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COASTAL COMMAND REVIEW

April 1944

Vol. III, No. 4

HEADQUARTERS,
COASTAL COMMAND
ROYAL AIR FORCE

COASTAL COMMAND REVIEW

Vol. III, No. 4—April 1944

CONTENTS

		Page
	Summary of the Month's Work: April	1
I.—ANTI U-BOAT		
	Summary of Anti U-Boat Operations: April	2
	Assessments: Analysis of U-Boats sighted during April	3
	Squadron Results: April	3
	Recent Attacks on U-Boats	4
	New A.A. Armament on U-Boats	8
	Aboard *U 231*: Survivors' Account	9
II.—ANTI SHIPPING		
	Summary of Anti-Shipping Operations: April	10
	Results Claimed for April	11
	Analysis of Weapons Expended	11
	March Assessments of Attacks on Enemy Shipping	11
	Shipping Strikes in April	12
III.—OTHER OPERATIONAL FLYING		
	Combats with Enemy Aircraft	13
	Photographic Reconnaissance	15
	A Mediterranean Convoy Attacked by the Luftwaffe	16
IV.—SPECIALIST AND GENERAL ARTICLES		
	Torpedoes	17
	The Joint Anti U-Boat School	18
	Works and Bricks	19
	H/F Wireless Communication Problems	20
	Homing by Gee	20

PLATES

Plate		*Opp. page*
1.	A Successful U-Boat Attack by Canso S/162	4
2.	La Pallice	5
3.	St. Nazaire	8
4.	Numbered Markings on the Coast of Eire	9
5.	R.P. Attack by the North Coates Wing	12
6.	Shipping Strike by the North Coates Wing on April 20	13
7.	Pillau / Gdynia	16
8.	"M" Class Minesweepers	17
9.	Shipping Strike by the North Coates Wing	18
10.	Gripholm / The Westmann Islands: Heimaey	19

CHART

		Opp. page
	Anti U-Boat Activities: April	6

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 of the Month's Work—April 1944

The Anti U-Boat Effort.—April has confirmed what March suggested—that the enemy has decided to conserve his U-Boats for forthcoming operations rather than send them out to try to prevent our convoys getting through. Recent actions in the North Atlantic must have convinced the German High Command of the wisdom of their decision, for out of three U-Boats sighted in the area one was probably sunk by a Canso and another certainly damaged, if not sunk, by a Sunderland. Both these victims were rash enough to show themselves in daylight. In the case of the Sunderland, it is probable that one of the depth charges made a direct hit and detonated, for the explosion threw the aircraft violently upwards, injuring the rear gunner and a wireless operator who was in the astrodome. The aircraft was considerably damaged, and when the pilot regained full control the U-Boat had vanished, leaving behind a lot of oil.

2. Total monthly sighting by Coastal Command also continue to decline steadily. In April, 23 U-Boats were found and 20 attacked; the figures for March were 33 and 24 respectively. In the Bay area there were 19 sightings in April and 16 attacks. As usual the majority of sightings were at night, the figures being 16 sightings and 14 attacks. Owing to the usual limitations on obtaining evidence of the results of night attacks, it is only possible at present to say that at least three look promising.

3. Between April 1 and May 5 there have been four occasions at night when two U-Boats have been sighted in company, but there does not seem to be any special significance in this. Two of these sightings were made close to the French coast, and there is every reason to believe that U-Boats sometimes leave harbour together or wait for a friend before approaching harbour, not with the idea of mutual protection, but to economise in the use of surface minesweeping escorts. This may also account for the third sighting, which was comparatively close to the Inner Bay. The fourth occasion was possibly entirely fortuitous, as the U-Boats were reported to be on opposite courses.

4. There is every indication that the lull in U-Boat activity will continue until the enemy becomes aware of the time and place of the forthcoming operations. Nevertheless, it is as important as ever to put down those U-Boats which do show themselves. Since his disastrous defeat in the early summer of 1943, Admiral Doenitz has made several attempts to stage a come-back. Each time he has failed. This next effort is likely to be his greatest, and we must be quite certain that we remain where we are—on top. Every U-Boat sunk or damaged now is one less to deal with during the intensive operations which are expected to take place shortly. Vigilance and practice during the lull will ensure that we are on the top of our form for the future task.

5. **Anti-Shipping Operations.**—Off the coasts of Norway and the Frisian Islands, in the North Sea, the Channel and the Bay, German shipping has been energetically harried during the month. The Beaufighter Wings have again done well, and North Coates achieved the distinction of mounting three strikes in three successive days. Both the Wellingtons and the Albacores of No. 415 Squadron kept up their fine work. In all, 720 anti-shipping sorties were flown in April, resulting in attacks on 38 targets by 121 aircraft. These include five major strikes off the Dutch coast and one off the Norwegian coast. These anti-shipping operations are known to be causing the enemy a continual drain of ships, cargoes and men, as well as tying up a very large escort force. This is the moment when Germany can least afford the luxury of providing every convoy with a heavy escort.

6. **Photographic Reconnaissance.**—The P.R. Squadrons were again very active. The *Tirpitz* was photographed in Alten Fiord both before and after the Fleet Air Arm attack on April 3, and the attacks of Bomber Command and the 8th U.S.A.A.F. on industrial targets, marshalling yards and airfields in Germany and German-occupied territory, have been fully recorded.

7. **Meteorological Flights.**—The Meteorological Squadrons and Flights have continued to provide regular information in the course of 498 sorties, often carried out in adverse weather. Their work has again been augmented by Fortresses of the U.S.A.A.F., which flew 54 sorties westward into the Atlantic.

8. **Air/Sea Rescue and Flying Control.**—219 calls were made on A/S.R. aircraft and, as a result, 189 aircrew were saved out of 608 who are believed to have ditched. The number of diversions has increased to 312, of which 198 were in 19 Group. On April 2 a D/F operator at Haverfordwest picked up an SOS call from a Bomber Command aircraft which was flying on one engine at 600 feet in an unknown position. The aircraft was given courses to steer and, thanks to this operator's alertness, it was able to fly on for an hour and twenty minutes and to make a successful landing at Donna Nook,

I.—ANTI U-BOAT

SUMMARY OF ANTI U-BOAT OPERATIONS BY COASTAL COMMAND AIRCRAFT

(Including Iceland, Azores, Gibraltar and U.S. Moroccan Sea Frontier)

APRIL, 1944

Duty and Base or Area.	Total Sorties.	Hours Flown.		U-Boats Sighted.		U-Boats Attacked.		Hours per Sighting.		No. 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)
Convoy Cover												
United Kingdom	41	593	286	—	—	—	—	—	—	—	—	—
Iceland	24	346	205	—	—	—	—	—	—	—	—	—
Gibraltar and Moroccan Sea Frontier	76	813	423	—	—	—	—	—	—	—	—	—
Azores	25	250	108	—	—	—	—	—	—	—	—	—
TOTAL CONVOY EFFORT	166	2,002	1,022	—	—	—	—	—	—	—	—	—
A/U Patrols												
Northern Transit												
United Kingdom	75	656	328	—	—	—	—	—	—	—	—	—
Iceland	38	491	299	—	—	—	—	—	—	—	—	—
Northern Convoy												
United Kingdom	70	966	396	1	1	1	1	483	198	2	2	2
Iceland	35	420	203	1	—	1	—	420	203	1	1	1
Azores	40	483	174	—	—	—	—	—	—	—	—	—
Bay of Biscay (including adjacent patrols)												
United Kingdom	834	8,505	4,222	3	16	2	14	448	222	17	16	12
Gibraltar and Moroccan Sea Frontier	10	114	51	—	—	—	—	—	—	—	—	—
Central Convoy												
Gibraltar and Moroccan Sea Frontier	709	5,841	4,024	1	—	1	—	5,841	4,024	1	1	—
Azores	53	584	232	—	—	—	—	—	—	—	—	—
TOTAL A/U PATROLS	1,864	18,060	9,929	6	17	5	15	785	432	21	20	15
ADD CONVOY EFFORT	166	2,002	1,022	—	—	—	—	—	—	—	—	—
TOTAL EFFORT	2,030	20,062	10,951	6	17	5	15	872	476	21	20	15
				23 U-Boats Sighted.		20 U-Boats Attacked.						

Note.—In addition to the above there were 4 chance sightings: 2 by Transit Aircraft, 1 by a Met. Flight Aircraft and 1 by an Aircraft on Anti-Shipping Patrol.

Summary—*continued.*

Assessments
(received up to May 15.)

Month.	Known Sunk.	Probably Sunk.	Damaged, A.	Damaged, B.	Slight Damage.	Insufficient evidence of Damage.	No Damage.	Unassessed.
February	2*	2	—	—	4	11	7	3
March	2*	1	—	2	2	8	6	3
April	—	1	—	—	1	2	2	14

* Two of the U-boats assessed as "known-sunk" (one in February and one in March) were shared with surface craft.

Analysis of U-Boats Sighted during April

Particulars of Incidents.	U-Boats.		Sorties when Aircraft.	
	Sighted.	Attacked.	Sighted.	Attacked.
On 19 occasions 1 U-Boat was sighted by 1 aircraft—18 aircraft attacked.	19	18	19	18
On 2 occasions 2 U-Boats were sighted by 1 aircraft—each aircraft attacked 1 U-Boat.	4	2	2	2
TOTALS	23	20	21	20

Squadron Results—April

				Sorties when U-Boat Sighted.	*Sorties when U-Boat Attacked.*
United Kingdom					
58	Halifax	St. Davids		3	3
502	Halifax	St. Davids		2	2
53	Liberator L.L.	St. Eval		4 (6 U.B.s)	4
224	Liberator L.L.	St. Eval		1	1
120	Liberator L.L.	Ballykelly		1	1
103 U.S.N.	Liberator	Dunkeswell		1	1
311 (Czech)	Liberator	Predannack		1	—
248	Mosquito	Portreath		1	1
423 (R.C.A.F.)	Sunderland	Castle Archdale ..		1	1
172	Wellington L.L.	Chivenor		1	1
304 (Polish)	Wellington L.L.	Chivenor		1	1
612	Wellington L.L.	Chivenor		2	2
Iceland					
162 (R.C.A.F.)	Catalina	Reykjavik		1	1
Gibraltar					
1 (French)	Catalina	Port Lyautey ..		1	1
				21	20
		Chance Sightings			
517 (Met.)	Halifax	St. Davids		1	—
333 (Norwegian)	Mosquito	Leuchars		1	—
				2	Nil

Recent Attacks on U-Boats

On the morning of March 10 **Mosquitos E** and **L/248,** armed with 6-pdr. cannon, were on anti-U-Boat patrol at 100 feet. There was 8/10–9/10 cloud at 1,500 feet and the visibility was 8–10 miles. In position 44° 05′ N., 05° 40′ W., they sighted a U-Boat on the surface escorted by four Elbing class destroyers. The force was steering due east at 12 knots. The U-Boat was of the 1,600-type, at least 300 feet long, dark grey in colour and she was armed with four to six guns of various types. Four attacks were made by "E" and one by "L" which formated with "E" during the second run. The U-Boat remained on the surface and she was hit twice on the bows and four or five times near the conning tower. During the first three attacks there was no opposition from the U-Boat and only slight flak from the destroyers This, however, became intense during the final run. The U-Boat was also escorted by eight to ten Ju.88s and one of these is claimed as destroyed by "E." Three others were destroyed by Mosquitos from the same squadron which were covering the anti U-Boat aircraft.

Comments

Persistent and determined attacks against a well armed and heavily escorted U-Boat. At least six hits are claimed by these two aircraft with their 6-pounder armament but it is not possible to say what damage or casualties they inflicted. Efforts should be made to obtain photographs of attacks to assist assessment. Otherwise an excellent performance.

A Snap Attack

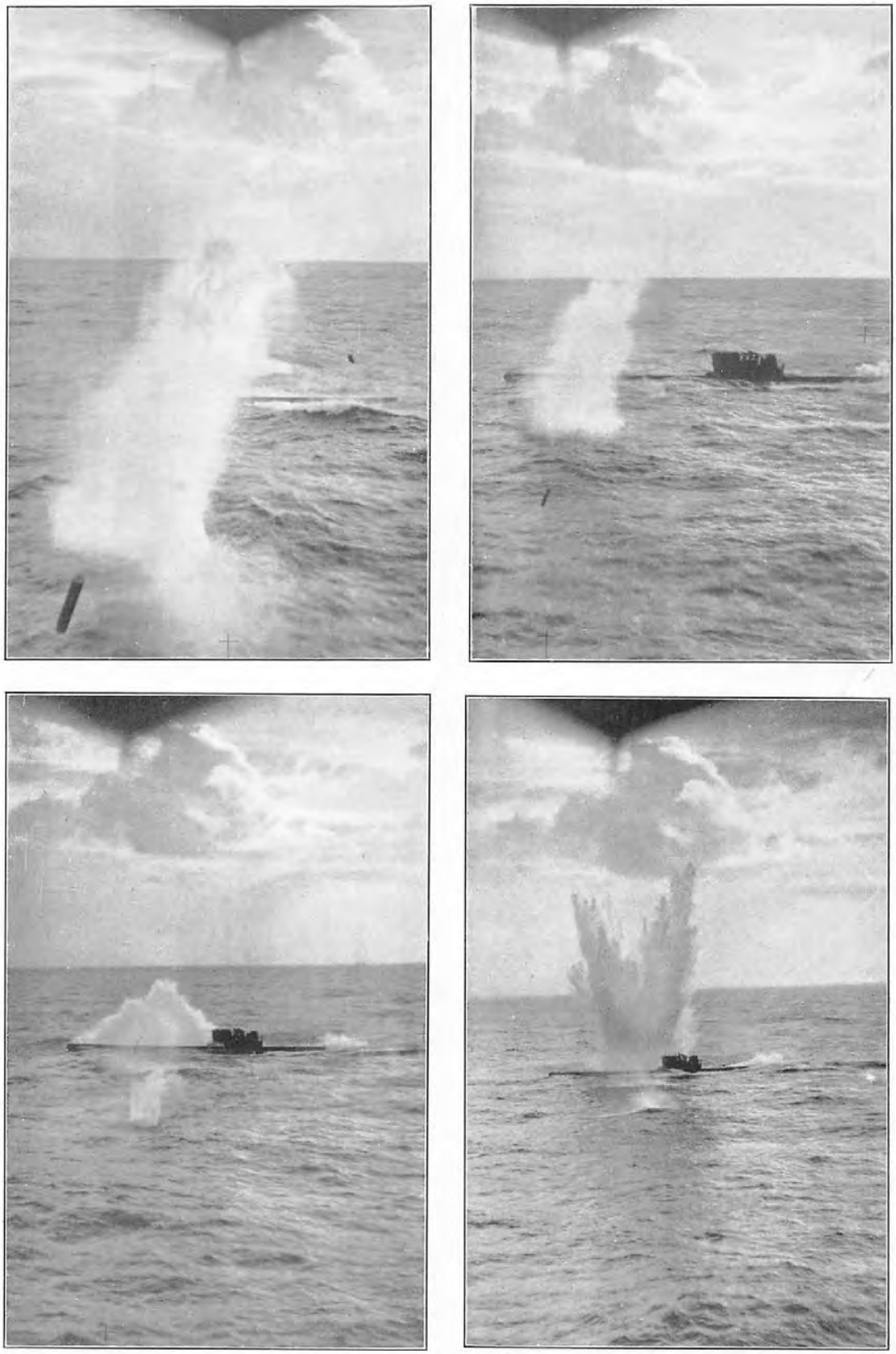
During darkness on March 11 conditions were very poor for searchlight attacks. There was 10/10ths cloud at 1,500 feet and 5/10ths from there to the surface. Moreover, occasional banks of fog reduced the visibility to about 400 yards. Apart from the difficulty of the weather **Wellington A/407** had been having trouble with the Radar, but the Captain was continuing his patrol in the hope that the set would improve. While the operator was retuning he picked up a contact four miles away on the starboard bow when the aircraft was flying at 1,000 feet. The Captain homed and switched on the searchlight from between 500 and 600 feet. It illuminated a U-Boat on the surface half a mile ahead in position 52° 43′ N., 21° 53′ W. She was steering 020° at 10–12 knots. Four 20-mm. guns in a quadruple mounting were seen on the bandstand as well as a single 20-mm. and a 30- or 40-mm. forward of the conning tower. The flak was in barrage form during the run in but normal after the attack. Although it meant attacking in a steep dive, the Wellington Captain decided to go in immediately lest the fog banks should provide cover for the enemy and prevent a second run. The six depth charges, which were spaced at 60 feet, were released from between 200 and 300 feet just before the aircraft pulled out of the dive. As a result the first four depth charges appeared to fall in a cluster and the fifth and sixth with normal spacing. One big explosion was seen on the enemy's port side close to the conning tower, and two smaller ones further away to port. The big explosion seemed to force the U-Boat bodily sideways causing the water all along the U-Boat's side to be disturbed—as it is in a sideways launching. The first flame float did not ignite and was probably destroyed in the explosion, while the second apparently split, causing a big fire on the water for two minutes. The U-Boat was seen to move between 200 and 500 yards away from this flame before she eventually lost way. During the run in the front gunner fired 100 rounds and claimed hits. The rear gunner did not fire after the attack as he was watching for the points of entry through the open window of the turret. Owing to the poor visibility the aircraft subsequently almost tracked over the U-Boat, which opened heavy and accurate fire. The aircraft took evasive action and dropped a marker 2–3 miles away. The wireless operator attempted to get in touch with Group but without success. Fifty-six minutes after the attack the U-Boat was still lying stopped on the surface, but the Wellington had to return to base.

Comments

A well executed attack in snap conditions when the weather was poor for searchlight aircraft. On the evidence it appears to have been a near overshoot, and the fact that the U-Boat was stationary for at least 56 minutes indicated damage to her engines. It was most unfortunate that no other aircraft could be homed to the scene.

A Relentless Hunt

On the night of March 12/13 **Wellington B/172,** on passage to its patrol area, was flying at 1,000 feet in cloudy, hazy conditions, when a Radar contact was obtained at a range of 8 miles. The Captain homed until the range was half a mile and then switched on the Leigh light. A fully surfaced U-Boat was illuminated dead ahead in position 46° 13′ N., 27° 28′ W. Her course was 110° and her speed 4 knots. As the aircraft came in to the attack one of the U-Boat's crew was seen running from the conning tower to man a single gun aft. This gun opened fire when the aircraft was a quarter of a mile away and continued to fire during the run in. The Navigator replied with his front gun. The aircraft attacked from the U-Boat's starboard beam and released from 30 feet six depth charges spaced at 60 feet. The rear gunner reported that the depth charges straddled the conning tower, for he was able to see a mass of explosions on the starboard side of the U-Boat and two separate explosions on the port side. The vessel heeled over to starboard and ceased



These consecutive photographs show a stick of depth charges straddling the U-Boat probably sunk by Canso S/162 on April 17. (*See* page 8.) The development of the explosion of the first depth charge can be seen particularly well.

PLATE 2

La Pallice photographed from 26,400 feet by 540 Squadron. The U-Boat pens are seen at the far end of the Inner Basin with a 500 ton U-Boat outside them. Two other 500-tonners are in the lock leading to the Outer Harbour. Projecting from the extreme left of the pens is a damaged *Seetier* destroyer which has been under repair since the beginning of this year.

fire. The aircraft climbed to 1,000 feet and flew back over the U-Boat's position but the crew saw nothing. The Captain therefore dropped a marker and shadowed for an hour and a half, making several runs at 300 feet over the scene of the attack in the hope that the cloud would break and enable him to see the U-Boat in the moonlight. The aircraft was in continuous Radar contact with the enemy, the contact remaining steady in relation to the marker. When after an hour and a half the contact disappeared, the aircraft investigated immediately and in obscured moonlight the crew saw an oil patch about 25 feet wide and 100 feet long. This was later investigated with the Leigh light and the presence of oil was confirmed. The aircraft dropped more markers in the area and left for base.

Comments

A good attack from a particularly low height. The U-Boat appears to have been damaged and thus became easier prey in the attacks which followed.

Later the same morning **Fortress R/206,** which had been sent to follow up the attack by B/172, sighted five marine markers on the starboard bow at 15 miles range. The Captain circled these at 300 feet but cloud down to 500 feet made observation difficult. At daybreak the markers could not be seen, but half an hour later a U-Boat came to the surface two miles north of the markers' position, bearing Green 30°, four to five miles from "R". The U-Boat was smaller than a 630-ton British submarine and the conning tower appeared long in comparison with the hull. It was dark grey in colour and had one railed bandstand. A medium calibre gun was carried on the deck forward of the conning tower and two or four smaller guns, probably 20-mm., on the bandstand. The Captain made a tight turn to port with the intention of sending a flash report to base and getting the crew to action stations, but as this turn was completed the U-Boat opened fire with the forward gun. The Captain then realized that the U-Boat intended to remain on the surface, so he continued to circle out of range, and tried to communicate with base. After a time the U-Boat fired a red flare followed shortly afterwards by two more. The aircraft replied with a two-star red and green cartridge and this temporarily silenced the U-Boat's guns. The Captain took this chance to edge closer and although the U-Boat re-opened fire a few minutes later, he went in to attack. To make the task of the German gunners as difficult as possible he came down in a diving turn from 1,000 feet, replying to the flak with the nose gun and mid-upper turret which scored hits on the enemy's conning tower. At 300 yards the aircraft straightened up for the attack and although the flak appeared to be all round, it was not hit. Four depth charges spaced at 100 feet were released from 40 feet on a bearing of Green 80° while the U-Boat was still on the surface. The depth charges straddled, one falling on the starboard side of the conning tower and three to port. The rear and port beam gunners opened fire and claim hits. Several members of the crew confirm that the U-Boat was entirely enveloped in spray and that she afterwards settled by the stern and slid under the water with the bows at an angle of 35–40 degrees. Within two or three minutes dark-coloured oil had spread in two irregular oblong patches 500 yards long with two smaller black patches in the middle. Big air bubbles also came to the surface. The aircraft circled at 1,500 feet to take photographs and dropped a marine marker. On instructions from base W/T homing signals were sent and by this means Fortress J/220 and H.M.C.S. *Prince Rupert* were brought to the scene. During the five hours from the time of the attack until the aircraft reached P.L.E., the oil patches showed no sign of movement. On the way home the Captain got in touch with *Prince Rupert* by R/T and informed her of the situation.

Comments

Good navigation and determination in the face of flak culminating in an accurate attack which materially contributed to the final sinking of this U-Boat by surface forces. It was very unwise, however, to delay the attack on a surfacing U-Boat in order to get off a flash report; by so doing the U-Boat was given time to man her guns and make all preparations for fighting it out.

Fortress J/220 was on the way to the position of B/172's attack when the wireless operator picked up the sighting and attack report of **R/206,** which gave approximately the same position. Nearly two hours later "R's" homing transmissions were heard at 150 miles' range. When "J" was approaching the position the homing signals ceased and at the same time an oil slick was sighted eight miles away on the starboard bow in position 46° 22′ N., 27° 42′ W. The aircraft circled the oil slick and waited for more homing signals. One marine marker was burning near the oil and three fluorescent markers were also seen. These had probably been dropped by an American Avenger aircraft which was marking the area. The Fortress crew also saw that the head of the oil slick formed an arrow and they suspected that it was moving. A flame float was dropped near the head of the slick which was then seen to move past the flame float at 1 to 1½ knots. The Captain of the aircraft decided to attack with two depth charges in the hope of bringing the U-Boat to the surface for a second attack. The two depth charges fell on the U-Boat's track 75 feet and 175 feet in front of the oil slick's head. After dropping the depth charges the crew saw that the oil slick had altered course 90° to port and that its head had become more blunt which presumably indicated either more oil or less speed. About an hour later the pilot sighted the *Prince Rupert* eight miles away and guided her to the spot by diving at the head of the oil slick and dropping two more flame floats. He also reported the attack by V/S. *Prince Rupert* was soon joined by U.S.S. *Haverfield* and the ships made several attacks. At this time several Avenger aircraft were seen in the area. H.M.C.S. *Prince Rupert* finally sank this U-Boat and took prisoners.

Comments

An intelligent appreciation of the situation led the captain of the aircraft to exercise his initiative and attack the oil slick. Although the U-Boat was probably too deep for the attack to be lethal, the fact that she was still being hunted must have discouraged the crew. Subsequent action by the aircraft led "Prince Rupert" to the exact spot, materially assisting in the final destruction of this U-Boat. This is a fine example of co-operation between aircraft and surface vessels and also between British and American anti U-Boat forces.

On the Enemy's Doorstep

When on anti U-Boat patrol on March 25 in fine but hazy weather with visibility three miles **Mosquitos L** and **I/248,** flying at 50 feet, sighted a U-Boat on the surface accompanied by two escort vessels, a trawler type ahead and a coaster astern. The position was 46° 48′ N., 02° 43′ W., and the U-Boat, which was dark grey in colour, was steering 030° at 3 knots. The Mosquitos attacked down sun with 6-pdr. cannon, " L " making four runs and " I " one. During the first four attacks intense and accurate flak was put up by the U-Boat and by both escort vessels but during the fifth run only the escorts fired. About ten hits were seen on the conning tower and on the forward deck near and below the waterline. After the attacks the U-Boat submerged and the Navigator of " I " saw an oil patch which he estimated to be 100 yards long and 30 yards wide.

Comments

A determined and very successful series of attacks with excellent confirmatory photographs. The evidence of hits together with the big oil patch seen after the U-Boat disappeared indicates the possibility of serious damage or even foundering.

Two days later the same two Mosquitos and crews were again out on offensive patrol in similar weather. On this occasion they found two U-Boats escorted by eleven vessels, one of which was probably a Sperrbrecher. The convoy was disposed with three A.S.T.s in line abreast followed in line astern by one 4/5,000-ton M/V, two U-Boats and a second M/V. Then came three more A.S.T.s in line abreast with two more astern and to port. There was also one A.S.T. on the U-Boat's starboard beam. The escorts were sighted first and the U-Boats afterwards. The U-Boats looked like 500-tonners and were dark grey in colour with no distinguishing features. Both aircraft attacked the rear U-Boat, " L " on the starboard bow and " I " on the beam. Four hits were seen as well as several possible hits underwater. The U-Boat remained on the surface. Intense heavy and medium flak was put up by all the vessels in the convoy and " I " was damaged.

Comments

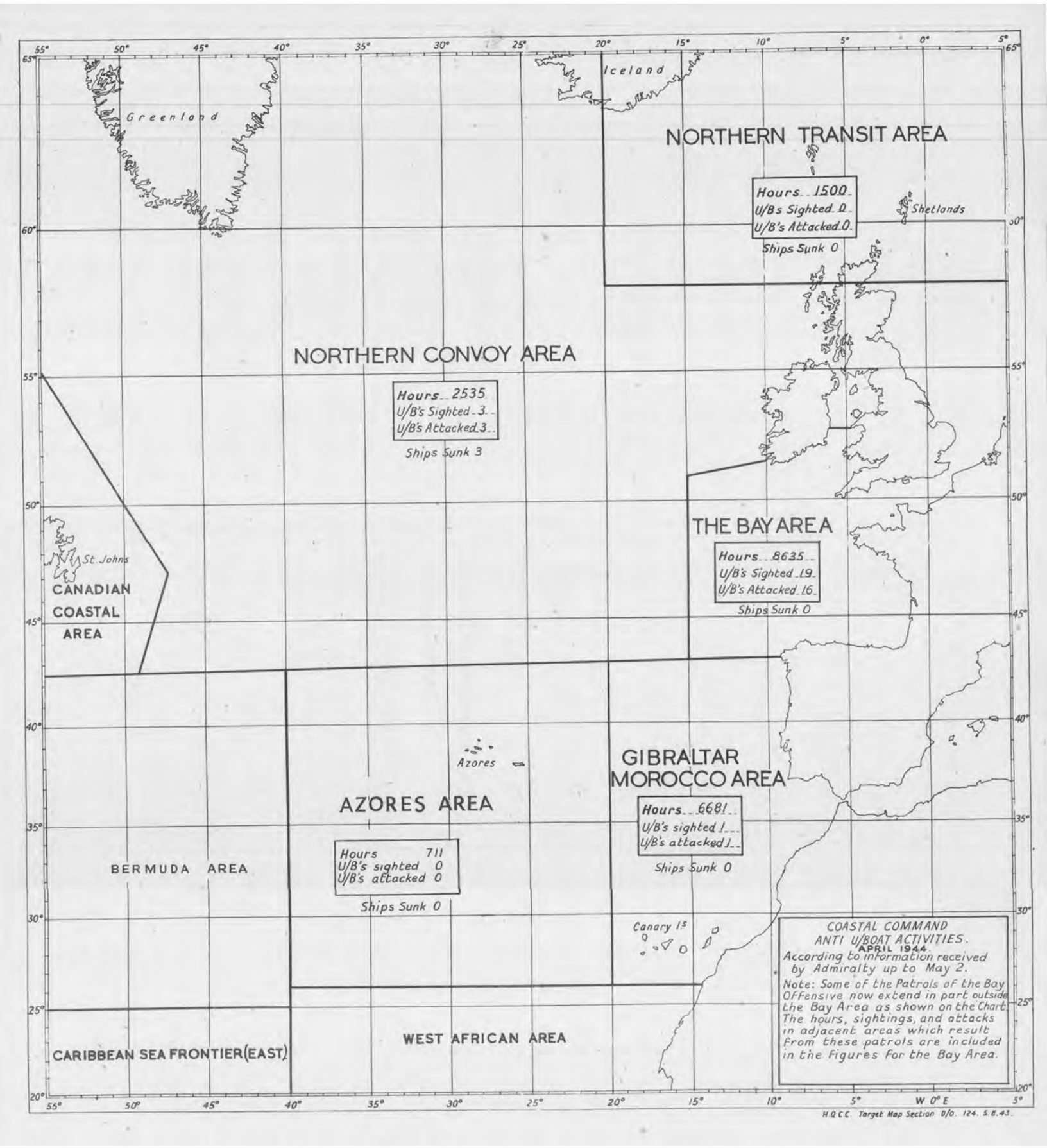
A very fine attack indeed pressed home with skill and determination. Evidence states that the U-Boat was hit but it was impossible to stay and observe after results. It must be very depressing for U-Boat crews to realise that they can be shot up on their own front door step even when in company with eleven escorts.

A Good Attack near the French Coast

In the early morning of March 31 **Liberator S/224** was flying at 300 feet in moderate night visibility over a calm sea, when a Radar contact was picked up 15 miles away on the port bow. The Liberator homed and lost height to 150 feet. At three-quarters of a mile the Leigh Light was switched on illuminating a fully surfaced U-Boat 5° on the port bow. Her position was 45° 37′ N., 03° 44′ W., and she was steering due west at 15 knots. She was painted very light grey and had a long, thin deck which broadened out near the conning tower, indicating a possible gun platform. There was a bandstand abaft the conning tower but the Liberator crew could not see any guns. After the attack, however, four streams of tracer were seen coming from the general direction of the conning tower. The nose gunner also saw four or five dark shapes which he thought were men. The Liberator attacked along the U-Boat's track from 150 feet and released six depth charges spaced at 55 feet. The Mark III bomb sight was used. The rear gunner estimates that all the depth charges fell along the enemy's starboard side very close to the hull, the centre of the stick being level with the bows. The U-Boat's gunners did not fire during the run in but when the aircraft was over the top of them they put up a single stream of red tracer which was not accurate. The rear gunner replied and estimates hits all round the conning tower. The tracer ceased and then the depth charge plumes hid the U-Boat from view. The aircraft then circled out of range and reported to base, maintaining contact with the enemy by Radar. The Captain soon discovered that the U-Boat was not making any progress. He therefore flew over the U-Boat at 500 feet and saw that she was slowly circling to port. The enemy gunners fired four streams of fairly accurate tracer but were silenced with 500 rounds from the aircraft's rear guns. About an hour and a half after the attack the Radar contact disappeared.

Comments

A good run in on Radar, but an attack up track is very difficult at night. As the points of entry were not seen it is impossible to say how close the explosions were, but the fact that the U-Boat circled slowly in much the same spot for nearly an hour and a half, indicates that some damage may have been done. As no flak was experienced during the run in it is likely that the U-Boat was surprised. The shadowing and signalling were well done.


Greenland
Iceland
NORTHERN TRANSIT AREA
Hours 1500
U/Bs Sighted 0
U/B's Attacked 0
Ships Sunk 0
Shetlands
NORTHERN CONVOY AREA
Hours 2535
U/B's Sighted 3
U/B's Attacked 3
Ships Sunk 3
THE BAY AREA
Hours 8635
U/B's Sighted 19
U/B's Attacked 16
Ships Sunk 0
St. Johns
CANADIAN COASTAL AREA
Azores
AZORES AREA
Hours 711
U/B's sighted 0
U/B's attacked 0
Ships Sunk 0
GIBRALTAR MOROCCO AREA
Hours 6681
U/B's sighted 1
U/B's attacked 1
Ships Sunk 0
BERMUDA AREA
Canary Is
WEST AFRICAN AREA
CARIBBEAN SEA FRONTIER(EAST)
COASTAL COMMAND
ANTI U/BOAT ACTIVITIES.
APRIL 1944.
According to information received by Admiralty up to May 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, and attacks in adjacent areas which result from these patrols are included in the figures for the Bay Area.
55° 50° 45° 40° 35° 30° 25° 20° 15° 10° 5° 0° 5°
65° 60° 55° 50° 45° 40° 35° 30° 25° 20°
W 0° E
H.Q.C.C. Target Map Section D/o. 124. 5.8.43.

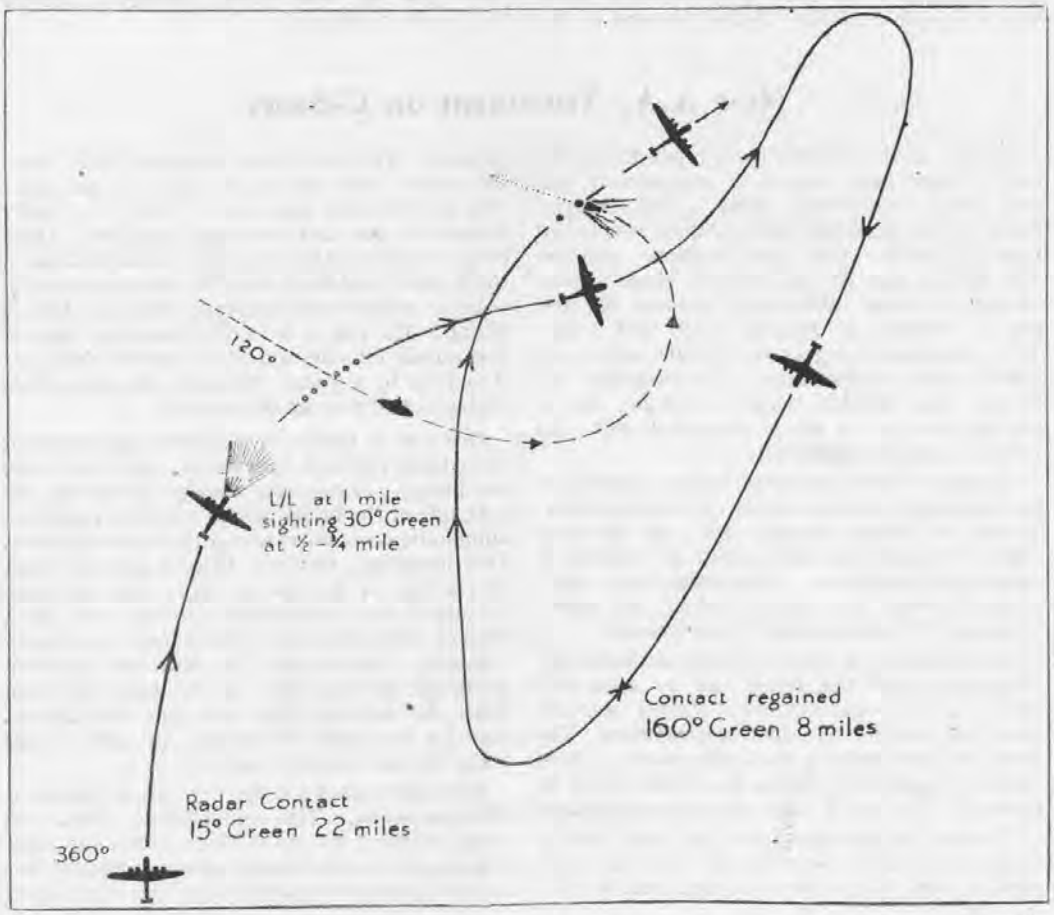
A Prevailing Fault

On April 20 **Liberator R/53** was flying on track 360° T. at 600 feet when a Radar contact was picked up at 22 miles range on a bearing of Green 015°. The Captain turned and began to home on a track of 015° with the wind almost dead astern. At just under a mile the Leigh Light was switched on illuminating a wake dead ahead. The Leigh Light was swept to starboard and it revealed a U-Boat half to three-quarters of a mile away bearing Green 30°. At this moment the aircraft's course was 065° T. The U-Boat, which was thought to be a 500-tonner, was painted light grey and had a big conning tower. In place of the usual rails there seemed to be plating round the gun platforms and it is believed that there was a gun forward of the conning tower. The U-Boat was high out of the water, the bulges on her side being clearly visible. Her course was 120° and she was making 18 knots. As soon as he sighted the U-Boat, the Liberator captain turned sharply to starboard and attacked from the enemy's starboard quarter. From 250 feet six depth charges spaced at 60 feet were dropped with the aid of the Mark III bomb sight. However, the aircraft had not been able to turn sharply enough and the depth charges straddled the wake fifty yards astern of the U-Boat. The front gunner opened accurate fire as soon as he saw his target and his fire was returned. The enemy gunners, however, did not allow enough deflection and their tracer, though right for line, passed behind the aircraft. The Liberator captain held his attacking course for five miles and then turned on to the reciprocal. The Radar contact was poor and faded out during the second approach but was regained after the Liberator had passed over the enemy's estimated position. The new contact bore Green 160° at 8 miles range. The Captain turned through 180° to starboard and sighted the U-Boat in the act of diving on a course of 300°. The Leigh Light was not used as the wake and swirl could be seen distinctly. The aircraft attacked again from 250 feet and released two depth charges spaced at 80 feet while the conning tower was disappearing in the apex of the swirl. The Mark III bomb sight was again used. The first depth charge undershot and the point of entry of the second was not seen. The second explosion, however, was seen 50 yards ahead of the swirl on the U-Boat's track. After searching the area for 17 minutes the Liberator set course for base having seen nothing more of the U-Boat. (*See* track diagram below.)

Comments

This attack shows how vitally important it is to assess accurately the relative drift during a Radar homing. After such a fine, long range contact it was disappointing to find a 30° turn necessary when the Leigh Light was switched on.

The crew were lucky to have the opportunity of making a second attack which probably gave the U-Boat a shaking up at least.



(C52359) B4

Probably Sunk

On April 17 **Canso S/162** (R.C.A.F.) was on an anti U-Boat patrol combined with a Met. flight. When flying at 800 feet in good visibility the second pilot sighted a wake six miles away on the starboard bow. The aircraft altered course and at four miles the U-Boat herself was seen with the aid of binoculars. The position was 60° 23′ N., 29° 20′ W. The U-Boat, which was painted a dirty brown colour, was steering 330° at 10 knots. The aircraft went in to attack out of sun and was fired on at 3,000 yards. The Captain altered course 30° to starboard and took undulating evasive action, at the same time closing the range to 1,200 yards. At this point he turned in again to attack and opened fire with the front gun. Hits were scored on the conning tower. Light flak and possibly some heavy flak burst all round the Canso, but it was not hit. At 300 yards the enemy stopped firing and did not put up any more flak during the rest of the action. The aircraft attacked from the enemy's starboard beam releasing from 50 feet three depth charges spaced at 100 feet. The first depth charge entered the water close to the starboard side forward of the conning tower, and the other two fell on the port side. After the attack the captain circled to port and saw the U-Boat emerging from the depth charge plumes. She first made a tight turn to starboard at about 12 knots and then circled to port, appearing to settle gradually lower in the water. Nine minutes after the attack, when the U-Boat was proceeding slowly at conning tower depth, there was a violent explosion 15 feet forward of the conning tower. A great plume of water like that thrown up by a depth charge explosion, shot into the air on either side of the U-Boat, which sank instantly. Immediately after she disappeared quantities of wreckage came to the surface, covering an area about 100 yards square. Big pieces of what looked like orange and reddish wood floated on the water, as well as two large cylindrical objects. One of these, which was open at one end, soon sank, but the other which was made of shiny metal, was closed and was still floating when the aircraft left. A continuous stream of air bubbles, four to eight feet in diameter, rose near the floating cylinder and were still rising over an hour after the attack. At first there were only slight traces of light oil near the wreckage but after three hours a patch of heavy dark oil appeared three quarters of a mile up wind of the wreckage. The dimensions of this patch were checked with the aid of a stop watch and found to be 600 yards by 250 yards. A stream of small oil bubbles rose to the up wind point of the patch, which expanded after an hour and a half to 3,000 yards by 600 yards. After homing other aircraft to the scene the Canso set course for base five hours and forty minutes after the attack.

Comments

A well thought out attack in the face of flak. The explosion and the shambles which followed it indicate that this U-Boat was probably sunk. A good effort all round which thoroughly deserved the success it achieved.

New A.A. Armament on U-Boats

U-Boats in the Atlantic bases began fitting the new 37 mm. fully automatic anti-aircraft gun just before Christmas, 1943. This weapon replaced the quadruple 20 mm. guns which had been in service since the previous summer. The 20 mm. gun has an effective range against aircraft of about 1,200 yards, whereas the new gun is effective at roughly twice that range. The maximum ranges are 2,150 yards and 4,300 yards respectively. Theoretically the 37 mm. fires 100–120 rounds a minute, but in practice the rate of fire is about half this. Its ceiling is about 12,000 feet.

The gun is fitted in a pivot socket mounted on the second gun platform abaft the conning tower. It can be trained through 360°, an operation which is believed to take about 10 seconds in operational conditions. A depression rail is fitted which prevents the gunner hitting the superstructure of the boat when firing forward.

The breech block, which contains the automatic mechanism, and the barrel can be assembled quickly, and a spare barrel is stowed near the mounting in a pressure-tight compartment. The barrel is fitted with a flash eliminator. Three men are required to change the barrel owing to its weight, but the job can be done in two minutes.

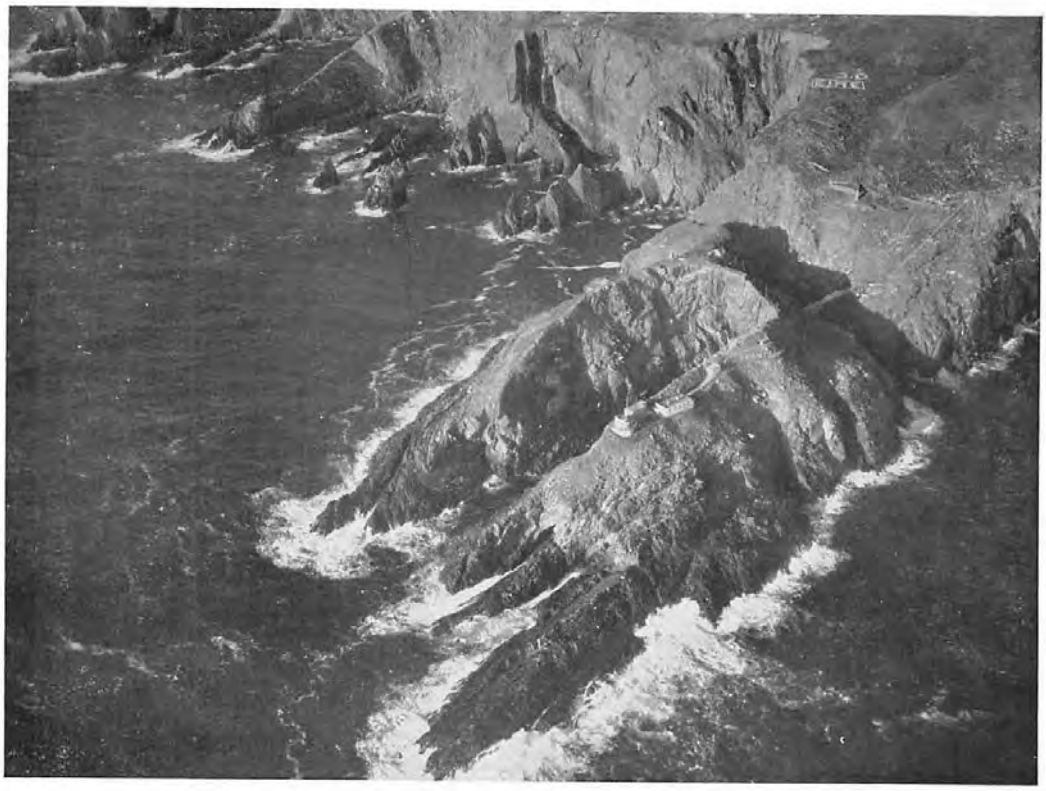
The gun has an elevation of 90° and can be depressed to 10°. Normally the ring and bead sight is used, but a telescopic sight can be substituted. The gun's crew consists of five men; the trainer, who sits on the left, the gun layer who also fires the gun, on the right, the loader behind the gun, and two supply numbers. These men are protected by armoured shields 15–20 mm. thick which fold back when the gun is secured in order to reduce water-resistance when the boat is diving. The gun is loaded by inserting clips of five rounds into the top of the breech block and it is fired by a pedal. Securing the gun before diving is said to take 60 seconds.

One case is known of a 37 mm. gun mounted on a third platform forward of, and level with, the bridge. Access was through a door on the port side of the bridge fairing and four ready-use ammunition containers were fitted on the platform. This mounting, however, had an adverse effect on the trim of the boat so that it was necessary to adjust the ammunition stowage and flood various tanks before the U-Boat could be properly trimmed. Incidentally this boat also mounted quadruple 20 mm. guns on the lower platform abaft the conning tower and two twin 20 mm. guns on the upper badstand. In spite of this array she was recently sunk.

The ammunition for the new gun is known as *Minenmunition*. This ammunition, which had been promised to the U-Boat crews for some time, received a good deal of advance publicity, but it has certainly not substantiated the extravagant

St. Nazaire photographed on April 5 by 540 Squadron. The massive U-Boat shelter in the Bassin de St. Nazaire (left centre), which can accommodate 32 U-Boats, is being strengthened with an extra thickness of roof. Immediately opposite the shelter is the new lock leading to the River Loire. This too is heavily protected by a concrete roof. The big Entrance Lock, which was damaged by the *Campbeltown* in March, 1942, is still being repaired, and is seen in the centre of the photograph.

PLATE 4



Many points on the coasts of Eire can now be identified by a white number and the word EIRE marked in letters 30 feet long. A special map is available which identifies each number and thereby enables crews to pinpoint themselves exactly when making a landfall in bad weather.

No. 30 (above) is Mizen Head, and No. 28 (below) is Toe Head.

claims which were made for it. The overall length of the round is 16·7 ins., and the visible part of the projectile measures 3·9 ins.

All the ammunition is orange tracer and is self-destroying at 5,000 yards. Fifty clips of five rounds each are kept ready for use in two watertight containers on deck. The ammunition is very sensitive and must be handled with care as it contains a very high explosive. It has an aluminium fuse head which detonates on impact.

The 37 mm. gun is undoubtedly very effective on shore where it can be thoroughly inspected and overhauled every day and where the gun platform is fixed. At sea, however, the delicate mechanism suffers from being submerged for 20 hours out of 24. For instance, the breech block contains a chain which runs horizontally like that of a bicycle. On the chain is a ratchet which pushes the cartridge into the breech. Prolonged submersion causes this chain to slacken, which is apt to cause a stoppage. The automatic mechanism also needs constant attention and the recoil system is known to suffer from the action of sea water.

Although the new gun is good on shore, U-Boat men and even Commanding Officers frequently comment unfavourably on its performance at sea. There has recently been talk of replacing it with some kind of rocket projector.

When the 37 mm. gun is serviceable it is certainly a weapon to be treated with respect. Fortunately for us, however, it is not reliable unless the ordnance rating in charge of it happens to be particularly good at his job. Indeed the unreliability of the new gun has tended to reduce the confidence of U-Boat officers in the wisdom of fighting on the surface.

Aboard "U 231": Survivors' Account

U 231 was sunk on the night of January 13, 1944, by Wellington L/172 operating from the Azores. She was proceeding on the surface, charging her batteries, in conditions of low cloud and diffused moonlight. Nobody on the bridge saw the Wellington until it was almost on top of them. Two explosions were seen and felt. One depth charge fell to port, 15 metres away, and another fell 2 metres away to starboard. Moreover, the aircraft's guns opened fire to good effect and bullets are said to have penetrated into the forward torpedo compartment. The Commanding Officer rushed on to the bridge and all anti-aircraft guns were made ready; but the concussion, or a hit, had jammed the training mechanism of the 37-mm. gun and put it out of action. Damage to the boat was considerable: the main switchboard caught fire, electrical equipment was damaged extensively, and water entered through the flanges of the stern torpedo tube.

The Wellington then attacked again and was engaged with 80 rounds of 20-mm. Hits were seen and the crew hoped, in vain, that the aircraft would not reach its base.

The Engineer reported that the boat was capable of diving and the Commanding Officer gave the order. Partly because of water entering the stern torpedo tube flange and partly because of damage to vents and pumps *U 231* grew very stern heavy. The electric motors were turning only very slowly and could hardly hold the boat, which assumed an angle of 70°. With difficulty she re-surfaced and the Commanding Officer ordered the crew to abandon ship. Most of them were picked up by U.S. warships some hours later.

This U-Boat had a singularly inglorious career. She was sunk on her third patrol and had spent a total of 121 days at sea. During this time she fired only one torpedo—which missed. Her lack of success was partly due to the character of her commanding officer, Kapitänleutnant Wolfgang Wenzel, a rabid and rather stupid Nazi. He was a nervous type and was considered by most of his crew to be unfit for the dangerous job of commanding a U-Boat. On both preceding patrols he continually violated the instructions of Dönitz, which were to attack on all occasions. Wenzel preferred to submerge on sighting ships or convoys, saying that air cover and escort vessels made such encounters dangerous.

Almost all the crew considered that after the Wellington's attack Wenzel should have made some attempt to save his boat. Instead, he abandoned ship and then tried to commit suicide by shooting himself in the mouth. He missed again, however, for the bullet lodged harmlessly in the back of his neck. Very few of the crew knew of this attempt as Wenzel explained to them that he had a sore throat.

In spite of an occasional commanding officer like Wenzel, the U-Boat crews are still fighting. They have undoubtedly lost much of their old dash and skill, but they are still capable of doing damage. Whatever the fighting spirit of her crew, a U-Boat at sea is a menace. If air and surface escorts should once relax, even a Wenzel will pluck up the courage to attack. The failure of *U 231* is the reward of great exertions by Allied escorts; greater exertions will produce even more ignominious failures.

II.—ANTI-SHIPPING

SUMMARY OF ANTI-SHIPPING OPERATIONS BY COASTAL COMMAND AIRCRAFT

APRIL 1944

Weapon Carried.	Number of Sorties.			Number of Aircraft to Attack.				
	On Reconnaissance.	On Strike.	Total.	On Reconnaissance.	On Strike.	Total.	Naval Target.	M/V Target.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DAY OPERATIONS.								
Torpedo	70	3	73	17	—	17	1	16
R.P.	132	11	143	38	—	38	6	32
D.C.	12	—	12	—	—	—	—	—
Cannon and M.G. only	300	1	301	40	—	40	9	31
TOTAL DAY	514	15	529	95	—	95	16	79
NIGHT OPERATIONS								
Torpedo	28	4	32	—	4	4	—	4
Bomb	96 (2)	9	105 (2)	15 (2)	7	22 (2)	14 (2)	8
D.C.	— (4)	—	— (4)	— (4)	—	— (4)	— (3)	— (1)
Cannon and M.G. only	54 (3)	—	54 (3)	— (3)	—	— (3)	— (3)	—
TOTAL NIGHT	178 (9)	13	191 (9)	15 (9)	11	26 (9)	14 (8)	12 (1)
ALL OPERATIONS								
Torpedo	98	7	105	17	4	21	1	20
R.P.	132	11	143	38	—	38	6	32
Bomb	96 (2)	9	105 (2)	15 (2)	7	22 (2)	14 (2)	8
D.C.	12 (4)	—	12 (4)	— (4)	—	— (4)	— (3)	— (1)
Cannon and M.G. only	354 (3)	1	355 (3)	40 (3)	—	40 (3)	9 (3)	31
GRAND TOTAL	692 (9)	28	720 (9)	110 (9)	11	121 (9)	30 (8)	91 (1)

Note.—The figures in brackets, which are not included in the totals, represent attacks on shipping by aircraft on A/U. patrols.

RESULTS CLAIMED FOR APRIL

(Subject to Assessment)

Torpedo	*Day :*	1 M/V (4,000 tons) seriously damaged. 1 Sperrbrecher (1,500 tons) sunk. 1 M/V (2,000 tons) seriously damaged.
	Night :	1 M/V (2,500 tons) seriously damaged.
Bombs	*Night :*	1 M/V (2,000 tons) seriously damaged. 1 E/Boat damaged. 1 Medium M/V damaged. 1 M/V (1,500 tons) damaged. 1 M/S damaged. 1 Vessel damaged.
R.P.	*Day :*	2 Armed trawlers sunk. 1 Armed trawler seriously damaged.
Cannon	*Day :*	4 E/V.s damaged. 1 E/V damaged. 1 Sperrbrecher (4,000 tons) damaged. 1 Coaster damaged. 1 Armed trawler damaged. 3 Armed trawlers damaged. 1 M/V (3/4,000 tons) damaged. 1 Armed trawler seriously damaged.

ANALYSIS OF WEAPONS EXPENDED

Weapon.	No. of Aircraft to Attack.	Weapons Expended.	
		M/V.	Naval.
Day Operations :—			
Torpedo, 8 ft.	17	16	1
R.P.	38	244 × 25 lb. A.P.	48 × 25 lb. A.P.
Night Operations :—			
Torpedo	4	4	—
Bomb	24	27 × 500 lb. M.C.	21 × 500 lb. M.C.
		12 × 250 lb. G.P.	48 × 250 lb. G.P.
	—	—	8 × 100 lb. A/S.
	—	—	10 × 600 lb. A/S.
Depth Charge	4	2 × 250 lb. D.C.s	16 × 250 lb. D.C.s

MARCH ASSESSMENTS OF ATTACKS ON ENEMY SHIPPING

Night :—

Bombs ..	Coaster damaged. 2 M/S damaged.
Torpedo ..	M/V (1,873 tons) sunk.

Day :—

Torpedo ..	2 M/V.s totalling 3,500 tons sunk. 3 M/V.s totalling 6,898 tons seriously damaged. 1 M/V. (1,000 tons) damaged.

Cannon :—

57 *mm.*	Coaster seriously damaged.
20 *mm.*	2 E/V.s seriously damaged. Coaster damaged. 9 E/V.s damaged. 1 M/S damaged.
R.P. Torp. and Bomb.	M/V (6,415 tons) total loss.

Shipping Strikes in April

In the Bay area on March 22, **Mosquitos L, Q, R, W, and V/248** attacked four enemy ships steaming in line ahead on a southerly course. The third ship in the line was a small tanker-type coastal vessel of about 1,000 tons and the other three were slightly smaller and of the armed trawler type. "L" and "Q" attacked the largest ship with cannon and scored many hits; great clouds of smoke and steam came from this vessel and it was left in a sinking condition. "R" and "W" seriously damaged the leading vessel and "V" shot up the second ship. All three ships attacked were smoking fiercely when our aircraft left the area.

Just about tea time on March 29 the **North Coates Wing** made a successful attack on a convoy north-east of Borkum. Two squadrons of Mustangs provided fighter escort and it was their long range which enabled the Wing to strike so far east. The striking force was made up of nine Beaufighters of No. 254 Squadron, six with torpedoes and three with cannon only, 10 Beaufighters of No. 236 Squadron using 25-lb. R.P. and cannon, and 10 Beaufighters of No. 143 Squadron with cannon only. The convoy, which was far less heavily escorted than those encountered farther west, comprised 16 merchant ships in two columns of eight, with three "M" class minesweepers in front, one on the seaward flank, and one sperrbrecher to the rear. The attack was made from the seaward side of the convoy, which was steaming west at 6 or 7 knots. Two merchant ships, one of 3/4,000 tons and the other of about 2,000 tons, were hit by torpedoes, three ships were damaged by R.P. and many cannon strikes were seen on all the vessels attacked. This very satisfactory attack was made during a reconnaissance in force and the Wing had no previous knowledge of the target. The flak-busting aircraft did their work most effectively, and enabled the Torbeaus to drop their torpedoes without loss or damage. One Beaufighter failed to return.

On April 2, in clear moonlight, **Beaufighters R, A, G, and D/254** attacked a convoy with torpedoes a few miles north of Nordeney. The convoy of about 20 ships was located by **Wellington D/415,** which homed the Beaufighters to the area and then dropped flares to illuminate the target. Two aircraft attacked from the landward and two from seaward, all of them concentrating on the leading vessels. All torpedoes were dropped from ranges between 800 and 1,000 yards. Shortly after the attack a great sheet of flame was seen at the head of the convoy by all our crews. One pilot reports that he saw a fire break out on one of the ships and spread all over it. In view of this one merchant ship is claimed as torpedoed and probably sunk. All the Beaufighters returned, although two of them crash-landed at base; one of these was "D", which was hit by flak in the port engine. The pilot put up a very good show in bringing his aircraft back on one engine.

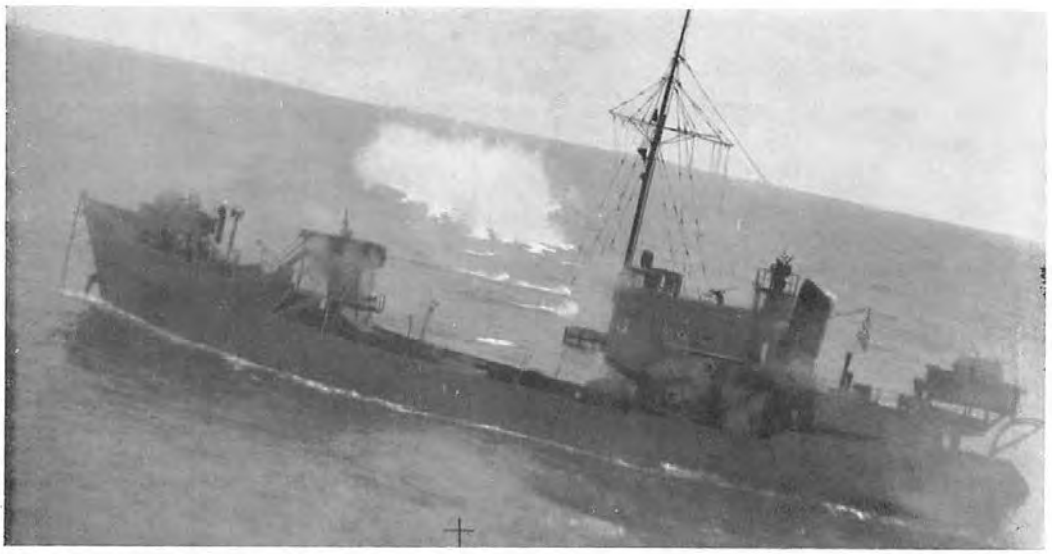
On April 7 the **Wick Wing** made a shipping attack near Stadtlandet. The Wing consisted of four Beaufighters of No. 144 Squadron with torpedoes and two with cannon, and eight Beaufighters of No. 404 Squadron, using 25-lb. R.P. and cannon. The convoy was steering a southerly course at 6 knots and comprised three merchant ships, one of 4,500 tons, another of 3,000 tons and the third of 2,000 tons, protected by seven escort vessels. There was one E/V at the head, one at the rear and five on the seaward flank of the convoy. The anti-flak aircraft did excellent work, damaging three of the escorts and scoring cannon strikes on the two larger M/V's. In particular, H/144 put up a very good performance; after attacking the rearmost escort and setting it on fire, "H" was hit by flak which pierced the port wing and released the dinghy. The dinghy wrapped itself round the tail and jammed the elevators, causing the aircraft to stall and spin for 200 feet. The pilot eventually got his aircraft under control and landed at Sumburgh with strips of dinghy still wrapped round the tail. The torpedo aircraft claim one hit on the 4,500 ton ship.

On April 18 the **North Coates Wing** flew an armed reconnaissance off the Frisian Islands. Eight Beaufighters of 236 Squadron, armed with cannon and 25-lb. R.P., eight of 143 Squadron, with cannon only, and two of 254 Squadron, made up the force. Weather was fine, though hazy, but no targets were found on the patrol. On the way back from patrol, however, the wing sighted two armed trawlers about 30 miles north of Borkum. The leader decided that these were better than nothing and he gave the order to attack. Each of the vessels was hit by five pairs of R.P. as well as by many cannon shells, some of the pilots making three or four separate attacks. One trawler was seen to sink and the other was left on fire in a sinking condition. All the Beaufighters returned safely to base.

The **North Coates Wing,** comprising nine Beaufighters of 143 Squadron armed with cannon, and nine of 236 Squadron with cannon and 25-lb. R.P., made another armed reconnaissance on April 19. Three ships, a coaster and two armed trawlers, were sighted and attacked a few miles off Terschelling. Many R.P. hits and cannon strikes were scored and one of the trawlers was destroyed, while the coaster was left seriously damaged and on fire. Some light flak was experienced early in the attack, but it soon died down when the Beaufighters opened up with their cannons. Some very good photographs support the claims made by our crews.

On April 20 the **North Coates Wing** again struck at enemy shipping off the Dutch coast. Six Torbeaus of 254 Squadron, eight cannon Beaufighters of 143 Squadron, and ten Beaufighters of 236 Squadron, armed with cannon and 25-lb. R.P., made up the force. They were escorted by 17 Mustangs. Off Schiermonnikoog the wing sighted a small convoy of four ships steaming slowly eastwards. The largest vessel was a sperrbrecher of about 1,500 tons, which was followed by three armed trawlers. The attack, which was launched from the seaward side, was begun by the anti-flak force: the aircraft of 143 Squadron sprayed the three trawlers with cannon shells and the R.P. aircraft concentrated on the sperrbrecher and one of the trawlers, at least two pairs of R.P. scoring direct hits. They were followed immediately by the Torbeaus which launched their torpedoes against the sperrbrecher and scored one definite hit amidships. There may have been other torpedo hits, but dense smoke and a great plume of water obscured the target and made accurate observation impossible. All our aircraft returned and only two of them

In the attack by the North Coates Wing on April 18, L and W/236 attacked a coaster which was already smoking. W fired a salvo which was 200 feet short, and L (whose nose camera took the above photographs) fired pairs from 800 yards to 500 yards. The pairs were fired in the pull-out so that the four pairs covered 900 feet on the sea, straddling the target but scoring only one hit.



On April 20, Nos. 245, 143 and 236 Squadrons attacked a small Sperrbrecher and some armed trawlers east of Ameland. The top photograph shows R.P.s on the way to the target, with one which undershot ricochetting out of the water towards the left centre. The middle photograph shows a torpedo hit on the Sperrbrecher, which eventually blew up. The crew of the trawler (lower photograph) are not manning a single gun. The Nazis ensign can be seen flying abaft the bridge.

sustained slight damage. The enemy, on the other hand, suffered greatly; the sperrbrecher was seriously damaged and probably sunk, two of the trawlers were badly damaged and the other was damaged. Excellent photographs show the torpedo hit and substantiate the other claims.

North Coates is to be congratulated on the fine work of the wing in making three strikes on three successive days. The hard work of both aircrews and ground crews is making the Dutch coast more unhealthy than ever for enemy coastal shipping.

During the hours of darkness on April 20/21 **Albacores** of **415 Squadron** operated against shipping in the Channel area. About two miles west of Le Touquet **"L"** sighted 12 to 15 E- or R-Boats and trawlers heading south in three columns. The pilot attacked with six 250-lb. bombs, one of which burst under the bows of one of the boats. This was followed by a dull red glow and the vessel is claimed as seriously damaged. Ten minutes later **"M"** sighted the same boats which had then begun to weave. The pilot immediately attacked in a steep dive and saw two bombs heading towards one of the vessels. As the aircraft broke away a bright flash illuminated the cockpit and, looking back, the observer could see a yellowish glow coming from the target. This vessel also is claimed as seriously damaged. About an hour and a half after these two attacks **"F"** sighted shipping near Gravelines which first revealed itself by putting up a fairly intense barrage of light and medium flak. "F" climbed to 2,500 feet and dived on one of the ships, an E- or R-Boat. Although the aircraft was twice hit by flak during the attack the pilot released six 250-lb. bombs from 1,000 feet. Flak from the target vessel ceased immediately and a dull red explosion was seen. This boat is claimed as destroyed.

Early on April 23 **Wellington H/415** obtained a Radar contact and homed on to an enemy convoy near Norderney. On reaching the area the pilot could not at first see any ships owing to darkness and haze. He therefore dropped a stick of flares and by their light sighted four or five merchant vessels and six escorts. He attacked the largest ship, an M/V of 3,500 tons, with five 500-lb. bombs which straddled the target, one of them being a direct hit. After the attack the ship caught fire and flames were still visible to the crew of "H" when they were over 10 miles away. Slight inaccurate flak was experienced after the bombing run, but the Wellington returned to base undamaged.

On the night of April 23 **Wellington A/415** sighted five E-Boats about 30 miles west of Ijmuiden. They were travelling at 20 knots on a westerly course in line ahead. After sending a message to base "A" shadowed the boats and twice illuminated them with flares, flak being experienced each time. After the second illumination the E-Boats altered course to 090° and although they kept roughly the same formation, they began weaving separately. The pilot attacked with eight 100-lb. A/S bombs, but he did not see where they exploded. However, two separate fires were distinctly seen after the attack and they were still burning when "A" set course for base. In view of this two E-Boats are claimed as damaged. Apart from the damage done to the enemy, this attack had the effect of turning them back towards their own coast.

Early on April 24 **Albacore E/415** sighted a long continuous wake eight miles west of Boulogne. Closer investigation showed that this was made by a column of five E- or R-Boats. The pilot made a diving attack towards the head of the wake and released six 250-lb. bombs from 800 feet. Two of these bombs were seen to score direct hits on the target and one E- or R-Boat is claimed as destroyed.

In the early dawn of April 28 **Albacore D/415** sighted a vessel, believed to be a trawler or escort vessel, a few miles off Cap de La Hague. The pilot dived on the target and released six 250-lb. bombs. One of them hit and damaged the enemy's stern and another was a near miss.

III.—OTHER OPERATIONAL FLYING

Combats with Enemy Aircraft

During the night of March 28 **Wellington F/304** (Polish) encountered two enemy aircraft in the Bay of Biscay. Darkness made it impossible to identify the aircraft with certainty, but they are thought to have been Me. 110's. The rear gunner sighted the exhaust of the first enemy aircraft about 1,500 yards away on the port quarter, while the second was about 1,800 yards astern of "F". The aircraft closed in and the Wellington pilot, warned by the rear gunner, took evasive action. The second German disappeared for a while but the rear gunner, getting the silhouette of the first in his sight, fired a long burst and saw the enemy's starboard engine catch fire. A few moments later both the gunner and the Radar operator saw this aircraft dive into the sea and explode with a brilliant flash. Almost immediately after this the other German attacked with machine gun and cannon fire. Most of the fire passed about 20 yards to port of the Wellington but one purple shell burst close to the rear turret, broke the glass screen and put one of the guns out of action. The gunner was wounded by splinters but continued to fire his guns when the enemy made two more attacks. After the third attack, during which he opened fire at 1,000 yards, the German broke away and was not seen again. The successful result of this action was due to excellent team work and good shooting by the rear gunner.

Mosquito L/333 (Norwegian), while on patrol off the Norwegian coast on March 29, sighted a B.V.138 near Bremanger. "L" made a wide turn to get astern of the enemy and attacked from the starboard quarter, firing a short burst from 600 yards. The B.V. turned to port and presented a non-deflection shot to the Mosquito pilot who fired a long burst and closed to within 50 yards. Pieces fell off the wings and the port

engine of the enemy aircraft caught fire; it lost height gradually, hit the sea and sank. The observer of the Mosquito took photographs which confirm the destruction of the B.V.138.

After a shipping strike off the Norwegian coast on March 30, six Beaufighters of No. 144 Squadron and two of No. 404 Squadron became involved in combats with enemy aircraft. The enemy force was a mixed one and included five Me.110's, three A.R.196's, three F.W.190's, and two Me.109's. **K/404** made a quarter attack on an Me.110, opening fire at 400 yards. After a one-second burst the 110 burst into flames and crashed in the sea. "K" began to chase another Me.110 but was itself attacked by a F.W.190, so the pilot took evasive action and flew out to sea. The pilot of **E/144** saw a Beaufighter being pursued by two Me.110's and he turned into position behind the rearmost of them. From 300 yards he fired a long burst of cannon and saw the enemy aircraft turn towards the coast with clouds of smoke coming from its port engine. Four of our aircraft were very slightly damaged, but there were no casualties among the crews. The Beaufighters did well against a superior force which included single engine fighters.

On April 11 **Mosquitos F and Z/248,** after making attacks on a convoy close to the west coast of France, engaged several Ju.88's. "F" attacked a Ju.88 on the bow, opening fire from 250 yards, and scored several hits. The enemy aircraft continued on course for a short distance before its port engine exploded and burst into flames. The aircraft dived into the sea and was destroyed. Just after this the pilot of "F" saw a Mosquito being pursued by an 88. He turned towards the enemy aircraft and fired a short burst from 800 yards, causing it to break away. "F" closed the range and fired several short bursts until all his ammunition was expended. The pilot saw very many hits all over the fuselage and wings of the enemy aircraft, which was last seen flying low over the sea towards the coast.

"Z" made five separate attacks, four of which had to be broken off owing to other Ju.88's attacking from behind. On his fifth attack the pilot went in on the port beam of one of the 88's and fired a short burst from his machine guns. The enemy aircraft turned over on to its back and dived vertically into the sea.

Two Sunderlands

In the Bay area on March 23, **Sunderland F/461** encountered four Ju.88's. The enemy aircraft were first sighted 3 to 4 miles away on the port bow at 2,000 ft. "F" immediately jettisoned depth charges and lost height to 1,000 ft. The 88's turned towards the Sunderland and from a position 4 miles astern they flew up abreast of "F," two on either beam. Both aircraft on the port beam closed to 1,200 to 1,500 yards, turned in to attack, and opened fire from 1,200 yards. "F" turned sharply to port to meet this attack and began to corkscrew. The 88's broke off at 600 yards and about 800 ft. above the Sunderland, the tail gunner of which fired a long burst at one of them as it passed astern. The two aircraft on the starboard side did not attack, so the fire controller instructed the captain to cease corkscrewing and resume course. All four enemy aircraft then went about 3 miles astern to prepare for their next attack. During this break the Sunderland captain altered course in order to lead the enemy as far away from their bases as possible. The second attack opened in much the same way as the first, two 88's taking station on either beam. The starboard pair made a dummy attack but broke off about 1,000 ft. above "F." Fortunately, the controller was not drawn by this manœuvre, and the genuine attack from the port side was countered by a steep diving turn to port. By then the starboard outer engine had stopped, as a fuel supply line had been cut during the first attack. The Germans made four more similar attacks before they finally gave up the battle. The Sunderland captain took the same evasive action every time, ignoring the dummy attacks from starboard and countering the real attacks from port with a steep diving turn into each attack. After the attacks, while the enemy were re-assembling astern, the Sunderland regained height to 1,000 ft. Only the first attack did any damage to "F," and all attacks were broken off at a minimum of 600 yards. Excellent team work was chiefly responsible for the safe return of the aircraft from this combat. The navigator, who acted as fire controller, was always ready with the right instructions, the pilot handled the aircraft skilfully, and the gunners kept the enemy at a distance with accurate shooting. The flight engineer also deserves credit for his part in bringing the damaged aircraft home over 500 miles of sea.

Forty miles from the scene of the attack on F/461, **Sunderland M/461** became involved with nine Ju.88's on the same day and at about the same time. At first only two enemy aircraft were seen. They apparently saw "M" at the same moment and they flew away about 4 miles on the port bow. The Sunderland immediately began to climb and had reached 1,200 ft. when the two 88's came in to attack on the port bow. Meanwhile, more 88's had arrived; two were seen on the port quarter and others approached on the starboard side. To counter the first attack, "M's" captain waited until the two aircraft were within 800 yards and then made a steep diving turn to port and passed beneath them. The Sunderland was not damaged in this attack and the mid-upper gunner was able to get in several good bursts as the Ju.'s passed overhead. After the diving turn the two aircraft previously on the port quarter were brought on to the port bow whence they made a dummy attack, breaking off at 1,000 yards. "M" made a feint turn to port, followed immediately by a steep diving turn to starboard. This enabled the Sunderland to face the genuine attack which was developing from the starboard side; two 88's came in on the bow and two on the beam, followed closely by the pair which had first attacked. The Sunderland's sudden manœuvre seemed to confuse the enemy and only the leading pair made an effective attack. One shell hit the mid-upper turret, putting both guns temporarily out of action and spraying the gunner's face with perspex splinters. The gunner, however, soon got one of his weapons in action again and fired a long burst into the underside of an 88 as it passed over. It flew away with black smoke pouring from it.

All the enemy aircraft then flew away to port to re-assemble. When they returned nine of them were counted altogether. Three stood off on the Sunderland's port bow and six went round to starboard, two forming up on the bow, two on the beam and two on the quarter. The leading pair on the starboard bow peeled off for an attack and opened fire at 1,200 yards. As before, " M " held on course until the enemy were within 800 yards, and then dived steeply to starboard. The mid-upper gunner had by then got both his guns working again and he fired a good burst into one of the 88's at close range. The Sunderland was just preparing to meet an attack from the second pair when the fire controller saw that one of the port fuel tanks was on fire. The captain decided that he would have to ditch and ordered everyone to take up ditching stations. All the turrets except one were vacated, but the mid-upper gunner continued to fire at the enemy until " M " actually touched the water. The captain tried to land across wind along the swell, but there was too much drift. He therefore turned into wind and at the last moment turned back along the swell, thus cutting out most of the drift. The aircraft was thrown off the crest of the first wave, went down into the trough and bounced again. The captain tried to gain a little more speed, but the port inner motor had become unserviceable and, through lack of flying speed, the Sunderland hit the next wave half way up. The tail turret was knocked off and the aircraft sank within 2 minutes. One member of the crew went down with the aircraft and four of the others are missing. The first and second pilots were last seen clinging to one of the airscrews and are presumed to have gone down with the aircraft. The other two jumped into the water, but owing to the heavy seas and strong wind it was impossible to reach them with the dinghies and they were not seen again. The rest of the crew got away in two dinghies and were picked up 50 hours later by H.M. Destroyer *Saladin*. During the hours of daylight on the 24th and 25th, aircraft kept constant cover over the dinghies.

Good team work and skilful handling were again evident in this action. The Sunderland's crew put up a very fine fight.

Photographic Reconnaissance

In April 106 Wing produced another bumper crop of photographs. On one day of this month we made more negatives and prints than in the whole month of January, 1943. The figures below illustrate the striking expansion of photographic reconnaissance during the past year.

	January, 1943.	*April, 1943.*	*Record Day in April, 1944.*
Negatives	11,954	21,610	14,133
Prints	40,783	69,850	43,883

The total figures for April, 1944 were 354,801 prints and 111,277 negatives. The outstanding photographs of the month were those taken of the battleship *Tirpitz* in Alten Fjord after the attack by the Fleet Air Arm ; of marshalling yards completely devastated by Bomber Command ; and of airfields deep in Germany heavily damaged by United States heavy bombers.

The following reports were written by members of the aircrews concerned.

541 Squadron. Spitfire

On April 22 I was briefed to take damage assessment photographs of Cologne and Dusseldorf and to get photographic cover on both 36-in. and 5-in. cameras of a number of places in the Ruhr around Duisburg and Essen. I also hoped to photograph a strip of the Siegfried Line on my return. After take-off I climbed to 40,000 feet and crossed the enemy coast at Ostend. There was a certain amount of cirrus about and through it I could see a big river. This I took to be the Rhine but after wasting a certain amount of time I realized that it was in fact the Maas. I carried on westward and saw that the whole of the Ruhr and the stretch of the Rhine down to Cologne were absolutely clear, with very little industrial haze—a most unusual state of affairs. I was making a short trail but decided that my height would take me beyond the reach of most of the flak. I approached the southern suburbs of Cologne from the west and then turned sharply and did a run over the town from south to north. I kept to the eastern bank of the Rhine as most of the big industrial plants are in that district. As I turned and did another run from north-east to south-west quite a lot of flak came up well below me. On the next run I saw three big black bursts nearly up to my height but very wide to port and unusually widely separated. I made two more runs over Cologne, but although there was plenty of the lower flak at about 35,000 feet, I saw no more at my own level. I then photographed Munchen Gladbach, and set course for Dusselforf. Here I made a run from south to north and again saw a lot of bursts at 35,000–36,000 feet. However, when I was over the middle of the target three big black bursts popped up exactly at my height and very close, one on either side and one ahead and to starboard. On looking back I was not sure if I had quite covered the whole town so I turned and did a run in a shallow dive at high speed, losing height to about 36,000 feet. I did not see any more close flak.

I went on to the Ruhr area and did three runs over Krefeld, Duisburg, Essen and Bochum. I saw a lot of the 35,000 feet flak but nothing up to my height. I decided that I had pretty well covered the area when I found I had forgotten to turn the 5-in. camera on, so I had to go back and do another run. I then left the Ruhr area and did three long runs up and down the Siegfried Line from Geldern to just west of Munchen Gladbach. This area should really have been covered from a lower altitude to get a bigger scale, but photographic conditions were very

good so I stayed up at 40,000 feet in order to cover a greater area on each run. The Siegfried Line is a large, straggling area, very difficult to pinpoint and usually partially covered by low cloud, so I was anxious to cover as much area as I could in such favourable conditions. Fortunately the photographs were found to be good enough for their purpose.

This was a very satisfactory sortie for me as I had been to the Ruhr several times before and had always found it covered by cloud or thick industrial haze. This time the whole area was cloudless and clear and all the photographs proved to be excellent. I saw no aircraft or trails at any time throughout the sortie.

544 Squadron. Mosquito

We took off from base at 0655 hours on April 14 and landed at Coltishall 45 minutes later to refuel. The duty crew there had our aircraft topped up and in the air again 15 minutes after touching down. Our targets were widespread, extending from the Gdynia–Danzig area to Königsberg and down to Breslau. We climbed across the North Sea over 10/10ths medium cloud into 10/10ths cirrus, which extended up to 40,000 feet. At 29,000 feet we levelled out and stayed at that height for the remainder of the trip. Our first pinpoint was a glimpse of the coast near Stettin, but after that the weather steadily improved and the Gulf of Danzig was almost cloudless. We turned the cameras on over an airfield east of Gdynia and left them on as we flew over Gdynia harbour, where we photographed the cruisers *Hipper* and *Leipzig*. Offshore we sighted the *Admiral Sheer* and the *Prince Eugen* attended by a host of smaller fry. They had obviously just left the harbour. We gave Danzig a couple of runs and then crossed the bay to Pillau, where we found a convoy on the point of entering. Our next objectives were airfields west and east of Königsberg and the town itself. After this we made a run down the east side of Frisches Haven to Marienburg, where we could clearly see the tremendous damage done by the American Fortresses. After photographing various other targets *en route*, we reached the last one near Breslau and set course for Italy. All this time we were leaving a short non-persistent trail, but the Hun did not appear to be interested. We switched the cameras on from time to time over various airfields, particularly in the Vienna area, but the visibility was deteriorating as we progressed southwards. However, when we crossed out at Solta Island in the Adriatic we could see Italy ahead, and landed at San Severo in the Foggia plain at 1340 hours, having been airborne 5 hours 45 minutes from Coltishall.

We took off next day at 1505 hours and climbed towards Venice. We flew from there to Orleans in France at 30,000 feet in 10/10ths cirrus, but the weather cleared slightly in this area, and we caught a glimpse of Le Havre as we crossed the French coast. We touched down at base at 1950 hours, the return journey having taken us 4 hours 45 minutes.

A Mediterranean Convoy Attacked by the Luftwaffe

Between 2145 and 2215 hours on March 19 the enemy attempted a combined torpedo and glider bomb attack on an eastbound convoy north of Cape Sigli. The convoy was not damaged and the enemy lost one He.177 destroyed by a Beaufighter and one Ju.88 which crashed into the sea on the way to the attack.

The enemy's reconnaissance began on March 18 when there were two aircraft in the neighbourhood of our ships. One of these was shot down 35 miles north-west of Habibas Island. The convoy was shadowed throughout the next day and its composition, course and speed were no doubt regularly reported back to base.

The first Radar information of the threatened attack came at 2123 hours when a raid was plotted flying west at 2,000 feet 25 miles north of Cape Sigli.

The enemy employed a mixed force of some 25 to 30 He.111's, Ju.88's and He.177's. Contrary to their habit the Germans did not, as far as is known, provide a fighter escort of Ju.88C–6's.

An interesting feature of this attack was the enemy's use of pathfinder aircraft. Apparently three of these were employed and they tried to mark the convoy with flares. It is reported that bunches of seven flares were dropped in five lines to the seaward side of the convoy. According to Naval reports only the first two of these were at all effective, the remainder being dropped some eight miles north-east of the convoy. It is also reported that the flares were of poor quality.

The attack was a complete failure. The enemy aircraft made their approach at all heights from sea level upwards but most of them flew at 6,000 feet. The bulk of the strike force failed to find the convoy and the attack of those aircraft which did find their target was straggling and poorly executed. Three Hs.293 glider bombs and two torpedoes were seen and a number of underwater explosions were felt. There was no damage to any ship in the convoy.

Beaufighters of **153 Squadron** were scrambled to intercept the raiders. A number of contacts were obtained and lost, but one He.177 was destroyed by a Beaufighter about 60 miles north-east of Reghaia. A German air gunner, who was picked up from the sea, said that he was the only survivor from a Ju.88 which crashed into the sea while flying low on the way to the convoy. The pilot of another Beaufighter sighted what he believes to have been a Ju.288 which took evasive action and escaped. None of the Beaufighters was damaged.

German prisoners of war have frequently stated that they believed that attacks against our convoys would in future be made at night as the more usual dusk attacks were proving too expensive. This night attack made with the help of pathfinders is the first time the enemy has tried these new tactics. Doubtless he will be satisfied with the smallness of his losses, but he can pride himself only on such successes as are provided by Dr. Goebbels. The Doktor's radio claimed that "during the evening hours of March 19 a formation of German torpedo planes in an attack on an enemy convoy off the North African coast damaged five freighters totalling over 30,000 tons.

PLATE 7

Above.—The U-Boat base at Pillau photographed by 544 Squadron. Five U-Boats of 250 tons, ten of 500 tons and six of 750 tons are present. Pillau, which is in East Prussia, is one of the U-Boat training centres in the Baltic. Below.—Gdynia photographed on the same sortie. Both these photographs were taken from about 29,000 feet, the difference in scale being due to the fact that the 36″ lens was used for the upper picture and the 6″ lens for the lower.

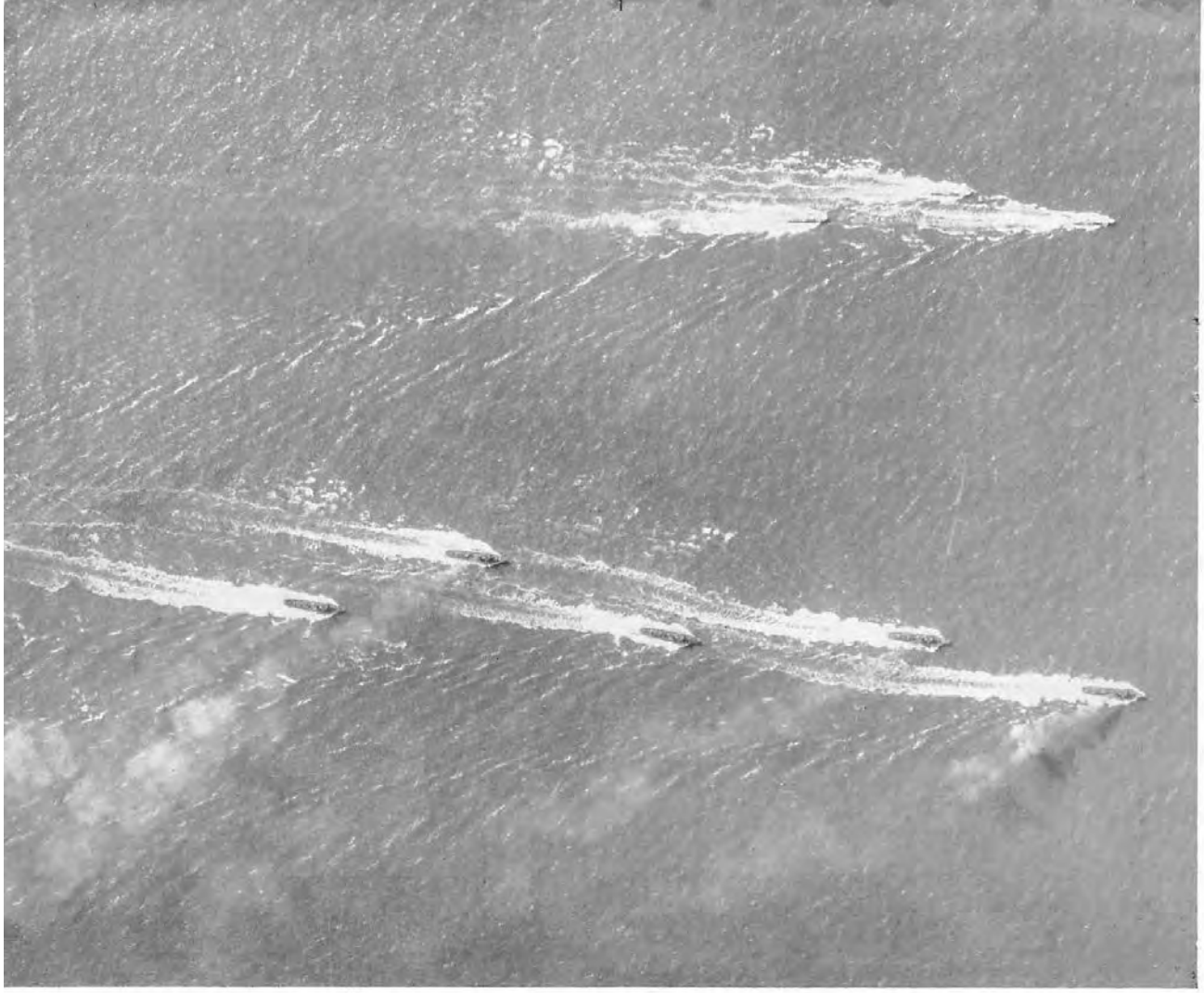


PLATE 8

"M" class minesweepers photographed off Heligoland by 540 Squadron. The upper photograph shows five minesweepers and three R-Boats proceeding in staggered line ahead at 13 knots. Below, two vessels of this class are seen sweeping. One of them is passing through the disturbance caused by the explosion of a mine forty-five seconds earlier.

IV.—SPECIALIST AND GENERAL ARTICLES

Torpedoes

The forerunner of the present-day torpedo was a floating keg-mine, first used about 150 years ago. It consisted of a keg loaded with a small charge of gunpowder and fired by a lanyard running from the keg to the shore. The keg was floated down the stream and when it fouled the target, the lanyard was pulled and the charge set off. The name torpedo appeared in 1805 when Robert Fulton, an American, developed a mine which could be floated against the hull of a vessel and then exploded by a clockwork mechanism. These weapons do not seem to have been very successful and for a time development was restricted to stationary submarine mines. Later, however, there was a revival of attempts to find a means of taking the charge to the target rather than waiting until the target hit the charge.

These target-seeking torpedoes were developed along three lines, the portable, the controlled and the uncontrollable. Portable torpedoes, which were the first really practical weapons, consisted of a charge fixed to the end of a long pole and carried in a small boat. When the attacking boat reached the target the pole was run out over the bow and the charge was immersed. When the charge came into contact with the enemy's hull it was exploded electrically. This weapon was frequently used in the American Civil War and some notable successes were achieved. Nevertheless the explosion was liable to be as dangerous to the attackers as to the victims and when ships began to be equipped with numbers of small guns and searchlights, the odds against successful attacks with spar-torpedoes became too great. However, the Royal Navy has recently demonstrated that this type of weapon is by no means impracticable, for the "Chariot," or human torpedo, is directly descended from these spar-torpedoes.

Controllable torpedoes carried their own motive power and were steered electrically by means of wires which trailed behind the torpedo. The Lay, Sims-Edison and Brennan torpedoes were the best known weapons of this type. The Brennan torpedo travelled underwater and was propelled by the unwinding of two drums of steel wire inside the torpedo. The rotation of these drums was coupled to the propellers and the weapon was steered by varying the speed of unwinding each wire. This torpedo was used for harbour defence in England, but it was obviously unsuited for ships in action.

One of the more interesting types of uncontrolled torpedo was the Howell. Motive power was provided for this weapon by connecting an engine outside the torpedo to the axle of a fly-wheel inside. When the fly-wheel was sufficiently spun up the engine was disconnected and the fly-wheel connected to the propellers. The torpedo was then launched and driven ahead until the fly-wheel stopped.

In 1862 Captain Luppis of the Austrian Navy and Robert Whitehead, an Englishman employed in an Austrian factory at Fiume, developed the first modern torpedo. It weighed 300 lbs., travelled underwater and was driven by compressed air. Its speed, for a short distance, was six miles an hour, and the charge was 18 lbs. of dynamite. By 1887 the Whitehead torpedo had greatly improved and had acquired a speed of 27 knots up to 4,000 yards. The basic mechanical features incorporated in this torpedo are included in the modern torpedo with the exception of a few additional refinements.

It will be naturally understood that up to this period the whole development of torpedoes was designed with the idea of launching them from ships from either above water or underwater tubes. With the advent of torpedo-carrying aircraft some additional modifications to the British torpedo were required. The major ones were :—

(*a*) The fitting of an air delay valve to prevent the torpedo engine running until the torpedo entered the water.

(*b*) The introduction of an air tail to control the flight in air of the torpedo.

The present day torpedo can be divided into four main sections :—

(i) *The head* consists of either the warhead containing an explosive for operational use, or a blowing head for practice running.

(ii) *The forebody* consists of the air vessel and the balance chamber, and fuel and oil bottles.

(iii) *The afterbody* houses the engine room and the buoyancy chamber.

(iv) *The tail* consists of a crown wheel shaft and two propellers rotating in opposite directions, and the horizontal and vertical rudders.

The torpedo is propelled by a two-cycle four-cylinder radial semi-diesel engine developing up to 210 horse-power at high speeds.

The air vessel, which is charged to a pressure of about 2,000 lbs. per square inch, supplies air for working the gyro, the starting valve and the air delay valve, and it maintains a pressure on the fuel bottle which supplies the engine. It also maintains a pressure on the lubricating oil bottle for the lubrication of all working parts.

The torpedo is kept to its set depth by means of a depth gear situated in the balance chamber. This gear consists of a pendulum weight controlled by a hydrostatic valve and a depth spring, and it is the controlling mechanism which transmits rectifying movements to the horizontal rudders. Directional control is maintained by a gyroscope, the movement of which is transmitted to the vertical rudders. The gyroscope, which is in the buoyancy chamber, can be pre-set for straight running or angling according to the method of attack to be adopted. The type of warhead used in the R.A.F. is known as the Mark XII–XVB. The initiation is made by a pistol which is fitted in a pocket on the top of the warhead. Until the torpedo enters the water the pistol is "safe" and it is armed by the action of the water over a

paddle wheel which drives the detonators into the primers. This happens after about 250 yards travel through the water.

Experiments have been made with various types of air tails from the box kite type to the present type. Early tails were fitted with drum control wires, which were wound on to a small drum attached to the aircraft, the other end being attached to the air tail. These wires were made to a pre-determined length and on the release of the torpedo from the aircraft they unwound from the drum. When they reached their full length they imparted a slight check to the tail of the torpedo before breaking, thus placing the torpedo in its correct trajectory for its flight in air. This method was unsatisfactory and a new type of air tail is now in use.

In spite of all devices to control the flight of the torpedo in the air there are still limitations, and a great deal depends upon the attitude of the aircraft at the time of release. The aircraft must be laterally level and all tendency to skid must be avoided, as this will result in an unsatisfactory run of the torpedo. Experiments are constantly being made to widen the limitations imposed on the pilot of a torpedo-carrying aircraft, thus giving him greater tactical freedom.

The torpedo as an anti-shipping weapon has, in spite of its present limitations, great possibilities. In the case of vessels of 4,000 tons and upwards it is more able to inflict severe underwater damage than any other armament weapon, and in the future the development of bigger torpedoes and warheads together with improved and simpler sighting technique will further enhance the possibilities of this weapon.

The Joint Anti U-Boat School

An anti U-Boat School was started by the Navy at Ballykelly in April, 1943, and was attended at first by crews who were destined to serve aboard the Escort Carriers *Archer* and *Biter*. It was important that these crews, who had had no previous experience of anti U-Boat work, should learn the job as quickly as possible. With this end in view they did their training in their own aircraft from Ballykelly and made full use of the R.A.F. facilities which existed there.

The School showed signs of being a success, but there was something lacking. It was not possible to share the experience of those who had actually been engaged on anti U-Boat operations. With the provision of facilities at Maydown in June it became possible to attach Coastal Command aircraft and crews. Air exercises were arranged with escort groups and submarines which were working up. At the end of August the Merchant Navy captains of M.A.C. ships and their air officers began to attend, and in September they were joined by officers from escort vessels. So all the participants in the Battle of the Atlantic were able to work out their problems together, and an idea which had been formed at the Atlantic convoy conference in January began to take shape.

Thus the courses now include men from every branch of the war against U-Boats and the advantages are great. Officers from surface vessels are sent up in aircraft exercising with the escorts, and aircrew go to sea with the ships. In this way each side learns the possibilities and the limitations of the other's equipment. Moreover, Fleet Air Arm and R.A.F. crews are able to appreciate the capabilities of the very different types of aircraft which each service uses, and to learn how air escort is best employed when both carrier-borne and land-based aircraft are available. In fact, the school is a true centre of combined operations.

One of the main lessons to be learnt concerns the importance of ship-to-aircraft communications, and initial lectures are largely devoted to this subject. Only those who have tried can appreciate the difficulties of passing long messages by Aldis lamp, and now that both sides get together there has been a great reduction of bad temper as well as a great improvement in signalling. The whole question is illustrated by one lecturer who, with pardonable exaggeration, claims that in the past only one bout of signalling was really successful: this occurred when the *Queen Mary* was steaming at full speed into a 50 miles an hour gale; when she wished to pass a message to the escorting Sunderland, the aircraft merely flew up and formated alongside and the whole thing was easy.

The history of anti U-Boat warfare is not neglected. The instructors tell of the trials made in the early days of the last war to use a pet seal to locate U-Boats. The wretched creature lived on one of H.M. ships and was kept on a starvation diet. When the ship reached enemy-infested waters the seal was put overboard. It was then supposed to find the refuse released by U-Boats and so lead the ingenious hunters up the trail of their quarry. Another story illustrates Anglo-American co-operation in the Atlantic. It is said that after much signalling between Whitehall and Texas an establishment of one cowboy per A/U vessel was provided. Where a U-Boat was unwise enough to show her periscope the cowboy whirled his lariat and lassooed it. It was then a simple matter to thread a bomb on to the rope and slide it down to the enemy's conning tower.

Apart from learning these historical developments of their art, crews may expect 15 to 20 hours' flying as well as a probable day at sea. A full Escort Group, a dummy convoy, and friendly submarines provide the material on which to practise, and Leigh Light aircraft are exercised in homing on to their targets. Lectures and films are given on all aspects of anti U-Boat warfare and a most comprehensive Tactical Library is available. Particular attention is given to the enemy's tactics and to his anti-aircraft equipment and new tactics are tried out to counter those of the enemy. Once they have got used to "eight bells," "liberty-boats," and other nautical ways Coastal Command crews cannot fail to benefit from the contact with their opposite numbers in the Navy and from the frank discussions on difficulties, failures and successes. The school is doing fine work in promoting inter-service co-operation to the ultimate damnation of all U-Boats.

In the course of a strike off Borkum on April 18 by the North Coates Wing, R.P. and cannon attacks were made on two armed trawlers, both of which were sunk. In these photographs, one of them is seen blowing up.

PLATE 10

These fishing villages were photographed by Nos. 333 and 162 Squadrons respectively. The upper picture is of Gripholm on the west coast of Norway and is typical of the many such communities seen by our aircraft patrolling that coast. The lower photograph shows Heimaey in the Westmann Islands, south of Iceland. The livelihood of this village depends entirely on catching, curing and salting fish.

Works and Bricks

Works and Bricks, otherwise the Air Ministry Works Directorate, comes in for a good deal of caustic comment in the R.A.F. But if those who wonder bitterly whether the runway will ever be finished, had an idea of the enormous task of this department, their criticism might well give way to astonishment. In October, 1939, for instance, there were 190 R.A.F. stations in this country; in November, 1943, there were 884, not including such units as Recruiting Centres, Embarkation Units and similar small detachments. This increase was produced by A.M.W.D.

The increase in the number of Airfield Stations is even more striking. In April, 1936, there were 53 such stations; in March, 1944, there were over 600. About 300,000 acres of the British Isles are now occupied by airfields. Moreover, the size and the quality of these airfields has changed immensely. The establishment for a standard Bomber station has almost doubled since 1940 and instead of three runways of 1,000 yards such a station now needs one runway of 2,000 and two of 1,400 yards.

All these changes have meant Major Works Services—sometimes costing as much as half a million pounds per station. In March, 1943, in addition to the contracts for new stations, major extensions (*i.e.*, between £20,000 and £500,000 in value) were being made on no less than 443 existing stations. To appreciate what this means it is necessary to realize the difficulties involved in undertaking such work in wartime. Men and materials must be found though both are in short supply; transport and supervision have to be arranged, and yet the time programme must be kept as closely as possible.

The provision of runways, perimeter tracks and hardstandings is one of the biggest jobs. Apart from the building of new runways very many extensions are always in hand. Moreover, the work of extending runways almost invariably has to be done while the station remains open for operational flying. The area of paved runways, tracks and hardstandings is now about 160 million square yards. This is about the same area as that of all the land within the boundary of the City of Edinburgh; it nearly equals the area of the City of Birmingham, which has over a million inhabitants. It is also the equivalent of a 30 feet road stretching for 9,000 miles.

Emergency runways now being provided at some airfields are 3,000 yards long and 250 yards wide, which means that each runway is equivalent in area to 40 miles of main road. Though some of these changes may cost about a million pounds, they are classified as mere extensions.

So far the airfield programme has meant the carriage and use of over 7½ million lorry-loads of ballast and cement, so that the transport problem has often been very difficult. These figures take no account of hutting, steel for hangars and other items necessary for building an airfield.

But airfields are by no means the only stations in the R.A.F. Since 1939 over 275 non-airfield stations have been built and many others enlarged. Some of these stations, such as aviation fuel depots, bomb and ammunition dumps, R.A.F. hospitals, and A.S.R. bases are major constructional jobs. There is also a multitude of minor works to be put up, such as bombing ranges, headquarters, etc.

Over 50 new airfields have been built for the U.S.A.A.F. and the Americans themselves have built 14. In these cases the A.M.W.D. supplies all the materials and has a Resident Engineer with his staff on each site.

The difficult man-power situation has always kept the labour force inadequate. The highest total was reached in October, 1942, when 127,000 men were employed, but this figure has since declined considerably. The Directorate's requirements have constantly been cut down, but even the cut figure has not been available. Nor is the labour of the best type. Most of the younger and fitter men are in the Services and wartime conditions have had their effect on the remainder. On the whole the men have done well. The conditions in which the great majority have had to live (especially on new sites) have not always been appreciated. Sites are often miles from anywhere and the men have had to work in a sea of mud in bad weather with primitive accommodation and facilities.

In addition to new construction there is an ever increasing volume of maintenance work, particularly operational maintenance, that is, repairs to landing grounds, runways, lighting systems, etc. This work does not carry priority for labour supply and it is often a problem to get even a minimum labour force for remote stations.

Works and Bricks is in charge of construction abroad as well as at home and over 100 new landing grounds and stations have been built overseas. From Iceland to West Africa and from Ceylon to the Azores an enormous amount of work has been done and great difficulties overcome. In Malta, for instance, enemy bombs, and the shortage of supplies, labour and plant did not prevent the work being finished by the target date, so that all was ready for the operations against Sicily.

When you see a new airfield about to be occupied—with its great expanse of landing ground, its huge runways, perimeter track and dispersal areas, the accommodation, roads, water and electricity supply, W/T stations, drainage, etc.—it is not always easy to imagine the same site some nine months earlier occupied by fields, hedges, woods, ditches and farm buildings. Multiply this several hundreds of times and you will have some idea of the task which Works and Bricks has accomplished.

Some Problems of H/F Wireless Communications

It is probable that many aircrews and others have been puzzled by the vagaries of W/T communication. Wireless operators do, or should, know why conditions are better at some times than at others, and why different frequencies are used at different times and places; but to those who are not technicians such things may seem inexplicable. There are, however, excellent reasons for everything that is done.

Wireless waves travel by two separate paths—the ground route and the sky route. The ground ray, however, becomes rapidly attenuated, the degree of attentuation increasing with the frequency. Thus with a high frequency the range of communication is small, whereas with low or medium frequencies much longer ranges are attained. It is, however, the sky route which makes really long distance communication possible. This is due to a highly complicated phenomenon known as the ionosphere. This is an ionised layer of gas at a height of about 100 kilometres from the earth, which has the property of reflecting wireless waves. Waves so reflected will reach the earth again at a greater distance than they would have done if they had followed the ground route and, by being reflected several times, they can be transmitted over still greater distances.

Unfortunately this property of reflection has its complications: firstly the density of the layer varies from day to day and also throughout the 24 hours of each day; secondly, the height of the layer varies similarly, being higher during the night than during the day and having a greater average height in winter than in summer; thirdly, the higher the frequency of the waves the more they are likely to penetrate the layer rather than be reflected by it. Moreover, the ability to be reflected depends not only on frequency but also on the angle of incidence. If a transmitter sends out rays in all directions, some will go vertically upwards and strike the ionosphere immediately above the operator's head. These rays will not be reflected, but will penetrate the layer. But the rays which strike the layer further away from the transmitter will hit at a shallower angle and will have more chance of being reflected. Beyond a certain angle, that is beyond a certain distance from the transmitter, all rays will be reflected.

Similarly, if a fixed angle of incidence is taken (or a fixed distance), all rays above a certain frequency will penetrate the layer and all rays below that frequency will be reflected.

Two important points emerge from this: firstly for a given frequency there is a minimum distance at which sky ray reflection is possible; and secondly, for communication between any two points there is a maximum frequency which can be used for conditions existing at any one time: a shorter distance or a greater frequency, respectively, would cause the rays to penetrate. Also, it can be seen from the second point that if the height of the ionised layer varies, the maximum frequency will also vary, going down as the ionosphere rises and up if it falls. This explains why operational frequencies are higher by day than by night. Moreover, the further the waves are below the maximum possible frequency the greater is the attenuation of the waves and consequently the lower the signal strength. It is, therefore, always desirable to work at the highest possible frequency.

As the height of the ionosphere varies it will be realized that good H/F communication is not easy. Suppose that a highly reliable communication system is required between two points. If the system is to work 24 hours a day all the year round, the optimum frequencies must be worked out for various times of the day, and alternative frequencies must be provided for use at different seasons of the year. There are charts which give the predicted indication of these frequencies, but they are necessarily only guides and not prophecies. In such work experience is the most important factor.

The question is further complicated by the fact that the ionosphere is subject to irregular disturbances which will make it almost impossible for communication to be established. However, there exists a laboratory where observations are kept and expected disturbances promulgated. By this means it is possible, to a limited extent, to predict difficult conditions.

This whole subject is most complicated and an attempt to simplify it in non-scientific terms may well displease the technicians. Those, however, whose knowledge of wireless is rudimentary may perhaps understand why it is not always the wireless operator's fault when he "can't get through," and that changes of frequency are thought out with a definite purpose in mind.

Homing by GEE

A Sunderland recently reached its base at Pembroke Dock in very bad weather, the visibility being practically nil. The Radar had failed and it was found necessary to use GEE to home into the Haven mouth and up the harbour. The homing proved highly accurate and only 11 minutes elapsed between the decision to use GEE and the moment the Sunderland was waterborne. Without GEE the Q.G.H. procedure would have been used and would have taken four times as long.

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