, except during the night. This requires from us a high standard of training and skill in night attacks, with particular emphasis on the Radar operator and on his co-operation with the pilot. For many more weeks the rough seas of winter will demand an ability to pick up targets and home on to them despite extensive sea returns, that is if the night flying effort is not to be largely wasted and the U-Boat to get off scot free.

This closing in of the enemy patrols provides such excellent opportunities for offensive action within easy range that these operations will tend to take priority over the Bay until the enemy is forced once more to retire out of reach of medium-range aircraft. The immediate future, therefore, is concerned with offensive patrols close in to the west and north-west of Ireland, with the Bay offensive, and with the old threat to convoys in mid-Atlantic should the U-Boat be driven further to the west.

Coastal Command's main concern after this will be in protecting the convoys and shipping engaged in the invasion of Europe. Dates and details cannot be discussed here, but it is obvious that the large U-Boat fleet disposed in the Biscay ports and in the Baltic could be used to break up the vital supply and communication lines through the narrow waters along our western, eastern and southern seabords. Such close range anti U-Boat work may have to be continuous for a considerable period, day and night, and seems to require a redistribution of aircraft together with extreme mobility between diversion airfields in areas which have not seen the anti U-Boat types for many a day. Over and above this the enemy has enough U-Boats to maintain a threat to the transatlantic shipping. The problem, therefore, will be to re-orientate 75 per cent. of the hitherto long range Atlantic effort in such a way that the enemy may be engaged at close range in the narrow waters round England, even though a large proportion of this area is inside enemy single-engine fighter range.

It does not seem that there will be any revolutionary developments in U-Boat tactics in the immediate future. When so minded, the individual U-Boat will no doubt continue to fight back, using maximum zigzag steering and various kinds of flak. Two recent photographs show that, instead of the quadruple 20-mm. mounting, two 500-ton U-Boats are carrying on the after platform a single gun with a square shield protecting the gunlayer and trainer. This may be a 30 or a 37-mm. and presumably has a fairly high rate of fire to warrant its substitution for the quadruple 20-mm. The very fact that the enemy has reverted to a single-barrelled weapon underlines the difficulties inherent in trying to arm submarines with flak like that of surface vessels. These limitations, which are inevitable if the boats are to remain submarines in performance, will doubtless prevent the fitting of more efficient A/A weapons than those at present mounted.

Developments in motive power are no doubt progressing and we may expect that battery endurance will be increased so that more time can be spent submerged. Indeed it is possible that the long known experiments to build engines capable of functioning under water may come to fruition and thus enable the submariner's bugbear—the battery—to be dispensed with. This would mean that U-Boats would need to surface only to ventilate the boat and would put a still higher premium on the Radar training of our anti U-Boat squadrons.

These possible developments in U-Boat tactics add little to their powers of aggression, but may considerably add to their elusiveness as targets for aircraft. In strategy, however, there will probably be a major change while the invasion is in progress and during the follow-up. An analogy with "Torch"—the North African landing—is not possible, for the enemy was then apparently taken by surprise and the operation was a long way from purely German soil. This time he may be expected to regard it as a direct threat to the Fatherland. He will resist furiously on land and in the air, and is hardly likely to forego the full use of so potentially powerful a sea weapon as a U-Boat fleet based so close to both flanks of our sea communications with Europe.

The January Anti U-Boat Effort

Even when judged by the standards of summer of last year, January was a good month for the war on the U-Boats. There were 53 sightings and 36 attacks. The results in the Bay of Biscay were the highest since last July. The patrols yielded 32 sightings and 24 attacks, most of them during the spell of good weather, and there was at least one kill. At least two others were sunk outside the Bay.

All but one of the attacks in the Bay were at night. The exception was the kill by U/10, which found its U-Boat surfaced by day and ready to fight back. The four front guns of the Sunderland were highly successful in smothering the large quantity of flak put up by the U-Boat.

The attacks in the Bay with the new A/U flare were promising and credit goes to 502 and 58 squadrons for their success in developing the new technique.

Sightings fell off in the latter part of the month and more of them were made outside the Bay area; notably south-west of Ireland. A kill by L/172 (from the Azores) yielded a good crop of survivors. It is encouraging to note that most of the attacks in January followed Radar contacts. Better training and understanding of the importance of Radar will increase results in the future.

The Anti-Shipping Effort in January

In January five attacks were made against enemy shipping off the Norwegian coast. The Wick Beaufighter Wing made three of these, two with cannon and R.P., and the other with torpedoes, cannon and R.P. Two merchant vessels totalling 10,000 tons are claimed as seriously damaged and seven escort vessels and a merchantman of 2,000 tons as damaged. The other two attacks, which were made by the Leuchars Beaufighter Wing, resulted in the sinking of the minesweeper *Skagerak I* of 1,280 tons, serious damage to a merchant ship of 5,000 tons, damage to one small merchantman and some escort vessels.

Four attacks by Albacores in the Channel area resulted in serious damage to a destroyer and possible damage to six E or R boats.

Enemy reaction to our strikes off the Norwegian coast increased during January and five aircraft were lost. In three out of the five attacks enemy S/E fighters engaged our striking force, the number of S/E fighters varying between two and seven. These fighters tended to follow our aircraft further out to sea than during 1943 and several of our aircraft were saved only by skilful evasive action. There is, however, no evidence to suggest that the fighter force in Norway has been increased. The enemy again used rockets, but, as before, we suffered no damage from them.

During 1943 the percentage of hits with R.P. was disappointing, and it is therefore encouraging to note the success of the 60 lb. H.E. R.P. during January. One 5,000 ton merchant vessel was hit no less than 30 times during one attack, and on another occasion a 4,000 ton ship and several escort vessels were seriously damaged. A further point of interest is that hits from 60 lb. R.P. have usually caused fires.

The number of torpedo hits is increasing and the introduction of the gyro-angling technique should lead to even better results. The improved methods of sighting, increasing accuracy in the use of R.P., and the continued determination of the crews of anti-shipping squadrons, combine to promise us a successful year in 1944.

Anti-Shipping Strikes during 1943

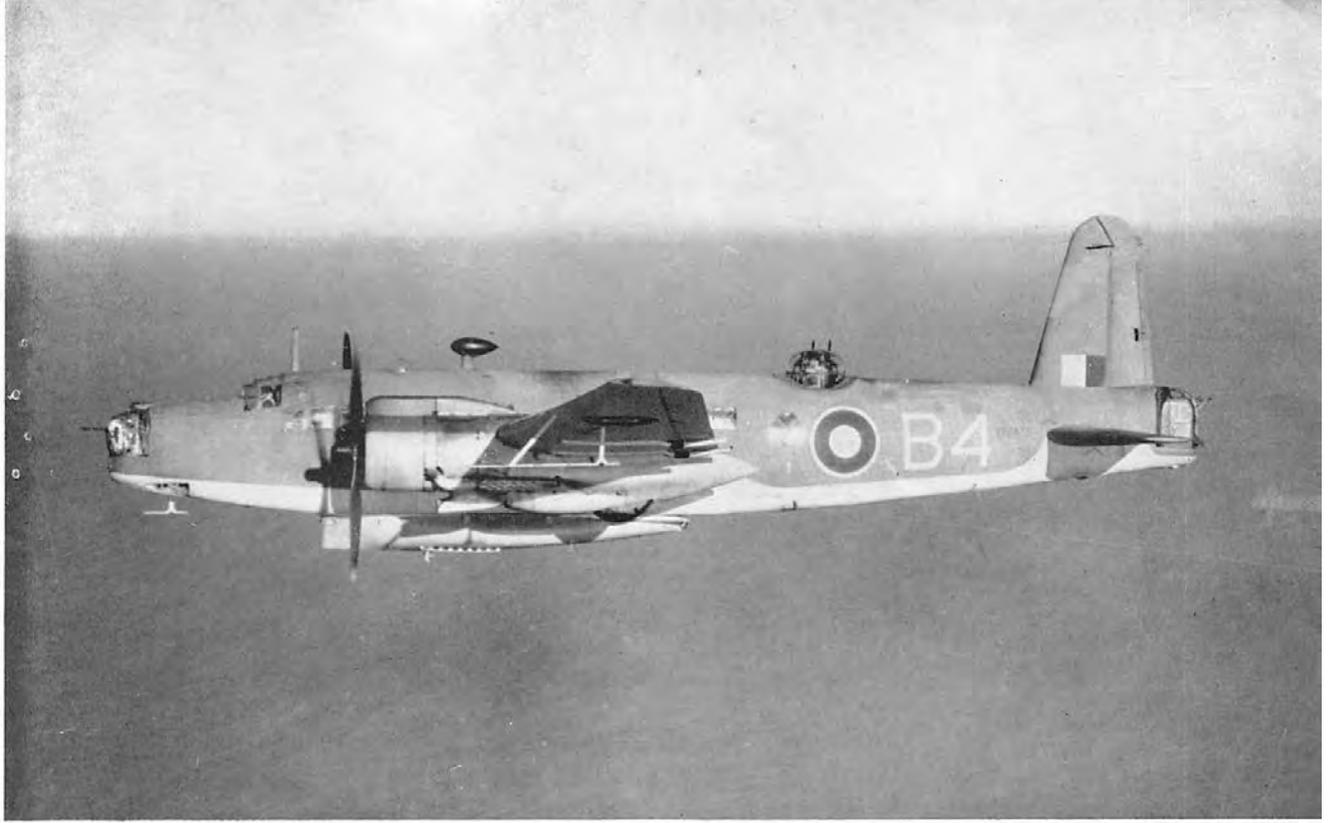
Complete figures are now available of the assessed results of Coastal Command strikes against enemy merchant shipping during 1943. They show that $22\frac{1}{2}$ ships of 95,168 tons were assessed as Sunk; 10 ships of 27,409 tons were assessed as Seriously Damaged, and 39 ships of 59,245 tons were assessed as Damaged. This makes the total of ships Hit $71\frac{1}{2}$ (181,822 tons).

One point of especial interest emerges from these figures. Up to the end of 1942, less than a fifth of the total tonnage assessed as hit was placed in Category I (sunk). But more than half the tonnage hit during 1943 was assessed as sunk—a tribute to more efficient aircraft and better weapons.

The complete figures from March 1, 1941 (when the Shipping Assessment Committees began operations) up to the end of 1943 shows:—

$77\frac{1}{2}$ ships of 253,066 tons assessed as Sunk,
70 ships of 190,158 tons assessed as Seriously Damaged,
 $191\frac{1}{2}$ ships of 593,143 tons assessed as Damaged.

Total 339 ships of 1,036,367 tons hit.



Above : A Warwick of 281 Squadron carrying an airborne lifeboat.

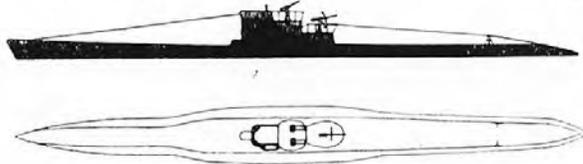
Below : A crashed F.W.200 photographed by 103 Squadron (U.S.N.).

PLATE 1.





PLAN AND SILHOUETTE OF
GERMAN 500TON U-BOAT WITH NEW MODIFICATIONS



On January 8, 1944, Sunderland U/10 (R.A.A.F.) sank a 500 ton U-Boat. The top photograph shows the U-Boat down by the stern. The lower photograph discloses modifications in the conning tower and armament.

Note.—The mounting on the lower bandstand is thought to carry a fully automatic 30-mm. gun. The non-folding, rectangular gun shield is about 5 ft. broad. The guns on the upper bandstand appear to be the usual 20-mm., in two twin mountings.

I.—ANTI U-BOAT

(See notes below.)

ANTI U-BOAT SCORES FROM JULY TO DECEMBER, 1943

PERCENTAGE FIGURES OF MERIT
IN BIG NUMERALS

10 Sq.	48 Sq.	53 Sq.	58 Sq.	59 Sq.	86 Sq.	120 Sq.	172 Sq.	179 Sq.
$\frac{10}{30} = 33$	$\frac{10}{10} = 100$	$\frac{46}{150} = 46$	$\frac{26}{40} = 65$	$\frac{30}{130} = 23$	$\frac{72}{100} = 72$	$\frac{102}{290} = 35$	$\frac{55}{100} = 55$	$\frac{158}{250} = 63$
190 Sq.	201 Sq.	202 Sq.	206 Sq.	210 Sq.	224 Sq.	228 Sq.	233 Sq.	269 Sq.
$\frac{0}{0} = 0$	$\frac{0}{0} = 0$	$\frac{6}{20} = 30$	$\frac{0}{0} = 0$	$\frac{16}{30} = 53$	$\frac{43}{90} = 48$	$\frac{30}{40} = 75$	$\frac{10}{10} = 100$	$\frac{33}{90} = 37$
304 Sq.	311 Sq.	330 Sq.	333 Sq.	407 Sq.	423 Sq.	461 Sq.	502 Sq.	547 Sq.
$\frac{3}{10} = 30$	$\frac{13}{20} = 65$	$\frac{0}{0} = 0$	$\frac{0}{0} = 0$	$\frac{32}{60} = 53$	$\frac{20}{20} = 100$	$\frac{23}{40} = 57$	$\frac{13}{80} = 16$	$\frac{0}{20} = 0$
612 Sq.	248 Sq.	103 Sq. U.S.N.	105 Sq. U.S.N.	110 Sq. U.S.N.	63 Sq. U.S.N.	220 Sq.	422 Sq.	236 Sq. (R.P.)
$\frac{15}{60} = 25$	$\frac{10}{10} = 100$	$\frac{20}{20} = 100$	$\frac{0}{10} = 0$	$\frac{10}{10} = 100$	$\frac{0}{10} = 0$	$\frac{10}{10} = 100$	$\frac{10}{20} = 50$	$\frac{0}{0} = 0$

Attacks on U-Boats

Note on Table above, showing Squadron Scores for the Six Months, July to December, 1943

The tables are based on the Admiralty assessments of all attacks by squadrons. Attacks are divided into the following categories:—

- (1) Misses. (2) Insufficient evidence of damage. (3) Damage.

The assessment Damage includes: **Known sunk, Probably sunk, Damage A, Damage B, Slight damage.** For the purpose of arriving at the result, the following system has been adopted:—

For each attack assessed as No Damage	0
For each attack assessed as Insufficient Evidence of Damage	3
For each attack assessed as Damaged, or Known Sunk	10

December was the quietest month in all 1943 and there were no notable changes in the scoreboard.

In the scoreboard published in the Review for December the figures for 103 and 110 squadrons were wrong. As there is no change in the scores of these squadrons the figures above are right for both periods.

During November aircraft of 179 Squadron at Lagens were occasionally operated by crews of 172 Squadron and vice versa. Sightings and attacks in these instances had been credited to the squadron whose crew was involved. Thus 179 Squadron are credited with 3 additional sightings and attacks for November which were previously given to 172 Squadron in the monthly results.

SUMMARY OF ANTI U-BOAT OPERATIONS BY COASTAL COMMAND AIRCRAFT
(Including Iceland, Azores, Gibraltar and U.S. Moroccan Sea Frontier)
JANUARY, 1944

Duty and Base or Area.	Total Sorties.	Hours Flown.		U-Boats Sighted.		U-Boats Attacked.		Hours per Sighting.		Number of Sorties.		Col. 10 Sorties with Flak.
		Base to Base.	On Patrol.	Day.	Night.	Day.	Night.	Base to Base.	On Patrol.	When U-Boat Sighted.	When U-Boat Attacked.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Convoy Cover</i>												
United Kingdom	82	1,082	400	—	—	—	—	—	—	—	—	—
Iceland	16	177	101	—	1	—	—	177	101	1	—	—
Gibraltar and Moroccan Sea Frontier	100	918	483	—	—	—	—	—	—	—	—	—
Azores	14	161	56	—	—	—	—	—	—	—	—	—
TOTAL CONVOY EFFORT	212	2,338	1,040	—	1	—	—	2,338	1,040	1	—	—
<i>A/U Patrols</i>												
Northern Transit												
United Kingdom	34	337	110	—	—	—	—	—	—	—	—	—
Iceland	12	98	43	1	—	1	—	98	43	1	1	—
Northern Convoy												
United Kingdom	159	1,863	834	4	—	4	—	466	208	4	4	4
Iceland	11	135	66	—	—	—	—	—	—	—	—	—
Azores	68	706	266	3	4	2	2	101	38	7	4	5
Bay of Biscay (including Adjacent Patrols)												
United Kingdom	641	6,640	3,416	1	31	1	23	207	107	33	25	27
Gibraltar and Moroccan Sea Frontier	91	1,191	424	—	—	—	—	—	—	—	—	—
Central Convoy												
Gibraltar and Moroccan Sea Frontier	606	4,880	3,710	5	3	1	2	610	464	10	5	4
Azores	106	784	384	—	—	—	—	—	—	—	—	—
TOTAL A/U PATROLS	1,728	16,634	9,253	14	38	9	27	320	178	55	39	40
Add Convoy Effort	212	2,338	1,040	—	1	—	—	—	—	1	—	—
TOTAL EFFORT	1,940	18,972	10,293	14	39	9	27	358	194	56	39	40
				53 U-Boats Sighted.		36 U-Boats Attacked.						

Note.—In addition to the above, there were four chance sightings by transit aircraft.

Assessments

Month.	Known Sunk.	Probably Sunk.	Damaged A.	Damaged B.	Slight Damage.	Insufficient Evidence of Damage.	No Damage.	Unassessed.
November	2	2	3	1	—	3	1	1
December	—	1	—	—	3	5	1	—
January	3	—	—	2	3	7	4	17

Analysis of U-Boats Sighted during January

Particulars of Incidents.	U-Boats.		Sorties when Aircraft	
	Sighted.	Attacked.	Sighted.	Attacked.
On 51 occasions 1 U-Boat was sighted by 1 aircraft— 34 aircraft attacked	51	34	51	34
One 1 occasion 1 U-Boat was sighted by 2 aircraft— both aircraft attacked	1	1	2	2
On 1 occasion 1 U-Boat was sighted by 3 aircraft— all aircraft attacked	1	1	3	3
Totals	53	36	56	39

Squadron Results—January

		Sorties when U-Boat Sighted.	Sorties when U-Boat Attacked.	
1. United Kingdom				
58	Halifax	St. Davids	5	5
502	Halifax	St. Davids	5	4
53	Liberator L.L.	St. Eval	2	1
224	Liberator L.L.	St. Eval	9	6
59	Liberator	Ballykelly	1	1
103 (U.S.N.)	Liberator	Dunkeswell	1	1
110 (U.S.N.)	Liberator	Dunkeswell	1	1
311 (Czech)	Liberator	Beaulieu	1	1
10 (R.A.A.F.)	Sunderland	Mount Batten	1	1
228	Sunderland	Pembroke Dock	1	0
461 (R.A.A.F.)	Sunderland	Pembroke Dock	1	1
172	Wellington L.L.	Chivenor	3	3
304 (Polish)	Wellington L.L.	Predannack	3	3
612	Wellington L.L.	Chivenor	3	1
2. Iceland				
120	Liberator L.L.	Reykjavik	2	1
3. Gibraltar and Moroccan Sea Frontier				
202	Catalina	New Camp	3	1
48	Hudson	North Front	2	0
132 (U.S.N.)	Ventura	Agadir	1	1
179	Wellington L.L.	North Front	4	3
4. Azores				
206	Fortress	Lagens	2	2
220	Fortress	Lagens	2	0
172	Wellington L.L.	Lagens (det.)	3	2
			56	39

Recent Attacks on U-Boats

Skilful Radar Approach

On January 2 **Halifax L/58** was on patrol in the eastern part of the Bay of Biscay when shortly after 1930 hours a Radar contact was obtained 9 miles on the port beam from a height of 1,000 ft. The aircraft immediately began to home, but lost contact at 6 miles. After searching for several minutes another contact was obtained, this time at a range of 15 miles. The aircraft again began to home and altered course so as to make use of the moon path. During the run in contact was several times lost, but the pilot twice regained it by lifting the nose of the Halifax. When the range was closed to one mile the captain sighted a U-Boat on the surface one mile fine on his port bow. The enemy fired one short burst of flak as the aircraft attacked from the starboard beam. Six 250-lb. depth charges, spaced at 60 ft., were released from 50 ft. and the plumes were seen on either side of the U-Boat between the conning tower and the bows. As the aircraft passed over the U-Boat the enemy fired another short burst of machine gun fire from four guns. After releasing a marine marker the aircraft circled and kept in contact by Radar. Forty minutes later the contact faded and the marker was lost in showers. While the aircraft was circling a regular flashing light was seen, but its origin was not discovered. Another light was seen later while the aircraft was searching the area, but it soon disappeared. About two hours after the attack the aircraft set course for base.

Analysis

A persevering Radar approach which led to a successful moon path sighting. The attack seems to have been excellent and damage may have been inflicted which prevented the U-Boat from diving for 40 minutes until Radar contact was finally lost. It is impossible to explain the flashing light, which was also believed to have been seen by L/502.

The loss of Radar contact when the nose of the aircraft is depressed is a common failing in Halifax aircraft due, it is believed, to the type of installation. Pilots should keep this in mind when homing on to a contact.

A Miss Astern

On January 3 **Liberator X/224** was on a night anti U-Boat patrol in the Bay of Biscay when shortly after 2000 hours a Radar contact was obtained at 16 miles range from 1,500 ft. The aircraft did not home immediately, but flew on in order to get into a position to attack up moon. The aircraft then turned and began homing directly on to the target. At 1 mile range the Leigh Light was switched on and illuminated a fully surfaced U-Boat on an easterly course. The aircraft immediately attacked from just abaft the port beam with eight Torpex depth charges, but the stick was seen to burst astern of the U-Boat. The enemy put up intense flak as soon as the searchlight was switched on, and the aircraft gunners replied. The U-Boat held steadily on her course and the aircraft made a machine gun attack in the face of more intense flak. The captain took switchback evasive action and the Liberator was not hit. Some minutes later contact was lost for good.

Analysis

A determined attack in the face of flak. On the evidence the stick missed astern out of damaging

range. It is worth noting that when a U-Boat is expecting an imminent attack it may increase speed to as much as 15 knots.

A Big Flash

In the early morning of January 4 **Wellington B/304** (Polish) was on an anti U-Boat patrol in the Bay of Biscay when a Radar contact was obtained at 7 miles range from 800 ft. The aircraft immediately began to home and at three-quarters of a mile the pilot sighted a long wake and immediately afterwards a surfaced U-Boat on a north-easterly course. The U-Boat was fully visible and so the Leigh Light was not switched on. The aircraft turned slightly to starboard and attacked from the port quarter with six Torpex depth charges spaced at 60 ft. The stick was seen to straddle the U-Boat. The rear-gunner scored many hits along the enemy's deck, and after the explosion of the depth charges the whole crew saw a big flash of light on the deck of the U-Boat. After the attack the U-Boat was seen travelling more slowly, but later she was lost to view and the Radar contact disappeared.

Analysis

A very well executed Radar approach and a well-planned attack. If the evidence is accurate, damage must have been inflicted, though it is not possible to say how serious it was. The big flash on deck and the diminishing speed are significant.

It is worth remembering that when contact is finally lost after an attack the area round the point of submergence should be searched with the Leigh Light as experience shows that this may produce valuable evidence of results.

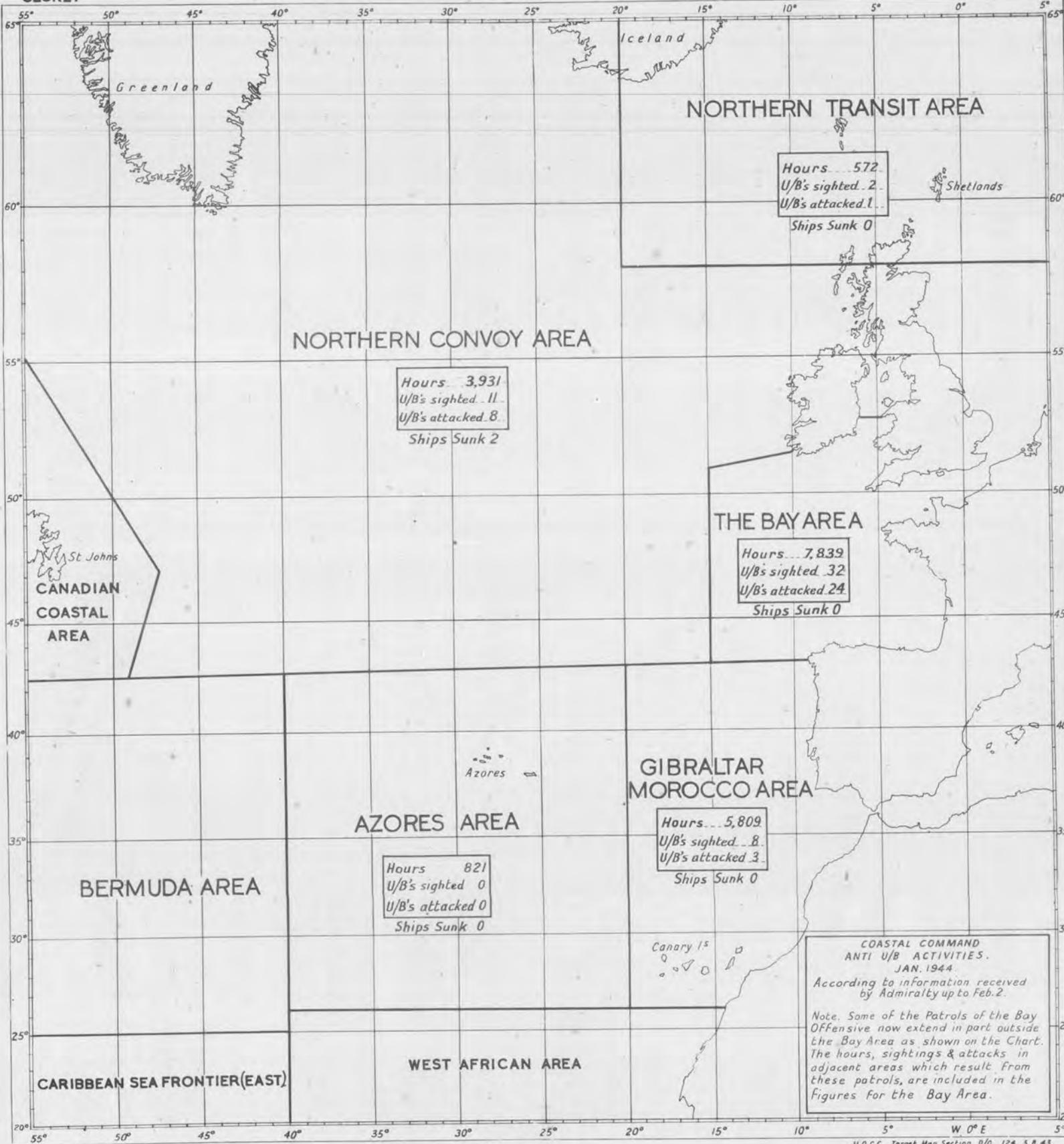
U-Boat Fires at Flares

Halifax R/58 on a night patrol in the Bay of Biscay on January 5 had just been investigating some fishing vessels when a Radar contact was obtained at 22 miles range from 2,200 ft. The aircraft homed and sighted first a wake and then a U-Boat on an easterly course 4 miles away. The U-Boat was not clearly identified until three anti U-Boat flares were released from 800 ft. She was then between 1 and 2 miles away. The German gunners at first fired at the flares but then elevated their guns to fire at the aircraft. Six Torpex depth charges were released from 150 ft. in a starboard beam attack and the stick was seen to overshoot, the nearest depth charge being estimated to have burst just to port of the bandstand. The aircraft then circled and released another anti U-Boat flare. The fire from the U-Boat again increased and was clearly directed against the flare; the Halifax gunners replied. Five minutes later contact was lost.

Analysis

This was a very long range pick-up for Mark III equipment and an excellent Radar approach with successful flare technique. The effort to lose height after identifying the U-Boat probably caused rather a high speed at release and hence an overshoot, but the immediate attack was fully justified. It is of great interest that the U-Boat fired at the flares. Although it is unlikely that major damage was inflicted by the depth charges the U-Boat must have been severely shaken and certainly had a rude shock at being attacked so close to home.

SECRET



COASTAL COMMAND
 ANTI U/B ACTIVITIES.
 JAN. 1944.
 According to information received
 by Admiralty up to Feb. 2.

Note. Some of the Patrols of the Bay
 Offensive now extend in part outside
 the Bay Area as shown on the Chart.
 The hours, sightings & attacks in
 adjacent areas which result from
 these patrols, are included in the
 Figures for the Bay Area.

A Day Kill

On January 8 **Sunderland U/10** (R.A.A.F.) was on a day patrol in the Bay of Biscay when shortly before noon a U-Boat with her conning tower awash was sighted 12 miles on the starboard bow from 4,300 ft. Visibility at the time was 15 to 20 miles with 10/10ths cloud at 4,300 ft. and a moderate sea. The U-Boat was a 500-tonner steering a westerly course at 12 knots (see plate 2). The aircraft immediately altered course to attack and when it was 5 miles away the U-Boat opened heavy fire. The Sunderland replied at 1,200 yards with four fixed Brownings, and the captain took successful evasive action round the curtain of flak. The first depth charge attack was abortive as the depth charge trolley failed to run out completely, but five or six dead or injured gunners were seen lying on the gun platform. The U-Boat had meanwhile altered course 90 degrees to starboard, but once more made good a westerly course after the aircraft had passed over. The Sunderland made a steep turn and again attacked from the starboard quarter, releasing six Torpex depth charges spaced at 60 ft. The depth charges straddled the U-Boat, two to port and four to starboard. The U-Boat immediately slowed down with a list to starboard. A little later she began to sink by the stern, and many of the crew were seen coming out of the conning tower. The aircraft then made another run firing all guns, but a minute and a half later the U-Boat sank by the stern. Just after she sank there was internal explosion in the vessel, and immediately after the attack much oil and wreckage was seen. Thirty or forty survivors were left in the water.

Analysis

The height (4,300 ft.) of patrol gave a very long sighting. Excellent marksmanship at 1,200 yards from the four fixed guns smothered the U-Boat's flak and killed or wounded most of the men on the bridge and at the guns. A perfect depth charge attack resulted in the sinking of the U-Boat, which left ample evidence of her destruction. This attack shows the value of a long continuous burst of fire at maximum range with the front guns. A splendid effort.

Unusual Armament

Soon after 1500 hours on January 13 several hundred miles south-west of Ireland, **Liberator A/59**, flying at 2,000 ft., sighted the bow wave of a U-Boat 8 miles away. The visibility was 10 miles with 5/10ths cloud at 2,500 ft. and a moderate sea. The U-Boat, which was steering north-west, was a 500-tonner and had one multiple mounting of four light guns on a platform abaft the conning tower, and a larger gun on deck abaft the platform. The Liberator immediately attacked from the starboard quarter and the U-Boat turned hard to starboard. The Mark III bomb sight was used and six depth charges spaced at 50 ft. were released. The first two depth charges appeared to straddle the stern of the U-Boat and the Liberator's rear gunner scored many hits on the hull and conning tower. After the attack the U-Boat continued to circle to starboard at high speed and the aircraft attacked again from the starboard quarter, releasing two depth charges. The rear gunner estimates that the first of these exploded immediately astern of the U-Boat and that the second overshot. The Liberator then came in again and made a machine gun attack. All these attacks were made out of the sun and the only

return fire came from the big gun aft. The ammunition was self-destroying and burst with a black puff. The rate of fire was estimated at 40 rounds a minute. Two more machine gun attacks were made out of sun without reply from the enemy and on the sixth run the U-Boat began to submerge. She first went down in a horizontal attitude, but then the stern suddenly rose at a steep angle and hung in the air for 10 to 15 seconds before it finally slid under the water.

Analysis

Well executed and resolute approaches and attacks in the face of flak. Although it seems unlikely that serious damage was caused it is possible that the U-Boat's helm became jammed and caused her to circle continuously to starboard. The accurate gunfire from the aircraft smothered the U-Boat's flak and very probably caused many casualties. It is probable that the damage was enough to force the enemy to return to port.

Promising Night Attack

On January 4 **Halifax Y/58** was on anti U-Boat patrol in the Bay of Biscay when shortly after 1900 hours a Radar contact was obtained at 10 miles range from 2,500 ft. The blip was very weak at first but afterwards became clearer. The aircraft began to home until a wake was sighted at 1½ miles range and then the U-Boat, at 1 mile. The aircraft immediately went into attack from the starboard quarter of the U-Boat, which was on a north-easterly course, and the stick of six depth charges spaced at 60 ft. was seen to straddle the U-Boat with one explosion close to her stern. A vivid violet flash was seen and the U-Boat was lifted out of the water by the explosions. The conning tower was seen apparently lower in the water and the contact then faded. Nothing further was seen and Y/58 was finally relieved.

Analysis

An excellent Radar approach and a very good attack. According to the evidence a lethal straddle may have been obtained, but the lack of definite after-results makes it impossible to give a precise opinion regarding the damage. The explosion of a depth charge is sometimes visible at night and this may account for the blue flash.

Accurate Attack with Mark III Bombsight

On December 10 **Liberator S/53** was on a night patrol in the Bay of Biscay when it obtained a contact at 10 miles range from 1,500 ft. The aircraft at once homed, losing height to 300 ft., and at three-quarters of a mile the Leigh Light was switched on, illuminating the U-Boat dead ahead in the act of submerging. The pilot altered course slightly to port and attacked from fine on the U-Boat's port bow, releasing five depth charges spaced at 50 ft., three seconds after the U-Boat had disappeared. The sixth depth charge hung up. The Mark III low-level bombsight was used. The navigator had the swirl in the sight at the time of release and the rear and beam gunners report that the stick fell across it. The bows of the U-Boat surfaced just clear of the depth charge plumes and a blue flash was seen among the plumes after the explosion. The aircraft searched for 4½ hours, but saw nothing further.

Analysis

This was a well planned and well executed attack indicating a very good standard of crew drill and

demonstrating the value of using the Mark III bombsight in a night attack by Leigh Light. The fact that the bows of the U-Boat broke surface just clear of the explosion plumes indicates that number 4 depth charge exploded over the hull abaft the conning tower, forcing the after end of the U-Boat down and the bows up. The blue flash seen when the plumes were well in the air may indicate an explosion in the U-Boat, unless it was from a depth charge detonating rather late.

A Long Range Radar Contact

At 2000 hours on January 7, in the Bay of Biscay, **Liberator N/224** obtained a good Radar contact at 25 miles. The pilot continued on his closing course, but the contact was lost in sea returns at 4-5 miles. Fortunately the U-Boat was sighted visually at 2 miles and was attacked immediately. The eight Mark XI depth charges dropped were thought to have straddled the conning tower. The U-Boat dived and the pilot was able to track over the swirl. The Mark III low-level bombsight was used. There was no return fire from the U-Boat, which had obviously made up its mind to dive on sight. A search was carried out with the Leigh Light but there was no evidence of any other results. Visibility was difficult because of a slight haze.

Analysis

This attack brings home very forcibly the vital importance of Radar in night attacks. It is disquieting to note that the sea-returns extended up to

4-5 miles in a calm sea. If it had been a moonless night it is very unlikely that the U-Boat would have been illuminated by the Leigh Light and a good attack would have been missed. However, the initial contact at 25 miles was excellent and the standard of visual look-out beyond reproach.

A Red Explosion

Wellington F/304 was flying at 1,500 ft. on January 3 when, shortly after midnight, a Radar contact was obtained at 4½ miles range. The aircraft circled down in order to get into position for possible attack. A minute or two later, after the aircraft had homed, a U-Boat was suddenly sighted 700 yards ahead from 100 ft. The aircraft immediately attacked from the port quarter, releasing six depth charges spaced at 60 ft. The stick was believed to have straddled the U-Boat and the rear gunner saw a big red explosion five seconds after the detonation of the depth charges. Hits were also scored with machine gun fire. A marine marker was dropped, but nothing further was seen during the next three-quarters of an hour and the aircraft finally set course for base.

Analysis

A well executed approach with the aid of Radar, and, according to the evidence, a very good attack. The large red-explosion was most encouraging and it must have been disappointing to the crew that owing to the darkness no results could be seen. In such circumstances it is well worth switching on the Leigh Light as this may reveal evidence of damage or destruction.

"A First-rate Performance"

In the afternoon of January 28 **Sunderland D/461** was on an anti U-Boat sweep near a big convoy south-west of Ireland when the front gunner sighted a wake three miles away on the starboard bow. The U-Boat herself was sighted through binoculars and was steering a northerly course. She was a 500-tonner, dark grey in colour, and had one quadruple 20-mm. mounting on the lower bandstand, one twin 20-mm. on the upper bandstand and two machine guns on the bridge. A white emblem was painted on the side of the conning tower. The U-Boat made no attempt to dive as the aircraft ran in, but opened fire with all guns at about 3,000 yards range. The nose gunner of the **Sunderland** opened up at 1,000 yards as the aircraft flew in through the continuous stream of flak from the six cannon and the machine guns. Tracer was seen passing between the hull and the port float and the pilot took evasive action. The barrage followed the aircraft but was always just too late to hit.

When 400 yards dead astern of the U-Boat the aircraft made a sharp turn to port and by the time it had closed to 200 yards the U-Boat's guns were silent and the **Sunderland** was able to attack from the U-Boat's port quarter without opposition. The first stick of four depth charges undershot, the nearest entering the water 30 yards from the conning tower. As the aircraft passed over, ten bodies were counted strewn about the conning tower and bandstand. There was no sign of life on the deck, although the U-Boat itself

seemed to be undamaged. The **Sunderland** immediately attacked again, this time from the U-Boat's starboard beam, and released the remaining two depth charges across the now silent U-Boat. A perfect straddle was achieved, the depth charges entering the water and exploding one on each side of the conning tower.

One minute later, while the aircraft was circling to take photographs, an explosion was seen and the U-Boat disintegrated. A large patch of oil immediately appeared littered with wreckage and bodies, dead and alive. Hoping to obtain further evidence of the kill, the captain dropped a dinghy to the survivors. This, however, failed to inflate.

Photographs were not taken during the first attack because the **Sunderland's** evasive action was so violent that the rear-facing camera was wrenched from its mounting and the navigator was thrown from the galley to the wardroom, where he was temporarily knocked unconscious.

Analysis

A very good look-out on the part of the front gunner and extremely good shooting. The U-Boat's box barrage has been noted before and the correct "undulating" evasive action as advised in Coastal Command Tactical Memoranda was adopted by the pilot. This undoubtedly saved the aircraft. The difficulties under which the depth charges were released in the first run resulted in an undershoot, but superb bombing with the remaining two depth charges in the second attack produced a decisive kill. A first-rate performance.

A Moonlight Kill

Wellington L/172 was carrying out an A/U patrol ahead of an Escort Group 400 miles north-east of the Azores on a fine night with the moon two nights past full, when a Radar contact was obtained at 10 miles range from 1,500 feet. The Captain flew into a position down moon of the contact and then began to home, losing height. When the aircraft was at 800 feet the U-Boat was sighted by moonlight $2\frac{1}{2}$ miles dead astern. The captain dived straight into attack from the port beam, while the front gunner raked the decks with machine gun fire. As the aircraft turned, the rear gunner, who also opened fire, saw the first depth charge explode close to the U-Boat on the port side. A brilliant blue flash was also observed as if the second depth charge had exploded on hitting the U-Boat. The pilot then circled to port, intending to attack on the U-Boat's port bow, but owing to cloud obscuring the moon the U-Boat was not sighted again until too late to attack. The U-Boat was then seen to have turned through 180° and lying stationary with the stern well down. The front gunner again opened fire, raking the U-Boat, and the latter replied with machine gun fire. A flame float was dropped immediately ahead of the U-Boat's starboard bow. The Wellington's captain again circled, but the moon once more became obscured, and the U-Boat was not sighted although contact was maintained on

Radar. Another run-in was made and this time the U-Boat was clearly seen by moonlight with the flame floats slightly astern. It was still lying stopped with the after part submerged and the bows well clear of the water. The remaining depth charges were now released in an attack from the starboard beam. The front gunner once more raked the decks and the U-Boat replied with what was estimated to be a single round of cannon-fire, which destroyed the Wellington's rear turret and wounded the rear gunner in the left leg. The rear gunner was also wounded with splinters in his left arm.

As the depth charges subsided, the U-Boat was seen to have disappeared.

Analysis

A very skilful and successful attack resulting in a "known sunk." It is arguable as to whether the Captain did right not to use his Leigh Light, particularly after the first attack, since it might have enabled him to deliver the coup de grace sooner. Although the Leigh Light gives away the position of the aircraft, provided it is trained on to the U-Boat, it also helps to blind the U-Boat's gunners, and in any case under moonlight conditions it is quite likely that the aircraft is visible to the U-Boat's gunners for a considerable distance.

Accurate bombing and altogether a very fine effort.

U-Boat Claims by the Enemy

National Socialism has undoubtedly made the Germans into a gullible race, if we judge by the broadcasts to which they are obliged to listen. On January 29, Heinrich Schweich gave a talk on U-Boat attacks, basing his arguments on 'facts' which were wholly imaginary. He first spoke to the Germans on the month's attacks in the Bay of Biscay, saying:—

"A special U-Boat operation was launched against the blockade which was to be enforced by air and sea forces, particularly by submarine chasing and locating groups. As is known, this operation resulted in severe losses to the enemy, the shock of which made him publish a partial admission. But he denied the full extent of the success of our surprise action. The U-Boat commanders, who have since arrived back at base, fully confirm the published figures of enemy destroyers lost. In fact, according to their statements, the number of enemy destroyers sunk must have been even higher than first reported. Admiral Land told the House of Representatives recently that U-Boats had reappeared surprisingly off the U.S. Atlantic coast and in the Caribbean. These facts show that assault operations constantly force the enemy to use his resources, particularly of light naval escort vessels, as he never knows where U-Boats will become active next."

Herr Schweich then went on to talk of the Arctic. He said:—

"In the Northern Arctic also the Anglo-Americans have been forced to take very thorough precautions to be able to carry to Murmansk the military supplies so insistently demanded by the Soviets. They have used not only light naval forces on this route, but also cruisers, battleships and aircraft-carriers. The convoy with which our U-Boats made contact a few days ago was not protected by such heavy units. The enemy believed he could make do with a strong destroyer screen and rely on favourable weather. However, this destroyer screen was extremely strong and when the first boat sighted the Murmansk-bound convoy, it became clear that every merchant ship was protected by two escort vessels. The core of the convoy was surrounded by a double protecting belt. Our commanders had first to deal with this escort force and this could only be done after the most violent engagements with the superior fire-power of the escort vessels.

"The first reports of enemy vessels sunk naturally dealt with destroyers. Later in the operations it became clear that, once again, the surprise blow had succeeded, with the result that all U-Boats operating in the Far North were able to join in sinking valuable merchant tonnage.

"Tanks, cars, aircraft and other military equipment went down into the Arctic before they could be used against our troops on the Eastern Front.

"The operations took place on the shipping route between the Arctic and the Barents Sea, north of Murmansk. In addition to the enemy sea escort, the attackers had to overcome almost incredible weather conditions. For hours on end, German look-outs had to contend with visibility of 500 metres or less in which their boat was liable to collide with another U-Boat or with an enemy escort vessel. In view of these conditions, our U-Boats' success in the Arctic is all the more remarkable."

The "success in the Arctic" was sadly different from the picture given to the Germans by Heinrich Schweich. This extraordinary and absurd exaggeration suggests that the German propaganda machine is running at full throttle, with the hope of deluding the public and bolstering up their spirits. Or it may be that the fighting spirit of the U-Boat crews is so lowered by our victories that exploits must be invented to keep up the façade of deception which the enemy has been forced to raise.

II.—ANTI-SHIPPING

Shipping Strikes in January

At 0057 hours on December 30 an **Albacore of 415 Squadron** took off from Manston on an anti-shipping patrol. The aircraft, which was loaded with six 250-lb. G.P. bombs, was vectored on to a target assumed to be in an area 5 miles north-east of Calais. This target was not found but after the **Albacore** had circled several times the pilot saw two stationary barges tied together lying half a mile off shore. As visibility was bad the pilot decided to bomb the barges as alternative targets. The attack was made on the seaward side of the target from 750 ft. No hits were seen but the bombs fell only 20 ft. away from one barge, which undoubtedly was damaged by the explosions.

Beaufighter R/236, on shipping reconnaissance west of Borkum on January 9, sighted a coaster of 300 to 400 tons. It was painted battleship grey and was steaming at 4 or 5 knots. **R/236** attacked from astern with four 20-mm. cannon, diving from 500 ft. to 50 ft. Strikes were seen on the superstructure and bridge.

On January 14, **No. 489 Squadron (R.N.Z.A.F.)** carried out a Rover Patrol on the Norwegian coast. The force consisted of three **Beaufighters** armed with one 18-in. torpedo each and four 20-mm. cannon, escorted by an anti-flak force of five **Beaufighters** with cannon only. In position 58° 00' N., 06° 25' E., an enemy convoy was sighted dead ahead steaming on a southerly course at 4 knots. It consisted of one M/V of 4,000 to 5,000 tons followed by a smaller M/V and was escorted by one "M" class minesweeper and three escort vessels. This convoy was also escorted by a float plane which withdrew hastily when the attack began. In order to attack as soon as possible and to avoid flak from the land, our aircraft came in from the seaward side in starboard echelon. The three **Torbeaus** attacked the large leading M/V from 40°, 70° and 90° on the starboard bow respectively. Aircraft "X" was hit in the nose by flak but the pilot carried on and dropped his torpedo. A large explosion was seen near the bow of the M/V followed by a black mushroom cloud of smoke which hung for a considerable time. The anti-flak aircraft, with the exception of aircraft "L" which had a complete cannon failure, attacked all the escort vessels with cannon and scored many hits.

This well-planned and well-executed attack was carried out in the face of flak from both the convoy and the shore. This is the Squadron's first attack since converting from Hampdens and great credit is due to the crews for their success.

Near Lister on January 14, the **Wick Beaufighter Wing** attacked two enemy convoys steaming on a southerly course. The first consisted of one M/V of 4,000 tons, one of 3,000 tons and one of 2,000 tons, escorted by two E/V.s. The second convoy, which was following the first, comprised one M/V of 4,000 tons and one of 3,000 tons escorted by three flak vessels.

The striking force consisted of eight **Torbeaus** of 144 Squadron each armed with one 18-in.

torpedo and four 20-mm. cannon escorted by nine **Beaufighters** of 404 Squadron with cannon and eight 60-lb. H.E. R.P. each, and seven **Beaufighters** of 144 Squadron armed with cannon only.

Course was set for a point 30 miles due south of the Naze. On reaching this point the formation turned north and the anti-flak aircraft, ranged on either flank of the **Torbeaus**, climbed to 1,000 ft. From this height they found it difficult to see the **Torbeaus** against the water and eventually they lost them. Immediately the convoys were sighted a sweep was made out to sea allowing the starboard anti-flak aircraft to come up into position and attack. The eight **Torbeaus** attacked the leading 4,000 ton M/V from bearings estimated between 40 and 100 degrees on the starboard side. Although the target ship took avoiding action, it is believed that she was hit on the stern as a column of water and smoke rose 50 to 100 ft. in the air. Seven of the escorting R.P. and cannon **Beaufighters** also attacked the first convoy, scoring R.P. hits on the foredeck of the same vessel as well as amidships and on the bridge. Two R.P. hits were scored on one of the E/V.s, and both M/V.s and all the E/V.s were hit by cannon fire. Seven cannon **Beaufighters** and two R.P. aircraft attacked the second convoy. The leading 4,000 ton M/V and escort vessel were attacked with R.P.s but no hits were seen and the E/V was strafed with cannon. The remaining aircraft attacked the E/V.s with cannon only and so damaged one that it ceased fire before the end of the attack. These aircraft were attacked by seven **Me.109**'s, three of which followed **D/144** 30 miles out to sea and made six attacks without inflicting any damage.

This blow was inflicted on the enemy in the face of heavy and accurate flak from both the vessels and shore batteries. Three aircraft did not return from this attack and others suffered superficial damage.

On the night of January 20 **Albacore L/415** took off on an anti-shipping patrol carrying six 250-lb. G.P. bombs. While flying at 2,500 ft. the aircraft was vectored on to two destroyers sailing in line astern 4 or 5 miles west of Le Touquet. On sighting the destroyers the **Albacore** turned a complete circle to port before attacking from the starboard bow of the leading destroyer. The bombs were released from 1,000 ft. in a dive and three were seen to explode on the destroyer's stern, where a big fire broke out. No flak was experienced during the run in, but immediately after the bombs were released accurate heavy and light flak of various colours was encountered, mostly from the rear destroyer. The pilot turned to port after the attack, climbing and taking evasive action, but was forced to dive for speed as the flak became more intense. The aircraft got away safely and returned to base undamaged.

The destroyers were later attacked by **M/415**, but the results were not seen.

Aircraft **L**'s attack was exceptionally well executed in face of heavy opposition. A first-class effort.

On January 20 an enemy convoy was successfully attacked near Stadtlandet by aircraft of the **Wick Wing**. The main striking force comprised six Beaufighters of 404 Squadron using R.P. (60 lb. H.E.), and the anti-flak escort was provided by six Beaufighters of 144 Squadron with cannon only. The convoy was steaming north at 5 knots, parallel to the coast. It consisted of two merchant vessels of 3,500 tons, each of them followed at a short distance by a bigger vessel of 6,000 tons. Six or seven escorts were spaced out in line ahead to seaward of the convoy, and there was one other escort vessel between the 6,000-ton ship and the shore. The wing leader first sighted the convoy 6 miles away, from 1,500 feet, and he was able to give precise instructions over the V.H.F. This contributed largely to the success and excellent co-ordination of the attack. Three of the anti-flak aircraft approached the rear of the convoy from the south, and attacked the escort to landward of the 6,000-ton ship, while the other three engaged two escort vessels on the outside. This appears to have been very effective as numerous strikes were seen and all three escort vessels ceased firing before the end of the attack. Less than a minute later the R.P. aircraft attacked the large merchant ship and scored thirty direct hits. Two R.P. hits were also seen on an escort vessel. After this attack the merchant vessel was enveloped in steam and smoke and caught fire. There was a large plume of black smoke from the escort which had been hit with R.P. All attacks were made in dives from 1,500-2,000 feet down to about 500 feet. The result of this determined effort was one 6,000-ton merchant ship seriously damaged and three escorts damaged. There were no casualties among our crews, and only three Beaufighters were slightly damaged.

No. 489 Squadron (R.N.Z.A.F.) carried out another successful strike off the Norwegian coast on January 20. The striking force comprised four Torbeaus, "M," "Y," "S" and "W," each armed with one 18-in. torpedo and four 20-mm. cannon, escorted by Beaufighters "L," "J," "A," and "T" (four 20-mm. cannon) as the anti-flak force. The aircraft took off from Leuchars at 0950 hours and set course for the coast of Norway. At 1133 hours, in position 58° 15' N., 06° 15' E., an enemy convoy was sighted, proceeding on a southerly course at 12 knots. It consisted of an armed merchant vessel escorted by an "M" class minesweeper on either bow. Photographs of the merchant vessel show that she resembles the auxiliary minelayer *Skagerak 1*. Five miles further south was a single 2,000-ton M/V steaming at 6 knots on a northerly course. It was intended to make a formation attack, but aircraft "M" and "Y" attacked the 2,000-ton M/V from the beam before the formation leader could instruct them to attack the other target. Both the torpedoes were seen to run, but no hits are claimed. Aircraft "Y" broke away from this attack and strafed the "M" class minesweeper on the starboard side of the southbound target. Torbeaus "S" and "W" flew north and turned in to attack the minelayer. The ship avoided to port, but "S" and "W" attacked from the starboard side and released their torpedoes at close range. A big explosion aft of amidships was seen by two aircraft

and the vessel afterwards sank. The anti-flak aircraft "A," "J" and "T" attacked the 2,000-ton M/V with long bursts of cannon and scored many hits. A big cloud of grey-white smoke from this vessel testified to their accuracy. "J" also attacked the "M" class minesweeper on the starboard side of the armed M/V. Medium flak came from the convoy, but the 2,000-ton M/V did not open fire. Aircraft "S" and "T" suffered slight damage. During the attack two Me.109's approached at low level from the land, climbed over the convoy and then disappeared. Perhaps they were afraid to give battle because of the Beaufighters' formidable rear armament.

Another determined attack north of Stadtlandet by the **Wick Beaufighter Wing** on January 26 resulted in damage to two M/Vs, an "M" class minesweeper, and an escort vessel. The striking force consisted of six Beaufighters of 144 Squadron (four 20-mm. cannon) and five Beaufighters of 404 Squadron (eight 60-lb. H.E., R.P.). The convoy was first sighted 20 miles ahead of the strike force and slightly to the starboard. It consisted of three M/Vs of 2,000 to 3,000 tons in line ahead escorted by one E/V ahead, one astern, and an "M" class minesweeper and an E/V to seaward. To the south of the convoy was a stationary M/V of 2,000 tons and an escort vessel. The six anti-flak aircraft attacked the minesweeper and the escort vessel on the seaward side of the convoy and scored many hits. After breaking away E/144 attacked the stationary M/V to the south and repeatedly hit her superstructure. The R.P. aircraft attacked the minesweeper, the E/Vs astern and on the seaward side, and the rear M/V. Aircraft "E" and "T" both fired all eight R.P.s in pairs at the minesweeper and "E" obtained four hits. "U" fired four R.P.s at the minesweeper without seeing the results, and four more at the rear M/V which was hit twice. "H" launched all eight R.P.s in rapid pairs against the E/V astern and hit her four times. All these aircraft used cannon effectively during the attack. Aircraft G/404, which failed to return, is thought to have successfully attacked the leading M/V. Gun crews on the minesweeper were hit and the vessel was left on fire, while both the M/V and E/V astern were enveloped in smoke. The leading M/V was also smoking at the bow.

This highly successful attack was carried out in face of flak from the ships and the shore and fighter opposition. Aircraft G/404 was attacked by three Me.109s and shot down in flames. Aircraft M/144 which was similarly attacked and seriously damaged was saved from destruction by U/404, who very gallantly turned back and attacked the fighters pursuing aircraft "M." "U" was then attacked out to sea until it gained cloud cover.

Liberator Q/311 (Czech) on anti U-Boat patrol on January 29, obtained a Radar contact at 20 miles. As the range closed an M/V of 2,000 to 3,000 tons was sighted with two smaller vessels nearby, one of which was possibly a U-Boat. The aircraft attacked the large M/V from 400 ft. and released seven 250 lb. Torpex depth charges set at 18 to 20 feet. No results were seen, but the aircraft made two more runs over the target and strafed it with machine-guns.

III.—OTHER OPERATIONAL FLYING

Combats with Enemy Aircraft

On December 20 a Liberator of **105 Squadron** (U.S.N.) encountered eight Ju.88's in the Bay. They were first sighted about six miles astern and flying on roughly the same track as the Liberator. As the enemy aircraft closed the range a yellow light flashed from the nose of No. 4, and No. 1 peeled off for an attack. The Ju. pilot opened fire at extreme range and came in to about 500 yards without doing any damage. At this distance, however, the Ju. was hit by fire from the tail, crown and waist guns of the Liberator, and was last seen losing height with smoke pouring from its starboard engine. As soon as the attack began the Liberator pilot took violent corkscrew evasive action, and kept it up until he gained cloud cover. Subsequent information has established that this Ju.88 was destroyed.

While circling a dinghy on December 30 **Sunderland X/228** sighted a F.W.Kurier about 10 miles away. As the enemy aircraft approached it fired a four-star red cartridge and opened fire from the dorsal turret at 1,000 yards range. The Sunderland turned in towards the Kurier and opened fire with the .5 nose gun. The enemy aircraft thereupon made for cloud followed by "X." For about 20 minutes the Sunderland chased the enemy in and out of cloud, and the gunners were able to get in an occasional

burst. It is probable that the Kurier was damaged for it slowed up considerably after being fired at and seemed unable to gain on "X." After the first exchange of fire the F.W. was most anxious to get away. It took no evasive action but was eventually lost in cloud. The Sunderland was undamaged and returned to circle the dinghy.

On January 20, **Mosquito K/333**, having completed an anti-shipping patrol and set course for base, sighted an enemy aircraft on the port quarter. The aircraft, later identified as a B.V.138, was flying coastwise in a northerly direction, at 300 feet. "K" made a wide turn to port to avoid being seen and approached the B.V. from dead astern. The enemy aircraft turned west and reduced height. "K" followed and opened fire at 500 yards. Both the enemy's outer engines caught fire. The Mosquito broke off but the enemy pilot turned towards the coast and extinguished the fires. "K" also turned and, getting astern of the B.V., fired another burst from 500 yards. Both engines caught fire again, the fire spreading to the whole of the port wing. A third burst was fired from 200 yards and the B.V.138 crashed into the sea, sinking immediately. During the action there was no return fire from the enemy's rear guns.

Photographic Reconnaissance

In spite of ten days of unfavourable weather the production figures of 106 Wing during January rank a close second to the record month of November, 1943. Benson's new record day produced 6,483 negatives from which 19,826 prints were made.

The highlight of the month has been reconnaissance of the "Military Installations of the Rocket Coast." P.R. sorties in this area have revealed the pin point positions of these targets, their state of completion and the damage they have suffered from our bombing offensive.

Since December 21, only two of the twelve attempted sorties have obtained photographs of Berlin. One obtained some photographs of the north-west of the city and the other had to work

through 8/10ths cloud. Weather prevented photographic reconnaissance of other targets in Germany which had been attacked by Bomber Command and the 8th Bomber Command.

Normal routine sorties produced useful information and requests for special reconnaissance of airfields and ports were met. The enemy continues to run merchant ships from the Bay through the hazards of the Channel. The most recent attempt was by the 7,000 ton *Havelland* type vessel which has been photographed aground and awash off Cap Blanc Nez. Two *Elbing* destroyers from the Baltic have been photographed in the Channel, presumably on their way to the Bay to replace the destroyers of that class sunk by the Royal Navy.

[The following selection of reports of photographic reconnaissance were written by members of the aircrews concerned.]

544 Squadron (Mosquito)

On January 20 we were briefed for targets East of Toulouse. We were airborne in a Mosquito 1X at 1120 hours and climbed to 10,000 feet over base before setting course for Toulouse.

We crossed out at Selsey Bill, on track, at 23,000 feet and found trails down to 23,500 feet. We debated whether to turn back, but hoping trails

would rise over the Channel we continued and finally crossed in at Caen at 25,000 feet, just under trails.

We flew over broken cloud in the middle of France but the sky was practically clear at Toulouse. We did one run over Toulouse and Toulouse Blagnac airfield for luck and then set course for the first target.

After covering the first two targets I noticed oil escaping from the starboard engine but as the temperatures and pressures seemed normal and as the remaining targets were in the general direction of home, we decided to continue. While doing the sixth target the oil pressure began to fall. I called the Observer back from the nose and he turned on the emergency oil supply but this did not seem to help and at 1400 hours, when the oil pressure was nearing 25 lbs., I feathered the starboard airscrew.

We first thought of going to Corsica but we decided there was too much water to fly over and we were not sure of the state of the aerodromes there anyway.

We next considered returning to base but I knew there was a lot of activity on the North French coast that day and I did not like the idea of coming out through it at 10,000 feet, on one engine.

We decided to set course for Gibraltar. I did not know what our petrol consumption would be on one engine and I did not think we had enough to reach Gibraltar, but we figured we would fly as far as possible, bale out and walk the rest of the way.

We set course for the east coast of Spain and decided to fly down it. I gradually reduced height from 26,000 to 12,500 feet, where we were able to maintain height without overheating the port engine. We had maps of Gibraltar and Marseilles but of nothing in between. However, after flying some time I remembered my emergency map which made it possible for us to get the outline of the coast and the approximate distance to Gibraltar.

By this time we had also figured that our petrol consumption would allow us just a faint chance of making Gibraltar as long as the engine held out. We set an approximate course inland for Gibraltar, and I decided to risk using some of our precious current (the generator is on the starboard engine) on sending out an S.O.S. in the hope of getting a vector to Gibraltar. We called both on W/T and V.H.F. but received no reply.

As soon as we left the coast we found it impossible to map read on my small map so the Observer busied himself getting ready to bale out. We tore off the inner hatch, tested his harness and parachute, etc.

After two hours on one engine we were getting a bit tired, but we computed our petrol consumption again and it proved to be less than the first estimate. If only that engine would hold out!

After three hours we found ourselves over mountains with approximately one hour's petrol left. We now figured we must be on our Gibraltar map (which included the south coast of Spain) but with so many mountains around we could not pin-point ourselves accurately. But we realized, from our watches, that we must be near the south coast. We flew over the mountains full of expectancy . . . we pin-pointed ourselves on the coast at Malaga and there silhouetted against the sinking sun, was the Rock of Gibraltar.

We circled the Rock at 10,000 feet, descended to 2,000 feet over the runway and fired off the colours of the day. I then made my first single engined landing in a Mosquito after spending six and a half hours in the air. Three and a half of these hours were on one engine and it did not even heat up.

540 Squadron (Mosquito)

We took off at 1100 hours on January 10, a bright morning, and set course for the Skagerrak. The weather over the other side was a bit doubtful, and we had been given alternative targets in south Norway and north Denmark.

Trails were found at 26,000 feet so we decided to fly below them at 25,500 feet. After an hour's flying we saw that although Norway was perfectly clear, Denmark was under 10/10ths cloud cover, so we set course for Lister aerodrome. (Soon after this trails came down quite suddenly and thickened, so we climbed smartly up to 28,000 ft., where we were making non-persistent trails half a mile long.)

Arriving off Lister, we were rather amazed to see three convoys close to the shore, two northbound and one southbound. Altogether they totalled eleven merchant vessels with the same number of escorts. While photographing we discussed whether or not we should head out to sea, send a sighting report to base or continue on our mission. We decided that the latter would not take too long, so we did a run over Lister aerodrome, receiving a fair amount of flak on the way. A few special targets were then photographed on the way to Kristiansand.

Kristiansand and Kjevik airfield were covered and a second run was attempted to make sure of the target. The flak was much more accurate than at Lister, coming up in concentrations of about one minute intervals toward the end of the run. The aircraft was rocked slightly and we altered course steeply to port. Our last target at Justoen Island was then covered.

Norway was looking very attractive with its fresh snow cover—like the new icing on a Christmas Cake. So we decided to turn back and attempt a cover of some targets we knew to be outstanding, north-west of Kristiansand.

At 1305, hours, while still making trails, we were running up on a target near Bjelland when an M.E. 109 was seen in front, 1,000 feet below, on a reciprocal track. The observer was recalled from the nose. We increased revolutions to 2,850 and boost to +10lbs. and headed towards the coast. The 109 was soon lost but another enemy aircraft was spotted ahead, in sun, about 1,000 feet above. His trails made him clearly visible to us. The enemy dived down to our height and we headed straight for home. At about 1,000 yards the aircraft, then recognized as a F.W. 190, opened fire for three seconds. The tracers went

well overhead. The F.W. overshot above and turning steeply to port, fell out of his turn and lost fully 1,000 feet.

We continued on a gradual dive at 2,850 revs. +8 boost out to sea and into sun. It was not necessary to jettison the drop tanks. The F.W. appeared to pursue us with the object of heading

us westward, but after five minutes, contact was lost.

At 1325 hours we set course for base, sent out sighting signals of the convoys, and landed at 1515 hours.

A small piece of shell casing was found in the starboard nacelle, presumably collected over Kristiansand.

Air/Sea Rescue

SEARCHES AND RESCUES IN JANUARY

On January 6 aircraft and surface vessels made a very fine rescue about 100 miles east of Spurn Head. At 0910 hours a signal was received from Lancaster T/626 reporting that it had petrol for only one hour's flying. A series of running fixes were taken on it and at 0945 hours a signal was received to say that it was about to ditch in position 53° 45' N., 02° 45' E. Eight Liberators of the U.S.A.A.F. were patrolling the area and one of these was diverted to the position of the Lancaster. Air/Sea Rescue aircraft from 279 Squadron had meanwhile begun their search and at 1310 hours a signal was received from W/279 to say that they and a Liberator were over a dinghy containing live aircrew. An airborne lifeboat was dropped, but very heavy seas prevented the ditched crew from reaching it. It was then decided to send two rescue motor launches from Yarmouth to attempt the rescue. These left at 1643 hours and arrived in the area about 2230 hours. While they were on the way the dinghy was constantly covered by aircraft of the two Air/Sea Rescue squadrons, 279 and 280, and flame floats were dropped at frequent intervals. At 0029 hours on the morning of January 7 the entire crew were rescued by one of the launches.

On January 7 Mosquito D/157 was reported by accompanying aircraft to have ditched in position 47° 08' N., 07° 30' W., and the crew of two were seen in their dinghy. (The Captain later got into his "K" dinghy.) At 1335 hours on January 8 a Warwick from 280 Squadron, with fighter escort, signalled that it was over two dinghies in position 47° 34' N., 06° 39' W., and at 1350 hours the airborne lifeboat was dropped, the crew immediately climbing aboard. A visual signal was sent to them to steer 350° T and it was seen that they had started the engines and set course. Contact was then lost owing to bad weather and in the afternoon of January 9 a Warwick from 280 Squadron, with Beaufighter escort, took off from Exeter to search for the airborne lifeboat. Two rescue motor launches also sailed from the Scillies to a rendezvous position. This search was unsuccessful but an improvement in the weather

next day enabled aircraft from 280 Squadron and 10 Group to continue the search. At 1515 hours a Mosquito from 157 Squadron sighted the survivors in position 40° 35' N., 06° 05' W. At 2236 hours that night a Liberator from 224 Squadron made another sighting at position 48° 56' N., 05° 45' W., but lost contact in the very poor visibility. Next day, January 11, the airborne lifeboat, which had covered over 100 miles, was intercepted by a rescue motor launch from the Scillies and the crew, both fit and well, were taken on board.

At 0252 hours on January 28 an S.O.S. was received from Lancaster Q/61. The Captain was ordered to land at Exeter and was given the distance. He replied that he had petrol for only 20 minutes and switched the I.F.F. to "distress." Two more fixes were passed at 0309 hours and 0311 hours, and seven minutes later the key was clamped down. The transmission ceased at 0324 hours and a second class fix was obtained which gave the position as 49° 42' N., 03° 27' W. A Radar track of the broad I.F.F. had been plotted and this faded at 0311 hours in a position 8 miles from the fix.

A Beaufighter from 405 Squadron was immediately sent out to search but was unsuccessful and at first light an extensive search was laid on by 10 Group. A Warwick carrying an airborne lifeboat stood by at Davidstowe Moor. At 1100 hours a Spitfire from 165 Squadron found a dinghy with four occupants in position 315° Guernsey 14 miles. The Warwick took off immediately with an escort of eight Spitfires and after dropping a smoke float to determine the direction of the wind, it released an airborne lifeboat at 1325 hours. The survivors paddled towards it and climbed in. After settling themselves they set course 330° T on instructions signalled by Aldis lamp from the Warwick. Four hours later the lifeboat was intercepted by M.T.B. 679 and the crew were landed at Dartmouth. Continuous fighter cover was provided throughout by aircraft of A.D.G.B., including Spitfires, Typhoons and Beaufighters and the enemy did not attempt to interfere with the rescue.



Target surfaced and coming round to port.
Speed, 5 knots.



Close up showing conning tower wash vanes and
new towing periscope.



Target surfaced. Speed 10 knots. (No tank or pump unit fitted.)



Target running at periscope depth.
Speed, 9 knots.



Target has submerged showing final swirl
left by conning tower.

Improvements in Submersible Target.—In the Coastal Command Review (July 1943) the submersible target was described. Several improvements have since made it more realistic. This was not simple. Just as seaworthiness and speed are opposed virtues, so the creation of a greater swirl and wake became opposed to ease in handling. The obvious solution was a larger target, with all its attractive possibilities for Radar approach. But this had to be rejected on the grounds of production and manoeuvrability.

The existing target was, therefore, modified and the wash vanes were changed in size and shape to give a firmer line of betraying wake. Next, a conning tower was added to increase the swirl on diving, but this also had to be limited in size because of the problems of stability and increased drag—the latter being offset by fitting a streamlined fairing to the ballast plates. Then, for the sake of protection, the pump unit was moved inside the perforated plates of the conning tower—perforated to save hamper and to increase ebullition on diving. Finally, an improved towing periscope was designed.

The prototype model, with all working parts adjustable, was built and delivered in November. The target went through minor teething troubles but these were overcome and now she tows better with less rend and jerk on the wires in a seaway. She leaves more surface wake and, of greater importance, a larger green swirl on diving. At times, depending upon the water, this swirl equals that made by predecessors with the use of the fluorescent pump.

The new model, now in production, will probably remain unchanged unless anything unexpected occurs. Within the limits of size and ease of handling she is now as real as invention and patience can make her.

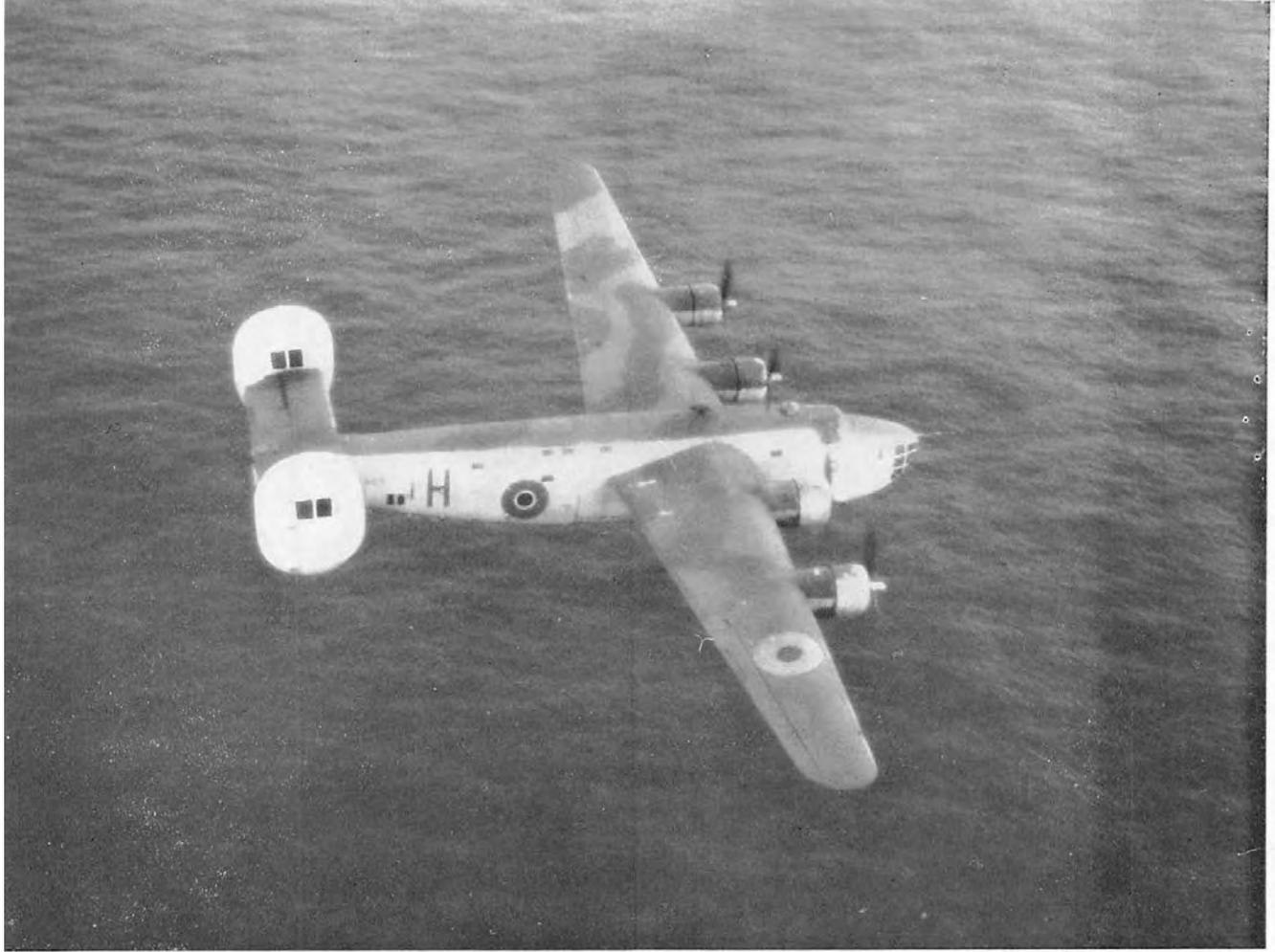


PLATE 4.

Above : AM 929. Below : Attack by AM 929 on U-Boat. (See letterpress on opposite page.)



IV.—SPECIALIST AND GENERAL ARTICLES

AM 929: a Biography

AM 929 is a Mark I Liberator of Coastal Command, powered by Pratt and Whitney Twin-Wasp engines. She is approaching her third birthday and has flown a distance equal to eight times the circumference of the world. Ninety per cent. of this flying has been in operations against the enemy. She has flown over 60 sorties in the North Atlantic and has escorted convoys bound north, south, east and west. She has been damaged by the enemy's fire, but she has given far more than she has taken. Her depth charges have sent to the bottom four U-Boats for certain and she has attacked and damaged many more. In all she has sighted 27 U-Boats. Almost all these have been shadowing our convoys and on seeing the Liberator they have crash-dived deep into the Atlantic where they lose contact with their prey.

AM 929 (Makers' No. 20) was built by Consolidated at San Diego, California. She was completed on May 26, 1941, and flown to La Guardia Field for tests. Thence she went to Wright Field, Daytona, and from there to Dorval, Canada, via La Guardia Field. On August 20 she flew the Atlantic and landed at Prestwick.

From August 20-29 AM 929 remained at Prestwick in the hands of Scottish Aviation, Limited, and underwent preliminary modification, that is, the first stage in her transformation from a United States B 24 heavy bomber into a first-line Liberator of Coastal Command. Next she flew to Boscombe Down where the R.A.F. gave her a type test. This consists of every kind of performance trial, and takes some time. AM 929 was ready by January, 1942, and returned to Prestwick for the major part of her conversion into a Coastal aircraft. This work, much of which was concerned with the installation of four 20-mm. forward-firing cannon, took over seven months because the necessary spares were very difficult to get: for more than three months the work hardly progressed at all as the spares were not to be had in this country. Eventually, however, the bottle-necks were straightened out, the supplies came through and AM 929 was ready to take her place in the line.

On August 1, 1942, A.M. 929 was flown to 120 Squadron at Ballykelly and was given the letter H. The beginning of her operational career was not auspicious. The first trip on August 9, a 15-hour convoy escort, was uneventful, but on her second trip she developed a petrol leak, and this, combined with poor visibility, caused her to return to base early. The next sortie began badly. The pilot found immediately after take-off that one of his engines was giving trouble and circled the airfield for 35 minutes before setting off on his mission. This was an important sortie to find the survivors of the troopship *Letitia* reported torpedoed and sunk on August 9, 610 miles west of Blacksod Bay. As it was then the 16th the 600 troops on board, if they had survived, would have been in the boats for seven days. But H did not find them. She cannot, however, be blamed for this as on the same day *Letitia* steamed safely into Halifax harbour after an uneventful crossing.

After this H's luck changed. On her next trip she joined naval vessels and a Catalina in a U-Boat hunt, and finding a most suspicious patch of air bubbles, dropped a stick of depth charges across it. When she left, the surface craft were still harrying the enemy, and it is believed that the U-Boat was eventually sunk.

This was at least action, and better was to follow. On her next trip, on August 19, H escorted convoy SL.118 and saw her first U-Boat. The captain went straight in to attack while the enemy was still on the surface. The U-Boat shuddered and remained surfaced for five seconds after the attack and then submerged steeply. This was described by the Naval Staff at Coastal Command as "an excellent attack," and was assessed by the Admiralty as "probably slightly damaged." It is certain that that particular U-Boat did not molest SL.118 again. Later in the same day H saw another U-Boat and attacked it with cannon and forced it to submerge. Three attacks in two sorties was too good to last, and the next trip produced nothing more exciting than a lot of French tunnymen. On August 28 H had an interesting day but was unlucky not to have a sighting. The convoy she was escorting had been attacked the night before and H did useful work in helping the stragglers to return to the fold. If encouragement was needed, the sight of a listing merchantman limping along with a torpedo in her side must have provided it. While she was with the main body of the convoy the S.N.O. sent her to investigate a suspected U-Boat some distance away. While H was on this search another U-Boat attacked the convoy and succeeded in torpedoing another ship. H did not find her U-Boat and soon afterwards had to return to base.

She was not able to have her revenge for some time, but she was soon translated to a more vital area of operations. After three uneventful sorties she was detached to Reykjavik and began to operate in support of the famous Russian convoys. In company with the other Iceland-based aircraft valuable cover was given to these convoys whose story would have been different had it been possible to give them, all through their journey, the same cover which they received from Iceland in the initial stages. During this time (September, 1942) H sighted three U-Boats near the convoys she was protecting and though she was unable to attack any of them they were all put down below the surface where they could do neither damage nor shadowing. On September 23 H saw an enemy aircraft for the first and last time in her career. The enemy, whose type was not identified, was shadowing the convoy when H appeared. Shots were exchanged and the enemy was glad to take refuge in a cloud rather than face H's four cannons. H was not hit. At the end of the month she returned to Ballykelly.

October, 1942, was an exciting month. On the 10th she returned to Iceland and two days later made two attacks. The U-Boats were shadowing convoy ONS. 136 and one of them was the victim of H's first definite kill. A stick of depth charges was dropped across the enemy vessel and the

explosion of the third depth charge was so close to the hull that chunks of metal flew into the air in all directions. One big piece flew past the astonished eyes of the gunner in the rear turret. He reported that the U-Boat was completely covered in the explosions and lifted out of the water so that the whole deck was clearly visible, with water pouring off it. After the attack a big cylindrical piece of wreckage studded with bolts came to the surface and floated for over half an hour in the middle of a wide patch of oil. Three days later H attacked again. Three U-Boats were sighted this time around convoy SL.104. In the first attack two U-Boats were sighted and while running in to attack the further one, the nearer one was treated to a burst of cannon fire which he was glad to escape by submerging. The second German was attacked with depth charges and severely shaken up. This attack was extremely difficult for H as she was unable to get low enough to drop a really accurate stick. Later another U-Boat (or one of the two previously attacked) was seen nearby and attacked with depth charges. Though none of these U-Boats was much more than badly shaken, it is certain that they were discouraged from pressing their attentions on SL.104. The next day H completed the hat-trick with her third action in three sorties. This U-Boat also escaped serious damage but was forced to submerge.

Even this did not finish H's account for the month. After two uneventful sorties, on the second of which she did valuable work in reforming a scattered convoy, H again saw three U-Boats round a convoy. One was attacked, though probably not damaged, and the other two escaped by crash diving. H was beginning to make a speciality of sighting three U-Boats at a time and on November 5 she did it again. They were all around convoy SL.107 and the first one certainly never worried convoys again for she achieved momentary fame as H's second kill. When the depth charges exploded, instead of throwing up the usual vivid white plume, the columns of water were dark and dirty. The U-Boat's stern rose to an angle of 50° and the screws revolved aimlessly in the air. Soon after she sank, a wide patch of air bubbles foamed on the water for about eight minutes. The second U-Boat of the trio went under before she could be attacked, but the third received H's remaining depth charges. There was not enough evidence to assess the damage.

When H took off on her next trip on November 20 it was intended that she should return part of the way home to America. However, the weather in Newfoundland closed in and the crew's hopes of unlimited silk stockings and American cigarettes were deferred for several weeks. Her last trip in November was without incident, but in December her first sortie was one of those solid, colourless and glamourless achievements which may be boring in the extreme to Coastal crews, but which have made possible our success in the Battle of the Atlantic and possibly in the whole war. It was a straightforward escort of Convoy HX.217 and was devoid of incident. Yet this is what the Admiralty said of it in a signal of congratulation: "The six hours escort given to HX.217 on December 7 by H/120 at a distance of 800 miles from its base, certainly saved this convoy from serious casualties the following

night." Attacks on U-Boats are the highlights of the work of Coastal Command aircraft: but it is the long unwearied escort that brings home the much-needed bacon.

Of the four remaining sorties of 1942 three were uneventful—though one may have been slightly alarming to the crew: No. 3 engine developed an oil leak when the aircraft was a long way from base, but H brought the crew safely home on three engines. The other trip produced two attacks. The first, with a full stick of depth charges, damaged the enemy and a good deal of oil was seen. The remaining depth charges may have damaged the second U-Boat but the evidence is insufficient. The men of Convoy HX.218 were probably quite satisfied with H's efforts.

H began the New Year with a useful sortie on January 1 which rounded up a scattered convoy, and 10 days later she sighted a U-Boat near another convoy but was unable to attack before it dived. The next two trips were without incident: and on January 25 H returned to her native continent. When a long way from her base in Iceland, the pilot was diverted to Bluie West I in Greenland, and set course for that base. He was probably relieved to receive another signal telling him that he could land at Gander if he preferred it. He landed at Gander.

H was then very nearly due to have her engines changed. The originals (R.1830-33, Nos. 5830, 5831, 5019, 5833) had done fine service for nearly two years and there had been only two failures, both of a minor kind. At Gander it was decided that the engines could be most easily changed at Dorval in Canada, and H accordingly flew there. While she was at Dorval her new engines were fitted and at the same time a major inspection was done. After tests H returned to Gander and was ready for operations again.

On April 5, 1943, H returned to her accustomed area. She took off from Gander on a sweep to Reykjavik and sighted a periscope, but it disappeared before an attack could be made. This incident began a period of ill-luck for H. On her next trip, on April 22, she sighted no fewer than four U-Boats, but each time she tried to attack the depth charges hung up. Perhaps, however, the rage of the crew was somewhat mitigated by the novelty of landing at Goose Bay in Labrador. The aircraft returned to Iceland three days later and had poor luck and uneventful trips for the next two months. Several of the sorties were curtailed or spoiled by bad weather and low visibility. During this time nine sorties were made.

On June 24 H made a fitting come-back. The *Coastal Command Review* for June, 1943, describes the action thus: "While *en route* to carry out anti-submarine escort to Convoy ONS.11, a fully surfaced 740-ton U-Boat was sighted 75 miles north of the convoy. The U-Boat and aircraft must have seen each other simultaneously for the enemy began to take violent evasive action. The captain dived straight in to attack and opened fire. The U-Boat was then putting up considerable opposition and as the captain released the depth charges, a cannon shell entered the starboard side of the nose wheel compartment and rendered all the hydraulics useless. This caused the bomb doors to 'creep' so that only two depth charges were released. These straddled the U-Boat just forward of the conning tower and

it is estimated that No. 1 exploded almost underneath, just aft of the conning tower. The U-Boat was not visible after the explosion subsided, but about 20 seconds later, 15 ft. of the bows appeared at a very steep angle and then slid under again. The captain did not realize that the hydraulics were out of action and he attempted to attack with one depth charge which did not release. On tracking over the position air bubbles and oil were seen coming to the surface, and from 12 to 15 survivors had appeared, clinging to a long cylindrical object.

"In addition to the shell which put the hydraulics out of action, a second shell entered and exploded in the port wing, outside the outer port engine. A serious petrol leak was also started in the starboard tanks, by machine gun bullets. The remaining depth charge load was jettisoned and the aircraft set course for base. A considerable amount of petrol flooded the interior, but the leak stopped when the petrol reached the level of the hole.

"On arrival at base the undercarriage and flaps were lowered by emergency methods and for three-quarters of an hour the crew tried to repair the brake hydraulic pipe lines. This was impossible and the captain then decided to land in tail down attitude. The whole crew, except the flight engineer, took up station in the rear of the aircraft together with all ammunition and movable gear. The mirror camera was removed from its mounting to prevent damage.

"A perfect approach was made at very slow speed and a three-point landing made, touching down within a few feet of the end of the runway. Immediately the aircraft touched, the two inboard engines were cut, the two outer ones being kept in case a swing developed. After running 1,000 yards most of the speed had been lost but a swing to port had begun. This was checked by opening up the port outer engine, and the aircraft was eventually brought to rest. The damage from landing was confined to slight buckling of the underskin of the fuselage. The only member of the crew injured was the flight engineer whose neck, back and legs were struck by pieces of shrapnel."

After this magnificent action H was transferred to 43 Group for repair. A month later she was in the line again but bad weather and poor luck dogged her on the next few trips, several of which had to be cut short. During August and September the U-Boat killing business was bad in the North Atlantic and H did seven trips without

excitement. Then on October 17 she got another kill. H saw the enemy at much the same moment as another Liberator and both aircraft attacked. On her first run H did not drop any depth charges, but turned steeply and came in for another attack in which the stick of depth charges straddled the enemy. The other Liberator followed and also got a straddle. On every run the U-Boat put up intense anti-aircraft fire, but both Liberators replied and caused casualties among the German gunners. The U-Boat was by then crippled and H delivered the *coup de grâce*. The bows reared up and the enemy vessel sank immediately, leaving many survivors in the water. H was suitably revenged for the damage she had received in her earlier action.

In November, 1943, H returned to her friends, Scottish Aviation, at Prestwick. She was due for a large-scale overhaul after her long exertions. When this is finished she will go once more into the Battle of the Atlantic. It will be a different battle from the one to which she was brought at the beginning of her career. Then she formed part of the only Liberator squadron in Coastal Command; the only squadron whose aircraft could reach the real battle ground between surface ships and U-Boats. But even she and her colleagues could not always effectively close the notorious Atlantic gap where the enemy destroyed so many men and ships and cargoes. The battle was critical and very hard. Facilities, weapons, training, and above all numbers were insufficient for Coastal to give the protection which was needed. But H and her sister Liberators with the naval escorts and shorter range aircraft staved off the disaster which was threatening. Each one of those sorties which the records classify as "uneventful" was an important part in the battle. To be in the air at all often meant flying through the gales and bitter weather of the North Atlantic winter, and when aircraft are patrolling, U-Boat men are anxious. We know this because so many of them have told us so.

But the new battle which H will fight is more a pursuit than a battle. The enemy is routed and we have now to deal with a series of rearguard actions. Instead of one Liberator squadron we have many: we can now flood an area with Liberators where in the past H would have operated alone. That curious German strategy of "elastic defence" is being stretched to bursting point and at the ceremonial fly-past over the German naval base at Kiel it would be fitting for H, an American aircraft with a British crew, to lead the Allied formations.

Some Notes on Rockets

Rockets for use as artillery have been in production in Britain, Russia and Germany since 1940. But it is only recently, with the help of journalistic imagination, that the public have become conscious of their possibilities, although for two years now our armed forces have been using several types of rockets against the enemy.

The high velocity performance of the British 3-in. anti-aircraft rocket indicates that rockets of similar design could be applied to many uses. The results with the British 3-in. anti-aircraft rocket stimulated interest in Britain and the United States, and in the tests that followed the 3-in. R.P.

was modified for use from aircraft. This weapon has been in operational use since June, 1943. It has been suggested that the Americans might also use an aircraft rocket by producing the British type in their own country. But cordite, the propellant we use, is not manufactured in big quantities in U.S.A. There is some advantage in using a faster burning propellant than cordite, as a slow burning rocket needs a larger sighting correction. But a stronger motor casing would be required to contain the rapidly expanding gases of the fast burning propellant, and this would reduce the charge/weight ratio of the motor. The

United States Navy developed a rocket similar to our 3-in. R.P., but using U.S. ballistite. Another high performance rocket is now on trial with the U.S. Army. There are also extensive experiments being carried out with launching equipment, both by our own Ministry of Aircraft Production and the United States Navy.

Rockets have many advantages over guns when fired from aircraft. The firing of heavy calibre guns from aircraft is limited by the ability of the structure of the aircraft to withstand the recoil. For instance, the recoil force from a 40-mm. cannon firing a 3-lb. shot is about 6,000 lb. The structure of the aircraft must therefore be stressed to withstand this. The calibre of the guns is therefore limited because of the point where it becomes impracticable to strengthen the structure any further.

This recoil problem disappears with rocket projectiles, because the recoil is taken up by the high velocity gases ejected by the rocket itself. These gases blow beneath the wing surfaces where they do not affect the aircraft, so long as no part of its structure lies in their path. The aircraft therefore flies steadily on its course during the firing of successive rounds.

The rocket projectile used by the Royal Air Force is a shot or shell which is moved forward by the recoil action of gas, which escapes at a very high speed from the rear of the rocket. This gas is generated by the combustion of the cordite in the rocket motor—the forward thrust on the rocket is about 2,000 lb. and the acceleration produced is 25 to 100 g., according to the size of the shell.

Gun projectiles leave the aircraft at maximum velocity and lose speed for the remainder of their flight. But bombs and rockets are released from the aircraft at low velocity and they gain speed so long as there is accelerating force. In this respect, therefore, the aircraft rocket is more closely related to the bomb.

The degree of accuracy obtainable with the weapon depends upon three factors: dispersion, attitude of the aircraft, and the aiming errors of the pilot. Although the rocket motors are manufactured with the highest possible degree of precision, there are inevitable inaccuracies which cause deviations from the intended flight path and a general dispersion around the sighting point. This dispersion decreases as the aircraft speed is increased. At 250 m.p.h. the spread is such that at 400 yards range 50 per cent. of the rockets will lie in a 16-ft. circle for the 25-lb. shot and a 20-ft. circle for the 60-lb. shell.

The rocket projectile should be fired as near parallel to the line of flight of the aircraft as possible in order to minimise the dispersion. This is due to the fact that when the rocket is freed from the constraining rails its speed relative to the aircraft is about 150 f.p.s., whereas the speed of the aircraft through the air will be two to three times as great. Therefore, if the rocket is fired at an angle to the line of flight of the aircraft, there will be a force acting on the tail fins tending to make the rocket swing back into the relative wind. It is impossible to set the rails parallel to the line of flight at all speeds and loadings. A mean position must therefore be selected—one at which the dispersion due to unavoidable changes will be as small as possible.

The aiming error of pilots is proportional to the range. With a good aircraft it has an average value of about 6 ft. per 1,000 ft., both vertically and horizontally. Range estimation is most important because of the curvature of the trajectory. And, as the rocket turns into the relative wind, its ultimate flight path will depend on the attitude and speed of the aircraft at the moment of firing. It is therefore essential to fly at a speed as near as possible to that for which the sight has been harmonised.

The following table compares some features of the rocket projectile, the gun projectile and the bomb. It relates to level flight at a speed of 250 m.p.h. at slant ranges of 400 and 1,000 yards.

Short Range, 400 yards.

Weapon.	Time of Flight (ft./sec.)	Gravity Drop (ft.)	Striking Velocity (ft./sec.)	Aircraft Aiming Error (ft.).	
				Azimuth.	Elevation.
250-lb. G.P. bomb	2.3	160	380	60	8
40-mm. gun	0.5	4	2,250	10	5
3-in. R.P. 25-lb. shot	1.2	30	1,550	16	10
3-in. R.P. 60-lb. shell	1.5	40	1,150	16	12

Long Range, 1,000 yards.

250-lb. G.P. bomb	7.7	1,000	450	80	25
40-mm. gun	1.4	29	1,710	25	10
3-in. R.P. 25-lb. shot	2.2	110	1,650	40	20
3-in. R.P. 60-lb. shell	3.0	180	1,100	40	20

In comparing the aiming errors with the four weapons, it should be remembered that the R.P. and gun projectiles will strike the target almost horizontally. But the bomb, particularly at the longer range, will strike at an appreciable angle to the horizontal. The relative chances of hitting the target therefore depend not only on the aiming errors but on the ratio of the projected areas of the target in the horizontal and vertical directions.

The weapon has many tactical advantages. A large projectile can be thrown forward at high speed without reaction on the aircraft and without carrying a heavy gun. The penetration of the rocket projectile at a given range is far greater than that of the bomb, or even of a 40-mm. gun when using the 25-lb. shot. Low approach to the target may be made. Instantaneous fuzing which will achieve damage at the point of impact may be used on the rocket projectile in low attack since

it will detonate well ahead of the aircraft. In similar conditions, a bomb would burst almost directly beneath the attacking aircraft.

To obtain a high degree of certainty in hitting targets of reasonable size, rockets may be fired in pattern salvos. As the rocket projectile does not rotate, and as the 25-lb. shot has the same diameter as the rocket motor the underwater ballistics of this version of the weapon are unusually good. After entering water at a horizontal angle of 20°, the projectile will travel nearly 100 ft. just below the surface, with sufficient velocity to penetrate the pressure hull of a submarine.

Technical improvements in performance, together with progressive developments in tactics and training may ultimately raise the rocket weapon to the status of a primary armament of the R.A.F.

Statistics

*On a door in Coastal Command Headquarters is the word **Statistics** which implies to the casual passer-by that what happens on the other side of the door is very dull. The following article, written by the Command Statistical Officer, helps us to appreciate the work done by his Branch and it goes towards reconciling us to the duty of filling in the forms and supplying the material from which he makes his records.*

Accurate facts and figures are vital to the planning of all war operations. Staff officers must know the exact results of previous operations if they are to plan for the future, and supply organizations base their orders on expenditure in the past. For instance, the Air Ministry must know the number of depth charges used by Coastal Command in any one period in order to forecast the number required for some future period. There is therefore a continuous demand for the figures which "Statistics" supplies.

Statistics are made up from the returns sent in by stations and units. Some of these returns may seem to go into unnecessary detail but some important facts can be discovered from the careful correlation of seemingly trivial details: facts which help the plans and tactics of tomorrow. For instance, a record of the height from which U-Boats are sighted may help us to find out whether the enemy is using Radar. For similar reasons we must keep a continuous record of facts and figures, and thus form a reservoir of useful knowledge to be drawn on for any particular problem.

The statistician has a dual task: first, to collect and store information in an accessible manner, and second, to analyse and present the collected material so that the important facts and trends can be discerned and interpreted with speed and ease.

A central source from which these figures could be obtained was formed at Command Headquarters last July. The information at present dealt with by this section falls under two main heads: first, a record of the numbers and state of serviceability of Coastal aircraft, and second, a record of their operational, training and other flights.

To provide detailed information of aircraft serviceability the "Conspectus" signal was introduced. This signal replaced three daily and one weekly return and although it contains more information than its predecessors, it is less than a third of their combined lengths. To deal with

Conspectus each aircraft in the Command is represented by a card on which full details of the aircraft are entered, together with the dates of its minor and major inspections, transfers from one unit to another and other relevant particulars. The history of the aircraft is thus built up on the card. The cards are arranged each day in racks according to the squadron location and state of serviceability of the aircraft. All this forms a pictorial record which enables us to see the daily state of the Command's aircraft at a glance. Any information required about a particular squadron or type of aircraft can be extracted quickly. For instance, it would be a few minutes' work to produce complete details of all the Command's aircraft listed on any particular day as "unserviceable awaiting spares." When an aircraft is transferred to 43 Group for repair, or written off, its card is filed so that details of the wastage in any particular type are available.

The Conspectus contains details of non-operational flying only. Statistics for all operational sorties are derived from the Form Orange supplemented by U-boats and the other combat reports. A punched card system has been adopted to record this material. The card has numerous holes around its edge and each hole represents an incident or an item of information. Each operational sortie has a separate card and the holes which tell the story of that sortie are punched out, leaving a gap on the edge of the card. Thus, if a Halifax takes off from a 19 Group station for an anti U-Boat patrol in the Bay where it engages an enemy aircraft and is damaged in combat, then the holes marked "Halifax," "19 Group," "Bay," "A/U patrol," "Enemy Aircraft," "combat" and "damaged," are punched out, together with any other relevant details such as load, bomb sight, etc. These cards are stored in a filing cabinet and the detailed information is available in a few moments. If, for instance, the Signals Staff wish to know the number of W/T failures on Wellingtons in September, the cards for all September sorties are

taken out and a long steel spike is threaded through the hole marked "Wellington." All sortie-cards relating to Wellingtons will have a gap where the hole has been punched out so that when the cards are lifted on the spike, all Wellington sorties will drop out. Gather these Wellington cards together, thread another spike through the "W/T failure" hole, and all W/T failures will drop out; thus in a few seconds you have the figures for W/T failures on Wellingtons during September. Almost every conceivable kind of statistical information can be obtained in this way.

By these methods a mass of information is stored in an easily accessible form by a small staff who have had no previous experience. The value of this material is obvious. Routine returns are easily built up from the stored information and

numerous daily enquiries can be answered quickly. Returns based on *Conspectus* are essential to check the progress of Planned Flying and Planned Maintenance. The summary which appears in the opening pages of this *Review* each month is one simple example of the use made of the punched cards. In short, the general trend of air operations and the tactics employed by the enemy can be weighed and studied from these statistics. Squadron moves, changes in planning, the abandoning of unsatisfactory weapons and the installation of new devices, may depend in part upon the knowledge gathered by Statistics. It will be seen, therefore, that it is not for any idle purpose that Forms Orange and *Conspectuses* are filled in. Each one of these takes its place in our archives, thus helping to give a complete and useful picture of the work of Coastal Command.

The Last Look Round

It is disturbing to realize that with all the advance that safety precautions have made disasters may still arise from neglect of almost insignificant defects which should be noticed in that last look round before taking off. For instance, badly fitted cowlings and panels nearly always reduce airspeed, and if they come adrift they can be very dangerous. On an Anson aircraft, unless the starboard cowlings are securely fastened, they may open at the front and subsequently come adrift. Then they may cut the tailplane bracings, with the result that the fin will collapse and the aircraft will probably crash.

Days were recently spent investigating an accident of this type involving an Anson. After examining the bracings, sabotage was suspected at first because the wires were cut clean through as if by pliers or a sharp instrument. It was eventually proved that the accident had been caused by a loose starboard cowling. Pilots and maintenance crews must pay particular attention to engine cowlings and inspect them closely before each flight. This applies to other types of aircraft, especially to all marks of Wellingtons. Try to develop a keen eye for small snags of this kind. For instance, compression creases may often be seen in the fuselage of Typhoons after a pilot has gone after the Hun and has had to subject his aircraft to every known form of combat drill. Look out for the flaking of paint or dope and don't merely have this flaking painted over. Refer the matter to your Engineer Officer. Train your eyes to discern skin wrinkles, humps and line cracks which run up the leading edge of the fin.

Mosquitos and Halifaxes have many cowlings and panels and the panels around the tail wheel of a Mosquito are particularly important. The fastener or button is retained by a strip of spring steel so that it cannot be lost when a screwdriver or coin is used to take the panel off or to secure it. This fastener can easily be seen if the mud and dirt is removed. It is possible that the dent caused through careless handling of this panel or by heavy landing may throw the button out of alignment with the securing hole. The result is that the fitting with the button attached is left unlocked. The outcome of this is that in flight the fastener is allowed to flap, vibrate and break off. When the aircraft lands again, a

button without the retaining plate may be found. The ground crew may replace the button or even perhaps a couple of buttons without retaining them with the necessary securing plate. Fuselages are designed for flexibility in combat, and when this stress occurs, out pops the button which is no longer retained. The panel then tears off, the elevator is damaged by the panel and the aircraft is soon out of control. Keep your eyes skinned for the 2-in. black strip which will indicate that the metal retaining strip is missing from the buttons. These observations apply equally to the cowlings on the Halifax.

Now a few words on undercarriage and bomb doors. The curtains inside the bomb doors of Wellingtons are retained with leather laces, double knotted. In spite of all instructions the correct knot is very often not tied. It should not be a simple bow like the bow of your shoe laces, nor should the laces be removed altogether to supply the needs of service boots. When these curtains are not properly secured there is trouble. They may come off in flight and a length of curtain 8 ft. by 1 ft. jams or settles nicely into the opening between the horn balance of the elevator and tail planes. There it is likely to be pounced upon by some particularly vicious Gremlins who will lash it about and cause the loss of the aircraft. Such curtains have been found near the wreckage of aircraft frayed like old rugs, and with the very marks of the airfoil imprinted on them, showing clearly what had happened. Look inside the bomb doors, see that these laces are properly secured and if so leave well alone. If you need shoe laces and the Equipment Officer is unreasonable, don't take them from your Wellington.

The undercarriage doors of Mosquitos should also be watched. When all the oil round these doors has been removed, very often a hair line crack will appear near the rivets retaining the main fitting. Take Form 700 action at once, or this door may come off in flight and add to the depressing score of accidents.

On one occasion an Engineer Officer was detailed to carry out an investigation into an accident. He had with him a Coastal Command Staff Officer. The Engineer Officer intended to stay at the Station at which they had landed



PLATE 5.

The Azores : Two photographs of Santa Ana (Rabo de Peixe) airfield on San Miguel Island.





The Azores : Two photographs of the airfield at Lagens.

PLATE 6.



and the Staff Officer was going on. The C.T.O. had undertaken to have the aircraft moved and serviced by the morning and the Staff Officer in an easy frame of mind went off for a night's sleep. The party detailed to move the aircraft were rather neglectful and in doing so the elevators were badly torn underneath by screw pickets. This escaped attention during the daily inspection. The Staff Officer took off but had to return with elevator trouble and he was just able to land before the elevators became wholly unserviceable. He had forgotten to carry out the drill, which the Engineer Officer had often impressed upon him, of walking around his aircraft with his

eyes wide open for possible snags. The Engineer Officer has flown with this officer many times since and has noted that he never takes off now without carrying out the drill.

These instances show a few circumstances in which damage may occur through thoughtlessness or negligence, stepping up the accident rate and thus helping the enemy. All who handle aircraft and who wish to reduce the accident rate should whisper under their breath, "Keep your eyes skinned for snags. Don't neglect the minor flaws. Refer them to your Engineer Officer or C.T.O., he will know how to deal with them."

Signals in 1943

Signals made many advances during 1943, especially in the development of Radar and communications equipment. The Command's increased activities resulted in an extension of its communication system. Very close liaison with the Admiralty led to a great improvement in communication between ships and aircraft. Some new types of airborne communication equipment were introduced, particularly for R/T where the T.R.1196 (H.F.) and T.R.1143 (V.H.F.) replaced the T.R.9 and the last of the old G.P. sets was replaced by modern equipment. The D/F loop has played an important part in concerted attacks by enabling reinforcing aircraft to home on to aircraft already on the scene.

Radar and Signals leaders have now been established in squadrons with the result that operating efficiency has improved and greater improvements will come naturally as the leaders settle into their responsibilities.

The area of hostilities is growing and shortage of man power is increasing as more and more men are sent overseas. To lessen this shortage, all non-essential services have been closed or shelved and members of the W.A.A.F. have replaced men wherever possible. The first W.A.A.F. Signals Officers came into the Command at the beginning of 1943. The frowns of the pessimists have not deterred the women in their enterprise and they have done well.

The Command shows signs of becoming more radio-minded. The specialist is always delighted when the layman taps his knowledge, and staffs and aircrews have encouraged Signals many times during the year, with their increasing interest. Those responsible for provision and maintenance have commented on this development. It was gratifying to hear the many comments from laymen on the articles written by Signals for the Review, especially the one on Radar in the November number.

The word development will always be associated with Radio, because its possibilities will never end. The new year already promises better radio weapons—and greater efforts for those who must maintain and operate them.

The tactical application of Radar has resulted in a battle of wits with the enemy, in which the

scientist and technician, working in continuous collaboration with the operator, pit their skill and ingenuity against their opposite numbers in Germany. We are holding our own in this and we have made Hitler admit that our success against the U-Boat has been due to our technical development. We all know that this development is Radar.

Search Radar

Early in 1943 an entirely new type of Search Radar was brought into use. It had the following advantages:—(a) Abolition of external drag-producing aerials; (b) plan position display; (c) operation on a wavelength outside the scope of the enemy search receiver.

The British version of this equipment is an adaptation of a Bomber Command set and is known as the Mark III. In the course of the year it became the standard equipment in Leigh Light Wellingtons and in Halifaxes. At the end of the year it was beginning to be fitted in Sunderlands. The American version is the Mark V of which there are two variants, one is A.S.G.1 with the chin aerial installation and the other is A.S.G.3, with the aerial in the position normally occupied by the ball turret. The Mark V is now being fitted to all Liberators delivered to the Command, the installation being done in U.S.A.

The provision of Mark III and V Radar has been one of the major factors in our success against the U-Boats in 1943. It enabled us to maintain our effort throughout the 24 hours and thus to give the U-Boat no respite at night in which to re-charge and ventilate. The tactics adopted by the enemy in face of this development have already been described in other articles in the *Review*.

The introduction of completely new equipment called for intensive training of operators and maintenance staffs. This was made very difficult by the lack of training equipment and a shortage of aircraft. These difficulties were eventually overcome and the new equipment very soon proved its worth—in fact on a number of occasions crews made successful attacks on their first sorties with the equipment.

Operating skill and technical reliability steadily improved throughout the year and the number of failures fell from 1 per 50 hours in the early days to 1 per 400 hours in December. In the latter month the enemy was using the utmost caution and surfacing only for a short period at night, so that but for Radar we would have been virtually impotent. This is shown by results; of 17 sightings in that month 10 were made by Radar and almost all of the 10 attacks were made by Radar and Leigh Light.

1943 was a good year for Radar, but there is much progress still to be made, especially in improving its tactical application in attack. The successful use of Radar depends to a great extent on the skill of the operator and to good crew drill. There are no grounds for complacency, for Radar is still a bunch of tricks and must be treated accordingly if the best is to be obtained from it.

Radio Aids

The existing D/F and Beacon organizations continued to give good service during 1943, but the extended operations of the Command during the year showed the need for a more precise and accurate navigational aid. To that end Gee has now been adopted as a standard requirement for almost all squadrons. We use both the existing Gee chains and a new chain which has been installed to meet our needs in the Bay area. This South Western Chain has been in operation for some months and aircraft fitting is over 75 per cent. complete. As with many new gadgets, Gee was slow in catching on, but it is now growing in popularity and there is no doubt that it is paying a very good dividend.

Radio Altimeters

Another device which has made excellent progress in 1943 is the Radio Altimeter. At first development was very slow and tedious and at the beginning of 1943 this Command appeared to be no nearer to getting a Radio Altimeter than it had been a year before. As nothing had been produced to meet our requirements, and it was decided to concentrate on the provision of the American type AYD which, although it reads to only 400 ft., promised to be fairly plentiful. The fitting of AYD is now about 60 per cent. completed and good progress is being made. An improved version called AYP, which reads up to 4,000 ft., will, it is hoped, become available in 1944.

Radar Beacons

After considerable delay a new and improved Radar Beacon became available to replace the interim type which has been in service much longer than was intended. At the end of the year 12 of the new type beacons were in use.

A.S.V./B.A.

It was decided early in 1942 that A.S.V./B.A. should be the accepted method of Beam Approach in Coastal Command. Progress in providing all the necessary air and ground equipment has, however, been very slow, but is now speeding up and 15 ground installations were operating with new equipment at the end of the year. There are

still difficulties with the provision of interrogation equipment in aircraft and although this is now in good supply it is unsatisfactory. In order to provide A.S.V./B.A. facilities we have, therefore, been forced to instal Mark II Radar in a "lash up" form.

Signals Organization

Changing U-Boat tactics and the need to destroy every U-Boat encountered have led to reorganization of signals procedure. It is vital that aircraft on escort duty should meet the convoys they are detailed to protect, and that an aircraft which has made an inconclusive attack can call up air and surface reinforcements. Homing procedure has therefore been used more than ever and it is now rare for this procedure to fail. A simple organization which enables ships and aircraft to be homed quickly to the scene of action has been evolved by Headquarters 19 Group, and is now embodied in C.C.T.I. No. 42.

The introduction of long range fighters fitted with V.H.F. has made it necessary for us to set up a ground V.H.F. organization, which is being built up on lines similar to that of A.D.G.B.

The inclusion of the Azores in the communication system was the most difficult problem of the year. Skeleton facilities were provided immediately and aircraft were operating under the Azores W/T control within a week of landing. Facilities have now been expanded and put on a more permanent footing.

The U-Boat war now covers the whole of the North Atlantic and co-ordination of the controlling authorities is essential. This requires rapid communication between Halifax, Iceland and Liverpool on the one hand and 19 Group, the Azores and Gibraltar on the other. It has also been necessary to link up Gibraltar, the Azores and Morocco. Most of the communication problems involved have been solved, but it has been difficult to obtain the necessary ground equipment. Moreover high power transmitters and special aerial arrays have had to be installed to deal with the problem set by the increase of V.L.R. aircraft in the Command. This V.L.R. aircraft organization will give 100 per cent. communication at the aircraft's extreme range.

Ground Equipment

Arrangements have been made for T.R.1196 ground installations to be provided at certain Stations to improve Flying Control R/T facilities. Similarly V.H.F. ground equipment has had to be installed at the appropriate stations to deal with the increased number of aircraft fitted with V.H.F. This is at present in mobile form, but it will be replaced by permanent stations in due course.

The year has seen the reconstruction and re-arrangement of ground stations in Iceland which now has more radio facilities and radio aids than any other equivalent area in Coastal Command. These include a large transmitting station solely for the long distance point-to-point links between Iceland and Canada and the United Kingdom. A separate ground station provides for all aircraft services.

Aircraft Equipment

The number of types of equipment in use in Coastal Command aircraft has still further increased during 1943. Thanks to the keenness and efficiency of the ground maintenance crews and operators this new equipment has been brought into service with a minimum of teething troubles and has considerably improved the efficiency of aircraft communications.

Until now R/T communication between aircraft and escort vessels has been very poor, chiefly because the T.R.9 was used. However, this has now been replaced by the T.R.1196B, which, together with similar American equipment, is entirely satisfactory. This is confirmed in the following signal made by the Commodore (D), W.A., to C-in-C., W.A. :—

“ E.G.B.4 reports from experience of last four months that R/T communications with Coastal Command aircraft has been excellent and difficult to improve.”

During the year a Dinghy Radio set has been made a standard fitting in all G.R. aircraft, but there is no record that it has been much used. The provision of this equipment has made it unnecessary to carry pigeons.

The V.H.F. R/T equipment for P.R.U., torpedo and fighter aircraft has now been standardized by the fitting of the T.R.1143. This equipment, although proving rather difficult to maintain, is giving very good results.

Centralized Radio Maintenance was introduced during the year and has resulted in a greatly increased standard of maintenance and economy in man hours. This year should see the establishment of this system throughout the Command. Although it was conceived independently it dovetails exactly into the Planned Flying Planned Maintenance scheme.

Ocean Landing by Flying Boats

A Precedent

The *Athenia* had been sunk, and unrestricted U-Boat warfare was in being when on September 15, 1939, two Sunderland flying boats of Coastal Command flew out into the Atlantic on anti-U-Boat patrol. In position 100 miles south-west of the Fastnet they sighted two ships' lifeboats. Huddled together in the boats were 34 survivors of the S.S. *Kensington Court* which, a short time before, had been blown up by a U-Boat. The captains of the Sunderlands knew that there were no vessels in the locality which could be guided to the rescue and they decided to risk a landing in the open sea. Skilfully they brought their Sunderlands down, alighting close by the lifeboats. The survivors were transferred to the aircraft in rubber dinghies, and within a few hours they stepped safely ashore.

By this adventure the Sunderland captains set up a precedent in the development of Air/Sea rescue. The popular press prophesied that ocean landings by flying boats would provide a new safeguard for our merchant sailors, and widespread interest was aroused. But their enthusiasm has not been justified in the years which followed. Many such landings have been made—some enforced by emergency, some to rescue survivors, and others in the discharge of special missions. Few have been successful. In fact, a recent analysis shows that for each landing and take off carried out successfully, two have ended in disaster.

Not unnaturally, therefore, Coastal Command has ruled that a flying boat may be allowed to land in the open sea only when special urgency, and the experience of the pilot, make the operation both necessary and advisable.

Nevertheless flying boats and, in particular, the *Catalina* and the *Sunderland*, have successfully completed important missions which involved the hazard of alighting on the ocean swell. These will be described later, but first of all some consideration should be given to the characteristics and limitations of the flying boat.

The Hazards

The rugged aspect of the *Sunderland* may perhaps mislead the landsman who can be excused for thinking that such a craft should surely be quite at home in the open sea. But for all its ark-like proportions the *Sunderland* and flying boats generally are mere eggshells of marine architecture. They are essentially aircraft which float and not boats which fly. For this reason their construction is as light as possible. The plates which form the hull of a flying boat are fashioned from duralumin only $\frac{3}{32}$ of an inch in thickness and although considerable strength is achieved by frames and bulkheads, a flying boat does not compare with the smallest fishing smack as a sea-going craft.

The weakest point in the seaworthiness of the flying boat rests in the wing tip floats. These are necessary to maintain stability. Without them the aircraft would roll on the water unchecked, until the whole boat capsized. The position of the float near the extremity of the wing does not lend itself to robust construction and the float is generally dependent upon struts and bracing wires. Thus, in the open sea, where large waves attack the aircraft from all directions, the wing tip float is subject to abnormal stresses. Should one carry away the flying boat will turn turtle and founder, even though the hull remains sound.

In spite of their fragility, flying boats have been known to remain afloat for days in the open sea, given reasonably calm conditions. For instance, there is the story of a *Catalina* which was abandoned during a flight between Plymouth and Gibraltar. The *Catalina* drifted happily away to the south, making a good two knots under the influence of wind and tide. During the next two days aircraft and motor launches from Gibraltar searched for the missing flying boat. On the second day it was tracked down by a high speed launch not far to the north-west of Cape Sparte in Spanish Morocco. She was still riding proudly

over the waves, and might well have sailed to Casablanca had she not been boarded by the pilot who accompanied the launch. Inside the aircraft he found everything in flying order. A radio generator hummed faintly on the dying accumulators, the flying controls were unlocked and moved slightly as the wind gusted over the mainplane, while the tanks contained ample petrol for the flight to Gibraltar. The engines were started up without trouble, and a skeleton crew returned the rover safely to base.

This Catalina was favoured by excellent weather. For the operations considered in this article a flying boat must do more than float safely in the sea. It must land, and it must take off again, and the greatest threats to its safety are focussed upon these manoeuvres. A simple example may help in explanation.

Consider a sheet of corrugated iron laid flat upon the ground. If a ruler is placed on edge and run across the corrugations, it will move quite smoothly on an even keel, with no tendency to rock. The contour of the corrugated sheet is similar to the contour of the surface of the water in the sheltered harbours from which flying boats are designed to operate. The waves are short in length, and steep according to the wind strength, but the mean surface of the water is level. Thus, when a flying boat "planes" over the water for take off, its hull, like the ruler on the corrugated sheet, bridges the crests of successive waves and flying trim remains comparatively undisturbed.

Imagine now that the corrugated sheet is stretched in length and amplified many times so that the ruler rests comfortably in the trough of a single corrugation. Any attempt to run the ruler over the sheet will result in violent rocking, there will be a tendency for the ruler to jump off the top of each corrugation. The contour of the sheet now corresponds approximately to the ocean swell, although of course this will be moving and often overlaid with cross swells and surface disturbance. When a flying boat lands in these conditions it will travel over the swell as it loses speed, and it may be thrown into the air as it reaches the top of a slope. When this happens the aircraft may stall and crash back on to the water with probable damage to the hull; or it may nose dive into the succeeding swell. If the pilot is sensible he will open up the engines and await more favourable conditions. Should the landing be enforced he is just unfortunate. In taking off, a similar process occurs. The aircraft is thrown into the air by the swell and it falls back heavily, or stalls. If the swell is not too high an experienced pilot may succeed, but the inexperienced pilot will almost certainly bounce to destruction.

Any landplane pilot would think twice about taking off from a rough surface which undulated to an amplitude of 25 ft. about six times in a thousand yards. That is roughly what an ocean landing and take-off imply.

Inexperienced pilots usually underestimate the size of the ocean swell and therefore attempt a landing only to find, when it is too late, that a seeming wall of water is rushing to meet them. The hazards of the open sea and the comparative fragility of flying boat construction have restricted

their normal operations to sheltered areas such as Milford Haven, Lough Erne, and the Solent.

Yet there have been occasions when the risk has been justified. The following examples, together with a detailed account of an ocean rescue in the North Atlantic, may serve to illustrate the results achieved and perhaps provide some guide to future attempts.

Successful Missions

The first incident was during the preparations for Allied landings in North Africa. Some time before the landings an important officer, with a small party of U.S. army officers, carried out a daring landing on the shore of North Africa. They proceeded to a lonely house where negotiations with French officials took place in secrecy. When the talks were concluded bad weather arrived and the party in their small folding canoes could not break through the heavy surf which pounded the beaches. For five days they were forced to camp near the shore in constant danger of discovery. Eventually they were able to paddle their way to the submarine which was standing by off the shore.

Meanwhile, in America and Britain, great convoys and vast armed forces awaited the word to go. The timing of the whole operation was likely to be thrown out of gear unless the officer could be brought speedily to London, with the results of his African conversations. The submarine set course for Gibraltar but many hours steaming still remained.

In Gibraltar harbour a squadron of Catalinas rode at their moorings. One of them was swiftly prepared to rendezvous with the submarine, land on the sea, and pick up the officer.

An experienced flying boat pilot commanded the Catalina, and the aircraft located the submarine in the appointed position. The pilot landed in the open sea without damage. The officer and his party were paddled across to the aircraft, and a few minutes later the Catalina took off after what the pilot described as a short sharp battle with the swell. On the landing strip at Gibraltar two Fortresses stood by to guarantee an express passage for the officer on the next lap to London. The Catalina landed back at Gibraltar and discharged her important cargo. Her efforts had gained 24 hours of vital time. Very soon the final executive was stamped upon appreciations and plans, and the greatest amphibious force in world history moved off towards the shores of Africa.

Although there is no suggestion that this Catalina made the invasion of Africa possible, by its unique qualities the flying boat was able to fulfil a vital part which no other type of aircraft could have undertaken.

Another Catalina figured in a similar mission which was carried out during this period.

After long confinement by the Nazis a French general escaped through Switzerland to the south coast of France. Early in October, 1942, a British submarine came close inshore to the French coast, and the general was taken aboard. Again the time factor became all important. Great assistance would be rendered to the Allied cause if the general could arrive in North Africa in time for the landings. The Catalina was detailed

to ensure that he did. Careful preparations were made and the best available pilot was selected. The submarine was intercepted in the notoriously stormy waters of the Gulf of Lyons about 40 miles south of Toulon. High seas had been whipped up by a strong wind, but nevertheless the captain of the flying boat brought off a magnificent landing.

There must have been a great risk of drowning the general during the precarious business of boarding the aircraft. But he suffered nothing worse than a thorough drenching. No doubt temporary discomforts were forgotten when he saw from the Catalina the coast line of French North Africa rising above the horizon. The general arrived in Algiers on October 7.

There were three main reasons for the success of these operations. They were carefully planned beforehand and experienced pilots, well able to assess sea conditions, were selected for the task. Also, the Catalina, by virtue of its compact construction and ability to make slow, fully stalled landings, is the ideal flying boat for the purpose.

Not all ocean landings can be planned like this. For instance, a Catalina on night convoy escort in the Atlantic was forced to land when both engines failed. The pilot was experienced and to this fact may be attributed the fact that the aircraft landed safely, in darkness, upon a heavy Atlantic swell. After riding out the storm until daylight the engineer effected repairs, and the Catalina managed to take off in the rough seas and return safely to its base.

Before passing on to a detailed account of the planning, and the successful completion of an ocean rescue by flying boat, it should be mentioned that a Sunderland shadowing units of the Italian Fleet in the Mediterranean found itself short of petrol at dusk. Rather than lose contact the captain landed in the sea, taxied after the fleet during the night, and returned to base at dawn, when a relief aircraft arrived.

Ocean Rescue in the North Atlantic

In June, 1943, a signal was received from a Coastal Command Fortress operating in the North-East Passage. The signal stated that a U-Boat had been sighted on the surface and gave a position which lay to the north-west of Faroes and to the east of Iceland. A few minutes later an SOS was picked up from the Fortress, only to be followed by a long silence.

Aircraft were directed to search in the area around the last known position. At seven o'clock at night, on the same day, an American Catalina from Iceland reported that he had located a rubber dinghy containing survivors. Nothing further was heard from this Catalina and it did not return to its base. Meanwhile, a full gale raged in the North Atlantic and for two days aircraft searched without finding the dinghy. Men do not live long when exposed to the waters of the North Atlantic, which are icy even in June. To make matters worse, the dinghy was drifting north-west, across the full length of a minefield, in which it was dangerous for naval vessels to move.

In the afternoon of the third day a Fortress found the survivors and dropped supplies. In the evening a Norwegian Sunderland attempted to land by the dinghy but, after being thrown

violently into the air on two valiant attempts, it was forced to return to base, leaving the survivors unaccompanied.

At 10 o'clock that night the Sunderland captain arrived back at the operations room at Sullum Voe and the drift plot of the dinghy was carefully examined. It was still in the minefield and evidently some time would elapse before surface vessels could reach it: time which might extend beyond the limit of the survivors' endurance. The suggestion was made that a Catalina should be specially prepared to attempt a rescue, immediately the dinghy was again located. Group Headquarters approved the suggestion and preparations went ahead.

A Catalina was selected and stripped. All depth charges, guns and ammunition, parachute packs, and other movable items not essentially needed were removed, for lightness was the first consideration. Petrol was cut down to the minimum required to reach the dinghy's position and return to Shetlands—a round trip of 750 miles. Then a skeleton crew was needed. Five men, navigator, two pilots, flight engineer, and wireless operator, were its complement instead of the normal nine. All the regular crews were either flying, resting or standing by for operations. Volunteers were therefore found from the few old hands who had completed their operational tour and who were awaiting posting.

Met. were consulted and they offered moderating sea conditions with a south westerly swell. The crew was briefed with particular emphasis on signals, for success depended upon homing with the radio compass, to a transmission from the aircraft circling the survivors.

At dawn the crew were shaken out and told by an excited controller that a Fortress had located the dinghy; that the weather was good and that the Catalina was required to take off right away.

The flying boat slipped away from her moorings with the crew checking radio gear, engines and navigation equipment. After take-off she headed north west from Shetlands. The navigator scratched his head and mumbled "Destination, one rubber dinghy, distance 350 miles, I certainly hope the radio functions." When within 100 miles of the survivors estimated position, the wireless operator ceased his ether searching and shouted the welcome words, "Fortress signals coming in." The radio compass was switched in and the direction-finding loop on the top of the main plane was swung athwartships. At first the needle on the pilot's indicator danced about, first left then right, and then it steadied in the central position. The aircraft was now heading down a radio beam which led straight to the aeriels of the Fortress.

Visibility had dropped to about two miles when the pilot spotted smoke floats on the sea just ahead. Then the Fortress appeared out of the mist, and below her was the dinghy: a tiny yellow spot on the grey sea.

The pilot flew low to gauge the state of the sea and to decide on the best direction for landing. The crew meanwhile ensured that their own dinghies were ready for immediate use, just in case they had to join the Fortress survivors. During a slow dummy approach the Catalina, flying very low, was caught in the backwash from the four propellers of the Fortress. The rescue nearly ended in disaster when a wing

dropped, responding to aileron control only in the nick of time. There was a long south westerly swell running and a light north-easterly wind: conditions for landing were favourable.

The Catalina approached into wind and therefore had the swell running up behind her. When the flying boat neared the water the pilot reduced the air speed to 60 knots and kept the nose high until the stalling point was reached. One big wave was cleared with a touch of engines, and then the aircraft stalled on to the water. She "bucketed" off twice and fell back with an impact which shook the whole aircraft. But she was still floating, and, when the crew inspected for damage, there was no sign of leaks. At first the seas hid the dinghy from view, but it was finally sighted as it rose on the crest of a swell.

Taxying across was a slow job. Every time the pilot attempted to turn, the nose buried itself in the swell and the sea came up green over the bows. He therefore had to taxi crabwise until he was able to cut the engines and allow the flying boat to drift towards the survivors. At last a line was heaved over to them. As the dinghy was hauled towards the aircraft, eight people were seen to be packed together, instead of the five previously reported. The survivors were weary and bedraggled. Despite their ordeal they managed a grin and a word of thanks as they came aboard. One man was suffering the onset of pneumonia and another was in great pain from an injured back and badly exposed feet. The weakest were put in the bunks and the others sat on the floor while the crew made ready for take-off.

From the main petrol drains 700 lbs. of fuel were jettisoned into the sea as being no longer required. The Catalina was allowed to drift clear of the dinghy so that it should not be fouled during the take-off run. It was very strange to be floating silently in the North Atlantic, with nothing in sight but the heaving waters. The flying boat seemed to be set in the centre of a great saucer with an ever undulating rim.

The most difficult moment had arrived. Even the captain could not be sure what would happen in the next 60 seconds and the crew could do nothing but hold on and hope. Suddenly a clear lane opened up in the seas ahead. The captain felt the gratitude Moses must have felt when he saw the parting of the Red Sea. Both engines were given full boost and the aircraft surged forward. She rushed over a swell, down into a trough and up the succeeding slope. The airspeed rose to 50 knots which at full power was sufficient for her to be held in the air. She maintained a steady climb. The complete manoeuvre occupied a space of seconds only. Hands were shaken all round the crew and one member had to go round "unbracing" the passengers who were not sure that the aircraft was air-borne.

Some time passed before the pilot could subdue his elation sufficient to steer a steady course back

to the Shetlands. Eventually George was engaged and conversation was possible with the captain of the Fortress.

Much could be written about the Wing Commander's account, but that is another story. Sufficient to state that the Fortress had been forced to ditch after a severe gun duel with a U-Boat, but not before they had seen the submarine founder and the survivors left swimming in the water. He told of the vanished American Catalina. It had attempted to land and rescue them in heavy seas. After a perfect initial touchdown it crashed through a huge wave and the starboard propeller flew off. The flying boat finally came to rest with only the aft part of the hull above the surface. Its crew managed to escape in dinghies, but they perished from exposure. Only one survivor was rescued, six days after the crash, by a U.S. cutter.

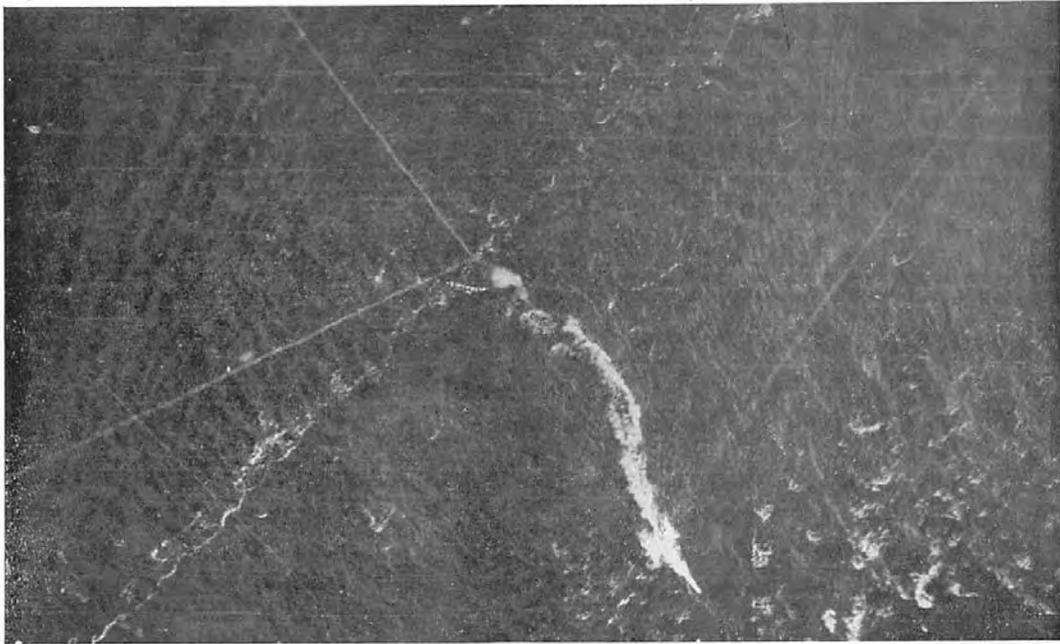
Several points emerge from this rescue. The landing must be made at the slowest speed possible and it should be "fully stalled," instead of the normal "fly on" landing. Time spent in low flying to assess sea conditions and judge the best direction for landing will be amply repaid. In this case conditions were favourable as the aircraft was able to approach with the swell and into the wind. The technique of landing along the ridge of the swell, which is often recommended, is not considered practicable since the swell is usually so irregular that no advantage is gained, unless the wind happens to be in that direction.

An operation of this nature should be carried out with a specially lightened aircraft, and prior preparation. Most disasters occur when boats attempt to land with their normal operational crew and loading. The loss of one Sunderland and severe damage to another during an attempted rescue in the Bay bear witness to the truth of this statement.

Finally, the arrangement for radio homing ruled out the necessity for the Catalina to carry out a search, and therefore fuel could be cut down to a minimum.

Although surface vessels provide the most effective and safe means for the rescue of survivors and should be called upon whenever possible, they are not always readily available. The flying boat may then be employed as a speedy substitute. Most of the difficulties can be overcome by preparation and flight planning, and flying boat pilots should become familiar with the best action in the event of an ocean landing and develop their ability to make a true judgment of sea conditions. Apart from any other considerations this knowledge may be of great help should they be forced to land.

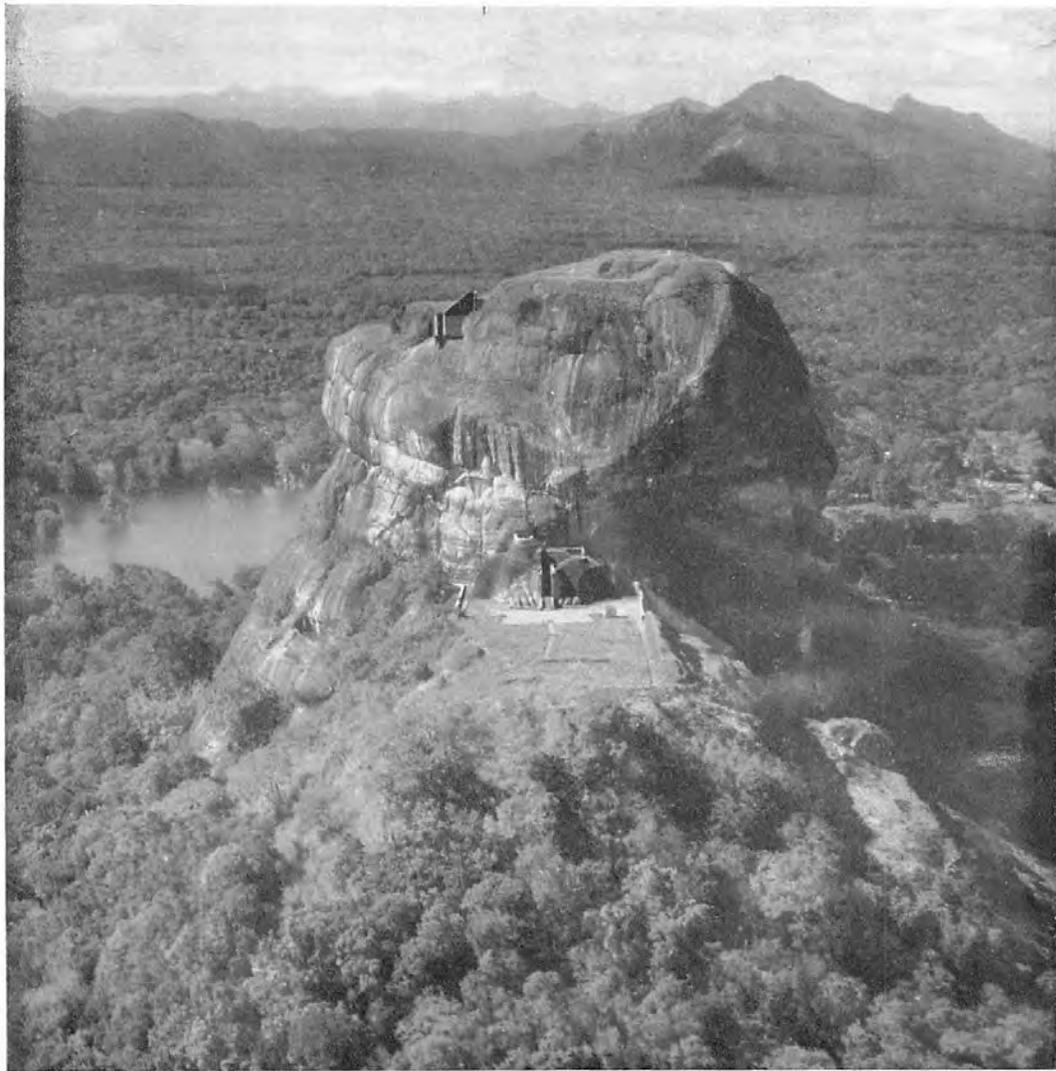
The Catalina has proved to be a most successful flying boat for open sea operations and when the Allied offensive moves across the Indian Ocean to the Pacific and the China Sea, greater opportunities may be presented for its employment.



The above photograph shows a collision between two practice torpedoes which met as they crossed the track of a ship. One torpedo sank immediately and the other surfaced with its blowing head knocked clean off, causing the irregular feathery wake seen in the photograph. The latter torpedo was recovered.



Cape Ortegal, on the north-west coast of Spain: a familiar landmark to Coastal Command aircraft, and believed to be equally useful to enemy aircraft also. Taken by 202 Squadron.



A famous landmark within the aerodrome circuit at Sigiriya, near the centre of Ceylon. This rock, which dominates the jungle, was once the home of a Cingalese monarch.



Trincomalee Aerodrome, Ceylon, showing hangars bombed by the Japanese, and the runway, recently completed.

The Sinking of the "Alsterufer"

As the *Alsterufer* steamed over the South Atlantic early in December, the crew counted the days and found that they should be at home for Christmas: at least they should make Bordeaux. But there was a delay of ten days and they had to modify their plans. *Weihnachten* would have to be spent at sea and all they could hope for was that Captain Piatek would hand out the six thousand bottles of beer he had taken on board in Kobe. But the *Alsterufer* was steaming nearer to the Bay of Biscay and the Captain would not run the risk of entering the danger zone with a tipsy crew. So the six thousand bottles lay safely in the hold. They had been ordered not to scuttle the ship even if they were sighted; with the flimsy promise that they might expect air cover if they were caught napping by our aircraft.

A little before ten o'clock on the morning of December 27, the blockade runner sighted Sunderland T/201 in position 46° 40' N., 19° 30' W. The *Alsterufer* realized that she had been recognized, so the Captain held his easterly course, although he had been ordered to turn south if he was identified, as though he were a British ship independently routed to Gibraltar.

T/201 began to shadow and, as soon as she was sighted, *Alsterufer* broke W/T silence and signalled the German Operations Directorate, giving her position and asking for support. The Germans replied that the support was being sent. T/201 remained in contact for four hours and then bombed through cloud without success. Two more Sunderlands, Q/422 and U/201, also made attacks; "Q" from 1,500 ft. and "U" through cloud; "Q" also sprayed the decks with machine-gun fire.

On the second run, bombs were released and the decks were again sprayed with fire. The only bomb seen to explode was a 40-yard under-shoot. This aircraft was damaged by flak, but she was able to return to base. The third Sunderland on the scene, U of 201, released one 500-lb. M.C. bomb from 4,000 ft.

Throughout these attacks the *Alsterufer* had been putting up a heavy barrage. The 4.14-in. (105-mm.) gun aft had fired about 30 H.E. shells, but they had missed so badly that the crew lost faith in what they afterwards described as "a cumbersome weapon." They relied on the two 1.45-in. (37-mm.) and the four 0.79-in. (20-mm.) guns, each of which used up a big quantity of ammunition. One 0.79-in. gunner swore that he saw his armour-piercing shells bouncing off the underside of a Sunderland. He was considerably disheartened by this. About twenty P.A.C. rockets had been fired, but many of the projectiles had proved to be duds and were thrown overboard.

Prisoners said that up to this stage the ship had not been damaged: not even by the machine gun fire, which passed well over them. But they were disconcerted when they saw bombs appearing out of the low cloud ceiling, imagining them to be directed by Radar.

As the morning passed, the situation on the bridge and in the W/T office became tense. Hope rose when the crew learned that destroyers were on their way to help them. But hope vanished again later when they were told not to expect

the destroyers until next morning. The crew then pinned their faith on the arrival of the promised aircraft, but even this hope became thin as the set tuned to the aircraft wavelength remained silent. By four o'clock in the afternoon no signal had been received and it was obvious that the promised aircraft were hours overdue. The Chief Petty Officer Telegraphist said afterwards that he could have wept with rage.

The final attack came at seven minutes past four in the afternoon, when Liberator "H" of 311 Squadron delivered a determined low-level attack, using all its armament. "H" attacked in a dive from the starboard beam, faced by heavy flak and parachutes on cables. The Liberator released eight R.P.s in pairs, the first at 800 ft. and the latter at 600 ft., at ranges between 600 and 400 yards. One 250-lb. G.P. bomb and one 500-lb. M.C. bomb were released at a height of 600 ft., using the Mark III L.L. sight. Five of the R.P.s struck the stern, causing a fire. During the run-in and the attack all machine guns were fired as they could be brought to bear, with the exception of the front gun. The aircraft was undamaged though trouble was experienced during the return flight in the starboard outer engine.

The master and other prisoners said they had no doubt that both bombs struck the ship. They landed on the hatch over hold four, smashing through it, exploding on the ratings' mess deck and killing two ratings who were resting and trying to soothe their nerves by playing chess. The men's kit, bedding, mattresses, grease and oil barrels began to blaze furiously. The bulkhead to the magazine had been started and there was imminent danger of a major explosion. The deck hoses had been rent by the bombs and there was no water for fighting the fires. The guns aft were either jammed or wrenched from their mountings and were useless. The ship's baker, running forward through dense smoke, fell through a hole in the deck and perished in the flames.

The main fuel supply pipe in the engine room was fractured irreparably and a bolt, sheered off by the concussion, struck the overhead lighting and extinguished it. The Third Engineer lost his nerve and the engine room staff panicked until they were restrained by the Chief Engineer, who stopped the engines.

One of the assistant engineers then ran on deck to ask the First Mate for permission to fire the engine-room scuttling charges. The Mate, who was busy loading his personal gear into a lifeboat, merely replied over his shoulder: "Not yet, not yet." The Engineer then ran to his own cabin for a blanket. He noticed that the refrigerating plant was damaged and giving off ammonia fumes.

The bomb explosion had brought down the aeriels and the telegraphists were busy trying to make temporary repairs. They claimed afterwards that they succeeded and that they managed to get off an emergency signal reporting the ship's position and that she had been bombed. They were waiting for more current to make a fuller report when a Petty Officer Telegraphist who had made a pyre of signal pads, code tables and

