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SELECTED ABBREVIATIONS

AAR	Air-to-Air Refuelling
AD	Air Defence
ADR	Air Defence Region
AEW	Airborne Early Warning
AGI	Intelligence Gathering Auxiliary vessel
ASUW	Anti-Surface Unit Warfare
ASV	Air-to-Surface Vessel (radar)
ASW	Anti-Submarine Warfare
C3 (and C3I)	Command, Control, Communications (and Intelligence)
CAP	Combat Air Patrol
ECM	Electronic Counter Measures
ESM	Electronic Support Measures
FOB	Forward Operating Base
IN	Inertial Navigation/gator
JMC	Joint Maritime Course
JMOTS	Joint Maritime Operational Training Staff
JTIDS	Joint Tactical Information Display System
LGB	Laser Guided Bomb
LOPRO	Low Probe
MOTU	Maritime Operational Training Unit
MPA	Maritime Patrol Aircraft
NAS	Naval Air Squadron
NDB	Nuclear Depth Bomb
ORBAT	Order of Battle
QRA	Quick Reaction Alert
SACLANT	(NATO's) Supreme Allied Commander Atlantic
SAG	Surface Action Group
SAR	Search and Rescue
SARAH	Search And Rescue And Homing (Beacon)
SARBE	Search And Rescue Beacon Equipment
SOSUS	Sound Surveillance System
SSBN	Nuclear-Powered Ballistic Missile Submarine
SSG	Guided Missile Submarine
SSGN	Nuclear-Powered Cruise Missile Submarine
SSN	Nuclear-Powered Attack Submarine
SURPIC	Surface Picture
TACDI	Tactical Direction
TASMO	Tactical Air Support of Maritime Operations (TASMO)

MARITIME OPERATIONS
RAF MUSEUM, HENDON, 7th APRIL 2004

WELCOME ADDRESS BY THE SOCIETY'S CHAIRMAN

Air Vice-Marshal Nigel Baldwin CB CBE FRAeS

Ladies and Gentlemen. Good morning and welcome to the recently refurbished Close Brothers Military Services Lecture Theatre. It is a privilege for us to be amongst the first to use it, indeed it will not be formally opened until next Tuesday. It looks so comfortable that I can see already that the afternoon speakers are going to have a particular challenge. As always, we are grateful to Dr Michael Fopp and his colleagues here at the Museum for letting us use their facilities yet again.

I am delighted to be able to introduce Air Chief Marshal Sir Michael Stear to keep today's show on the road. He began his RAF career as a National Serviceman, teaching Chinese, before going to Cambridge. He finished as Deputy Commander in Chief of Allied Forces Central Europe. In between, he survived a PSO's tour with our President, flew Hunters and Phantoms, with both the RAF and the USAF, and commanded Gütersloh when it was a Harrier, Puma and Wessex base. He was Air Cdre Plans at Strike Command, AOC 11 Group at Bentley Priory and an Assistant Chief in the Defence Staff and then, of much relevance for us this morning, AOC 18 Group at Northwood. So, he came late to the maritime scene but that will not diminish his authority today.

Sir Michael, you have control.

INTRODUCTION BY SEMINAR CHAIRMAN

Air Chief Marshal Sir Michael Stear

From our Chairman's introduction, it may appear that I came late to the maritime role with my appointment in 1989 as AOC 18 Group. In reality the 'flexibility of air power' was well demonstrated during my second Hunter tour as the Pilot Attack Instructor on No 208 ('Naval 8') Sqn based in the Persian Gulf. Maritime Strike and Air Defence both featured in our wide-ranging operational tasks there. We were involved in maintaining the operational readiness of the RN's frigates and destroyers in theatre, attacking at dawn, using what scant radar masking we could get from the coast of Qatar, and providing realistic high speed targets for the gunners on the resident minesweepers firing 'break up' shot.

Later, of the two Phantom squadrons which I was fortunate enough to command, one, No 56 Sqn, was part of the UK Air Defence Force. At least 90% of that time I spent over the sea. As AOC 11 Group I seemed to spend as much time dealing with the RN as I did with the RAF – hence, I believe I can reasonably claim a fair grounding in maritime affairs before arriving at Northwood!

The timing of today's seminar on maritime operations is particularly appropriate just three weeks after the magnificent Service of Thanksgiving in Westminster Abbey, arranged by the Maritime Air Trust's President, Air Chf Mshl Sir John Barraclough and attended by HM The Queen and HRH The Duke of Edinburgh, the Trust's Patron, and Prince Michael of Kent. On Her Majesty's behalf the Dean dedicated the most evocative memorial, created in the South Cloister, to the memory of those who served in Coastal Command and its successor formations, after which Her Majesty laid a wreath.

As the Maritime Air Trust's objectives are both in tune with and relevant to those of the Royal Air Force Historical Society, a few words on its aims are also apposite to today's proceedings. Under the headlines: A Tribute to the Past and our Commitment to the Future, The Untold Story and The Unpaid Debt, The Maritime Air Trust's Project *Constant Endeavour* states: 'The aim, under Royal Air Force Coastal Command's proud motto and Battle Honour, is to mark the sacrifice and contribution of all those who served with the Command and its overseas squadrons during World War Two, together with its

successor formations in later campaigns, and to promote a wider public understanding of those signal contributions to the cause of freedom.'

Its objectives are, therefore: 'To advance the education of the public in the history of the contribution of land-based maritime air power to victory in World War Two and in subsequent conflicts:

1. by the erection and maintenance of a commemorative tribute to all men and women who served in or with Coastal Command and its successive formations, including those from the Commonwealth and Allied Air Forces, and others similarly engaged in overseas theatres of war and conflict, and;

2. by assisting museums, centres of learning and the media in portraying and developing this record of British Maritime Air Power and its enduring importance to our Nation.'

Enough preamble, it is going to be a tightly packed and very busy day; so I think that we should make a start.

Although Coastal Command operated many different types over the years, the Sunderland is probably the most iconic of them. This one is a post-war Mk 5 of No 201 Sqn.

THE EVOLUTION OF BRITISH MARITIME AIR POWER DURING WW I

Wg Cdr Jeff Jefford

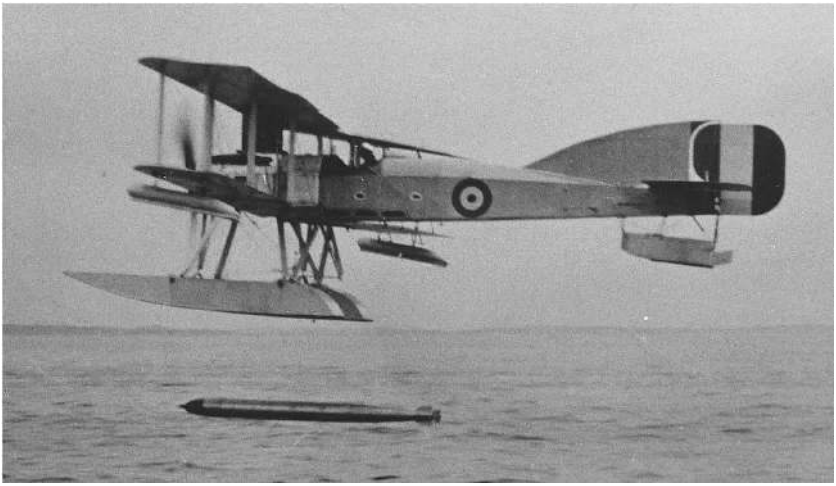
'Jeff' joined the RAF in 1959 as a pilot but (was) soon remustered as a navigator. His flying experience included tours with Nos 45, 83 and 50 Sqns and instructing at No 6 FTS. Administrative and staff appointments involved sundry jobs at Manby, Gatow, Brampton and a total of eight years at HQ Strike Command. He took early retirement in 1991 to read history at London University. He has three books to his credit and has been a member of the Society's Executive Committee since 1998; he is currently editor of its Journal.

'British Maritime Air Power in WW I' in 30 minutes is bit of a tall order so what you are going to get is bound to be a bit superficial – some width but not too much depth. Neither do I have any startlingly new insights to offer; everything that I have to say has been said before so all I am aiming to provide is a brief refresher course on the remarkable achievements that made the UK the indisputable world leader in the field of maritime aviation by November 1918 – both quantitatively and qualitatively.

I need to limit the breadth of my canvas which I will do by posing three questions. When?, Where? and What?

Because of the limited performance of the aeroplanes of the day, the operational capacity of early naval air was pretty limited, so I shall be concentrating, although not exclusively, on the *real* capabilities that were beginning to crystallise by 1917-18, rather than the potential of 1915 and earlier. So that is 'when'.

Although naval air was involved in most of the so-called 'side-show' campaigns, we shall not have time to examine any of these overseas activities so 'where' is going to be home waters, and mostly the North Sea. As to 'what', while the RNAS pioneered the use of armoured cars and strategic bombing and flew, what we might call, 'conventional' air operations in France, the constraints imposed by the time available precludes our examining these aspects so 'what' has to



The Short 184 could lift a 14-inch torpedo, but its operational capability was then little more than notional. (J M Bruce/G S Leslie)

be strictly confined to air/sea warfare.

Having identified what is to be excluded, I need to impose some sort of structure on what is left so I shall deal with it under four broad headings: anti-shipping; reconnaissance; anti-submarine and land attack. If we consider each of these in turn it should reveal some of the difficulties that were encountered, the measures that were adopted to overcome them and take in the evolution of the aircraft carrier along the way.

Anti-Shipping

We will do the easiest one first – anti-shipping. 'Easy' because it never really happened. The potential of the airborne torpedo, using floatplanes as the means of delivery, had been recognised from the outset. But floatplanes, especially the early ones, proved to be a bit too flimsy, apart from being cumbersome to unfold, launch and recover. The ubiquitous Short 184 was notionally capable of delivering a 14-inch torpedo, but to get airborne with this 800 lb load required ideal sea conditions – a light breeze and a slight chop (not too little and certainly not too much) – an engine giving full power (not always the case) – and it meant doing without an observer and carrying fuel for only 45 minutes or so – and even then ceiling was unlikely to be much

more than 1,000 feet.

There were three early successes in the Dardanelles in 1915, which showed that it could be done, but that was it. In home waters the German High Seas Fleet sortied only infrequently, so there were rarely any worthwhile targets in any case. Nevertheless, development continued and the purpose-built Sopwith Cuckoo torpedo bomber was entering service just as the war ended. The Cuckoo, with its half-ton, 18-inch torpedo, did represent a realistic manifestation of maritime air power and at one time there was even a proposal to mount a 120-aircraft strike against the German Navy in harbour. This very ambitious scheme was probably a war too early, but its effectiveness would eventually be demonstrated at Taranto and Pearl Harbour in 1940-41.[1]

Reconnaissance

So, let's move on to reconnaissance. Reconnaissance at sea was supposed to be done by fast cruisers with which the Royal Navy was amply supplied. The Germans had spent most of their pre-war budget on battleships with which it planned to defeat the British in a major fleet action. The wheels came off this plan when the British adopted a strategy of 'distant containment' – lurking at anchor in the Orkneys, which effectively blockaded the entire North Sea.

If and when the Grand Fleet ever did leave harbour the Germans needed to know about it, and quickly. Rather than trying to plug the cruiser-gap with ships, which would take about three years to build at a cost of half-a-million 1914-pounds apiece, they opted for very large rigid airships which could be constructed in about six months for a mere 'fifty grand'. The Germans eventually built more than 140 of these monsters, about half of which saw service with the navy over the North Sea. Their activities were not confined to reconnaissance, of course, and being almost invulnerable to interception, to begin with at least, their potential as bombers was exploited to mount some very alarming air raids on the UK.

While the Royal Navy had opted to stick with the traditional cruiser for scouting purposes, like generals wanting to see what was 'on the other side of the hill', cruiser-based admirals wanted to see 'over the horizon'. The answer, in both cases, was aeroplanes which, in the naval case, meant aeroplanes that could operate from ships *and*

ships that could keep up with the Fleet. Easier said than done at the beginning of WW I when the conventional 'flat-top' was no more than a hazy idea. The first three aviation vessels, *Empress*, *Engadine* and *Riviera*, were seaplane carriers adapted from fast passenger steamers. A hangar was provided towards the stern – not unlike the helicopter hangar on a modern destroyer – and they were provided with derricks with which to launch and recover their floatplanes.

It worked, up to a point, although these ships, which had been specifically selected for their 20-knot speed, had to stop while flying was taking place, which meant that they could not keep station with the cruisers that they were supposed to be supporting, which, at the same time, left the carrier unprotected.

Deck space was at a premium and, largely because of the flimsiness of contemporary aeroplanes, the seaplane carrier concept was not entirely successful, especially in the relatively rough waters of the North Sea – although it was not for want of trying.

The next stage in the evolutionary process was to capitalise on pre-war experiments by constructing launching ramps on a number of the navy's aviation vessels, most of which were 3,000 tonners. The result was a rather untidy arrangement with the box-like hangar grafted on forward of the fantail from which floatplanes could be lowered over the side and a steeply sloping flying off deck for wheeled aeroplanes erected in front of the bridge and running down to the bow.

With up to 20 kts of headway to provide a wind over the deck there was sufficient room to get a single-seat fighter airborne with the aim (or perhaps hope) of bringing down a reconnoitring Zeppelin. The problem, of course, was that, having launched it, there was no way to recover a wheeled aeroplane and, unless the pilot could reach the coast, he had no option but to ditch.

In the context of reconnaissance, I can hardly avoid making some reference to Jutland. I am no naval historian so I decline to enter the debate as to who won. Suffice to say that the Grand Fleet's aviation ship was the 18,000-ton ex-Cunarder, *Campania* and its ten aeroplanes just might have made a significant contribution, although that is not a foregone conclusion. Unfortunately, although she was prepared to sail, she missed the order to do so. Several hours later she set off in pursuit but, sailing unescorted in the face of the substantial submarine threat, Jellicoe ordered her back to port.

That left just the four seaplanes aboard the much smaller *Engadine* sailing with Beatty's cruisers. She was eventually ordered to launch an aeroplane, a procedure that took about half-an-hour and required her to heave to. The crew of the Short two-seater, FSL Rutland and Assistant Paymaster Trewin (the latter's rank providing a mute comment on the RNAS's policy on the provision of back-seaters at this stage of the war[2]) found and correctly identified Admiral Hipper's cruisers and registered that they were now steering a radically different course. Three W/T messages were successfully passed to *Engadine* but, sadly, 1916-era comms were such that *Engadine* was unable to relay this intelligence to anyone else. Fortunately, one of the scouting cruisers had also observed Hipper's change of course and it was able to inform Beatty.

The Germans had not had much luck at Jutland either. They deployed two waves of five Zeppelins each but only two made any kind of contribution, of which one was one entirely counterproductive (in that it, quite inexplicably, reported a non-existent concentration of shipping) and the other inaccurate. I think that we have to sum up the only participation of naval air in a major fleet action during WW I as a missed opportunity – for both sides. The aviators were there, doing what they could, but the state of the art was not yet really up to the job.

Anti-Submarine

Always a threat, the U-boat became a real menace in February 1917 when the Kaiser took a calculated risk and lifted all restrictions on submarine warfare, thus provoking the USA into declaring war. It was a race against time; Germany's U-boat captains had to persuade the British to sue for peace before America could complete its mobilisation. Shipping losses immediately rose frighteningly, almost doubling to an unsustainable 520,000 tons in February alone (almost equalling the 542,000 tons of new merchant shipping built in British yards in the whole of 1916) and peaking in April at more than 800,000 tons by which time it began to look as if the German gamble might actually come off. That it failed was due, in some measure, to maritime air power.

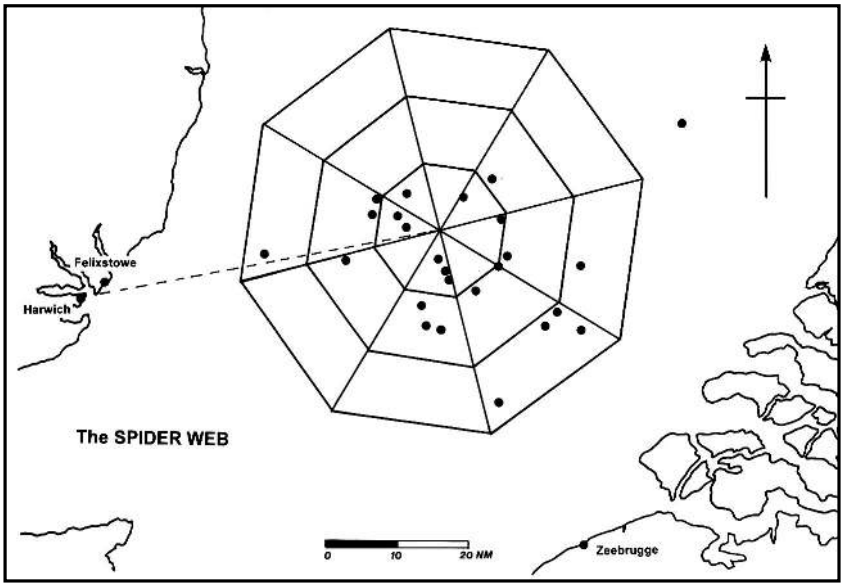
The earliest anti-submarine patrols had been flown by shore-based floatplanes, the idea being that floats provided a fair chance of

alighting successfully in the quite likely event, in 1914-15, of engine failure. If the crew could fix the problem they could take off again and, if not, their aeroplane provided them with a makeshift life raft while the sea slowly took it apart beneath them. The problem with floatplanes, was that they were so very susceptible to the sea state and prone to sustain damage, even when operating from relatively sheltered coastal waters. Their size also restricted their utility but they remained in use throughout the war and they did make a useful contribution by conducting inshore patrols.

Flying boats were a much better proposition for two reasons. First, they were far more robust than floatplanes and thus better able to withstand a battering from the sea. More importantly, however, they were better because they were bigger. A Felixstowe F.2 weighed about five tons, had twice as many men on board as a floatplane (four pairs of eyes instead of two) and could carry twice the bomb load double the distance – or remain on station far longer.

The U-boats were based on the Belgian coast and made their way out into the South West Approaches via the bottleneck represented by the Channel. Air power was employed in an attempt to put a cork in the bottle. This took the form of the famous Spider Web, the patrol area having a diameter of some sixty miles. The first patrol was flown in April 1917. Ignoring the sort of performance figures that tend to be quoted in the 'Boys Bumper Book of Aeroplanes', in reality, a Felixstowe 'boat actually droned along at about 60 knots so it would take it an hour to cross from one side of the pattern to the other and another hour to get back to where it had started, not forgetting to add the 30 miles to and from the end of the nearest spoke from its base at Felixstowe, which is another hour. That comes to three hours all told, without actually having made much of a 'search' or any allowance for the weather. Bear in mind that a 30 kt wind has a considerable effect on a 60 kt aeroplane; a 60 kt wind will stop it dead in its tracks.

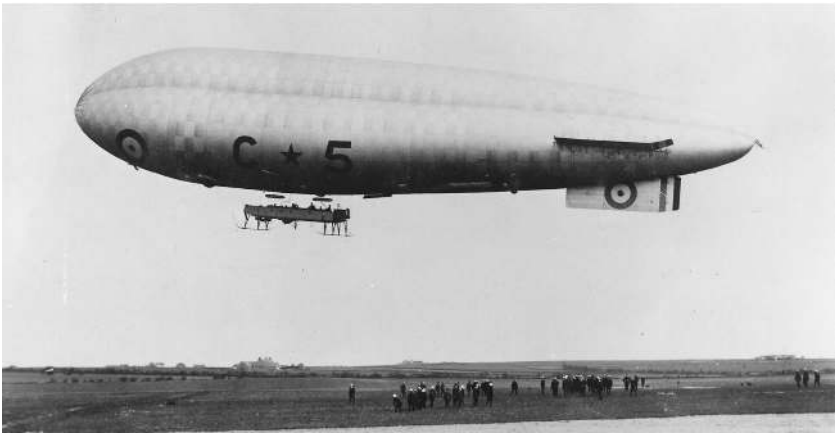
Each of the forty-seven symbols on the drawing represents a submarine sighted and/or bombed (note that I specifically do not say 'sunk') during the first twelve months, that is to April 1918, and the advocates of the Spider Web certainly believed that it had fulfilled its purpose. I think, however, that that is debatable. Without wishing to detract from the efforts made by the men who flew the patrols, the fact is that they did not actually prevent German submarines from getting



The Spider Web. Forty-seven incidents between April 1917 and November 1918 but only one sinking.

through and, with hindsight, I think that the effort would have been far more productively spent on convoy escort. Nevertheless, according to figures compiled by Douglas Hallam, the original CO of the Felixstowe War Flight, by the end of October 1918 his unit had flown 3,349 hours in the course of carrying out 1,073 patrols for an average sortie length of a little over three hours, although the longest was nine. The cost had been twenty-eight 'boats, but only ten lives. The average life of each boat lost was 78 flying hours. Those figures relate only to Felixstowe, which was not the only station to operate flying-boats; another early one was set up at Trescoe, in the Scillies, whence another 373 patrols were flown at a cost of three more lives and nine more aeroplanes. Additional flying boat stations were established later at Great Yarmouth, Houton Bay, Killingholme and elsewhere.

The non-rigid airship was another useful anti-submarine asset. Well over 200 airships had been delivered before the war ended when about half of them were still in commission. They offered very long endurance – the biggest of them, the 260-foot long North Sea Class, carried two five-man crews and routinely stayed out for 20 hours at a



*The Coastal Star-class airship C*5 lifting off from Longside. Note the size of the ground handling party; twice as many men would be needed on a breezy day. (J M Bruce/G S Leslie)*

time. Despite their rather ungainly appearance, non-rigids were no mean performers and they could certainly manage 40 kts or even more if they had to. They were not toothless either; a North Sea was armed with three Lewis guns, to detonate mines, and could carry six 230 lb bombs. They would not have coped very well with an attack by a 'proper' aeroplane, of course, but, generally speaking, most British airship operations were flown within a benign air environment.

On the downside, while airships were manoeuvrable enough in flight, they could be a handful close to the ground where they were very susceptible to gusts of wind, especially when being walked in or out of their large (and very expensive) sheds. The ground-handling problem was very labour intensive and, for a large rigid, could involve several hundred men. Incidentally, while most of us are familiar with the airship sheds that dominate the skyline at Cardington, we may not all appreciate that no fewer than sixty-one of these huge structures were erected around the UK during WW I, absorbing enough steel to have built a dozen destroyers.

While non-rigids (or blimps) could be frisky close to the ground, they did not require quite such large numbers of handlers as the big rigid ships, but they did suffer from another drawback in that they were vulnerable to engine failure. While the lift was generated by

hydrogen, the envelope's shape was maintained by air blown in by the propeller(s). If the engine stopped the ship would slowly deform, making it uncontrollable and it would finish up on the ground – or sea.

While airships were useful for patrol and reconnaissance work, their greatest contribution was as convoy escorts – and it was, of course, the convoy system that began to be introduced from May 1917 that actually provided the single most significant counter to the U-boat threat.

There was a second lighter-than-air factor in the anti-submarine equation – the innocuous looking kite balloon. Originally introduced to control shore bombardments by naval artillery, and used with some success for that purpose at Gallipoli, the naval kite balloon eventually came into its own for convoy escort work. From 3,000 feet its horizon was about 60 miles away. There was little chance of a tiny periscope being sighted at anything like that distance, of course, but the relatively large balloon was pretty visible to a submarine. Since the U-boat captain knew that the balloon would be tethered to a warship sailing in concert with others, that was usually sufficient to deter all but the most determined (or foolhardy) from making an attack.[3]

This deterrent characteristic of *air*craft takes us back to aeroplanes, but this time, land-based ones. If a mere balloon could keep a submarine at bay, an aeroplane would surely be even more effective. From May 1918, at the instigation of Capt Robert Groves, redundant DH 6 trainers began to be assigned to coastal patrol work. The idea caught on and the initial handful of DH 6 flights multiplied to fill the gaps in seaplane coverage until most of the coasts of England and Wales were under relatively constant surveillance. In practice, of course, the DH 6s were almost as harmless as the kite balloons, nevertheless they reported sixteen sightings of submarines and attacked eleven of them, although, unsurprisingly, with no tangible result.

By late 1917 the early problems with the reliability of engines had been largely overcome which meant that, as with the DH 6, it was no longer considered essential for a maritime aircraft to be a *sea*plane. Landplanes, which did not have to pay the weight and drag penalty involved in floats and hulls, had a much better performance, and could do without the complex infrastructure of tenders, slipways, winches, beaching trolleys and other such nautical paraphernalia.

In terms of their effectiveness as anti-submarine aircraft, Coastal Command's Ansons of 1936 were little better than the Blackburn Kangaroo of 1918.

Even more importantly, landplanes were far less susceptible to the weather. Basing his conclusions on the experience he had gained while directing RNAS activities from Dunkirk, in September 1917 Capt Charles Lambe pointed out that landplanes could operate on three times as many occasions as seaplanes. Since landplanes were clearly a 'force multiplier', the RAF planned to introduce much more capable land-based patrol aircraft, the Kangaroo, the Vimy and the DH 10. Of these, only a handful of Blackburn Kangaroos actually saw service but, as has been pointed out elsewhere, with an endurance of eight hours and a 1,000 lb bomb load these aircraft were probably just as effective as the Ansons with which Coastal Command would go to war twenty years later.

Apart from more capable and reliable aeroplanes, some quite sophisticated kit was beginning to appear, notably hydrophones. These eventually had a directional facility, providing two or more flying boats, down on the surface, with the ability to fix a submarine's position by triangulation, permitting another to carry out an airborne attack. A variation on the theme had been developed for airships which could turn into wind to 'hover' while dunking the sensor. There were no positive results before the war ended, but the system was just

	w/ending 18 Aug 17	w/ending 17 Aug 18
No of Patrols		
Aeroplanes	115	3,481
Airships	79	273
Kite Balloons	5	17
Hours Flown		
Aeroplanes	260	3,355
Airships	368	2,216
Kite Balloons	151	626
Miles Flown		
Aeroplanes	15,749	202,842
Airships	10,556	52,789
Kite Balloons	1,958	6,180
Submarines Sighted		
	7	12
Submarines Attacked		
	3	9

Fig 1. Maritime air effort for weeks ending 18 Aug 17 and 17 Aug 18.

beginning to be deployed and you can see the potential.

So what was the scale of all of this activity? Writing in 1934, Admiral Jellicoe states that by the end of 1917 we were sinking U-boats at much the same rate as they were being built and that 'the situation could therefore be said to be in hand.'[4] That conclusion probably involved a degree of hindsight, and I doubt that he was all that confident at the time. Nevertheless, when the corner was actually being turned, in November 1917, the resources committed to the campaign by naval air had amounted to about 200 aircraft and 50 airships. By the time that the RNAS ceased to exist this force had grown to 270 aeroplanes plus 70 airships but the RAF would more or less double this total over the next seven months or so.

So what did this substantial force achieve? Well, for one thing, a great deal of flying. Figure 1 shows the work done by the RNAS during the second week of August 1917 and by the RAF in the corresponding week in 1918, a roughly 800% increase in flying hours. At the time, it was believed that many U-boats might have been sunk but the contemporary claims of the enthusiastic submarine hunters were as overoptimistic as those of the fighter pilots on the Western Front. Post-WW II analysis, indicates that only one submarine (the UB 32) had actually been sunk at sea solely by air attack. Not much to show for a great deal of effort then.

Or was it? Sinking submarines was actually only a means to an end, not an end in itself. The campaign was not really about sinking submarines; it was about not letting ships be sunk. As Alfred Price has pointed out, U-boats managed to sink 257 merchantmen sailing in convoy during the last 18 months of the war but of these only two were lost from convoys enjoying an aerial escort. And that is a real measure of the contribution of maritime air power.

Land Attack

If the German Navy was disinclined to put to sea, and early wartime aeroplanes were unable to reach Zeppelins in flight, the answer was to go after them in their lairs and the RNAS mounted a number of raids on land targets. The problem – or one of them – was how to get there. A flying boat might be able to fly for six hours or so but at 60 kts that gave you a radius of action of no more than 180 miles, less than half of the distance from Felixstowe to Kiel.

So, how was the navy going to get an air striking force close enough to its targets in north west Germany? Obviously, it would take them there on ships and as early as Christmas Day 1914 seven floatplanes (out of nine launched) from the seaplane carriers *Empress*, *Riviera* and *Engadine* attempted to bomb the Zeppelin sheds at Cuxhaven. Although all of the crews survived, only three of the aeroplanes made it back to the ships. They had not destroyed any airships but they had scattered enough small bombs around to give the Germans a fright. This was not a one-off undertaking and more raids were planned, indeed between March and June 1915 seven further operations were actually mounted, but all failed for one reason or another – ships broke down, the weather intervened, aircraft were

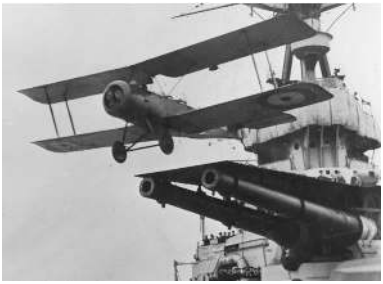
Water-skiing in a Sopwith Camel. (J M Bruce/G S Leslie)

damaged being launched or failed in flight, pilots got lost or were unable to find their targets.

In May 1916 the RNAS made a determined attempt to bomb Zeppelin sheds at Tøndern and the outcome shows just how difficult this seaplane business really was. Eleven single-seat Sopwiths were launched by *Vindex* and *Engadine*: four broke their propellers; three suffered engine failures and one was capsized by the wake of a destroyer. Of the three which managed to take off, one hit the wireless aerial of a ship and crashed, fatally, and another returned with an engine problem. Only one aeroplane (out of eleven!) managed to deliver its two 65 lb bombs – which were actually dropped on Danish territory – and the navy finally accepted that fragile floatplanes were simply not the answer.

So how else to get a relatively short-legged aeroplane within striking distance of its target? Tow it there on a lighter, and use sturdier machines. The idea was to use relatively hefty flying boats which were to be cast adrift at the launch point, take off under their own steam, conduct their business and then fly home. Several three-ship reconnaissance operations were mounted, although these achieved only moderate success.[5]

Having proved the concept, however, the idea was taken a stage further with the lighter being provided with decking which, with a 30 kt tow, was expected to provide enough room to get a Camel airborne.



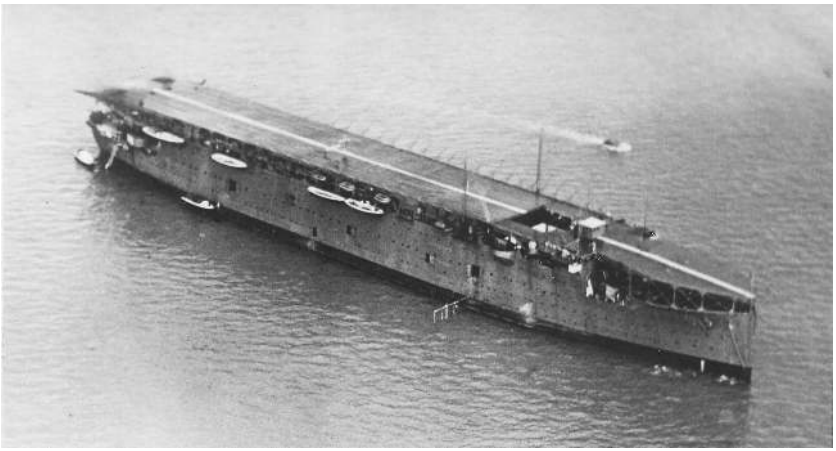
A Sopwith 1½ Strutter taking off from a platform mounted on top of the 15-inch guns of HMS Malaya*'s B Turret. (J M Bruce/G S Leslie)*

It did too and in August 1918 Lt Stuart Culley took off from a lighter and, having clambered up to 19,000 feet, he shot down the Zeppelin L53. Having ditched his aeroplane, it was fished out of the sea and bent back into shape – it now hangs from the ceiling of the Imperial War Museum at Lambeth.

While water-skiing in five-ton flying boats certainly showed initiative and enterprise, it hardly represented a practical long-term solution – after all, if it had done we would still be doing it. What was really needed was a way of operating landplanes from ships.

One option was to persevere with the launching platform idea with aeroplanes being carried by battleships and cruisers. Fixed platforms meant that the ship had to alter course and steam into wind in order to launch its aeroplane, but this inconvenience could be avoided by mounting the ramp atop a turret, or on a purpose-built turntable, which could be rotated into the relative wind. The problem with the ramp concept, of course, was that it was a one-shot system; there was little prospect of recovering the aeroplane, and certainly not in an immediately re-usable condition. Nevertheless, this 'bring-your-own-air-defence' scheme paid dividends in August 1917 when Flt Lt Bernard Smart used HMS *Yarmouth's* Sopwith Pup to shoot down the Zeppelin L23.

Meanwhile the fast cruiser *Furious* had been provided with a very long forward ramp, long enough perhaps to permit an aeroplane to land back on. Since a wind over the deck in excess of 40 kts was perfectly feasible and a Sopwith Pup could be controlled down to little more than 30 kts, it was worth a try. In August 1917 Sqn Cdr Edwin Dunning flew alongside, adjusted his speed to that of the ship, and crabbed in to permit his colleagues to grab hold of the almost stationary aeroplane and wrestle it down onto the deck. Hardly a realistic proposition with a Buccaneer, of course, and not that easy with a Pup and on his third attempt Dunning went over the side and



HMS Argus*, the world's first aviation vessel able to launch and recover aircraft while under way, had joined the Fleet by November 1918. (P G Crayden)*

was drowned.

Plan B was to build a landing-on platform aft of the superstructure. They tried it, but very severe turbulence and smoke from the funnels made this quite impractical. Plan C was to do away with the superstructure altogether to produce HMS *Argus* the world's first aviation vessel able to launch *and* recover aircraft *while under way* – the 'flat-top'.

Furious herself was rebuilt as a flat top in the 1920s but in August 1918, while still in her unsatisfactory fore-and-aft configuration, she carried out a very significant operation when she attacked those elusive Zeppelin sheds at Tøndern. Six of the seven Camels launched reached the target, setting fire to one of the sheds and destroying the two Zeppelins that were inside (L54 and L60). One pilot was lost and only two of the aircraft made it back to the ship where they were obliged to ditch because extensive trials had established that that was far less risky than attempting to land back on. Nevertheless, the Tøndern raid had been the world's first successful carrier-based air strike, one of the many trail-blazing achievements that made British maritime aviation so pre-eminent by the end of the war. One of the pilots, incidentally, was Capt William Dickson, later to become Chief

of the Air Staff, and ultimately Chief of the Defence Staff, in the 1950s.

Summary

It is difficult to provide precise figures to quantify the overall scale of effort devoted to maritime air but, when the war ended, the establishment of the units assigned to the Operations Groups, essentially those committed to the anti-submarine campaign in home waters, called for the provision of some 516 aeroplanes – a contemporary reckoning on file in the National Archives puts the actual number at 712 – to which we can add 107 airships and well in excess of 100 aircraft allocated to the Grand Fleet and Northern Patrol – so, *at least* 700 (and probably many more), which compares to the 1,900 or so stationed in France (1,678 with the BEF, 141 with the Independent Force and another 60 with 5 Gp).[6] In other words, leaving aside Home Defence, roughly 30% of the RAF's front line strength in NW Europe was dedicated to naval business – which rather contradicts the Admiralty's claims that the new Service had been neglecting its naval obligations.

Although there were still some divided responsibilities with respect to shipboard and lighter-than-air operations, the post-war RAF was clearly going to be the senior partner in air affairs and the system established in wartime was sustained for the next twenty years with seagoing air power under joint management with the navy running the ships while the air force flew the aeroplanes – or about a third of them.[7] Surprisingly, this schizophrenic arrangement seemed to work at the coal face but relationships were less satisfactory in the upper reaches of the hierarchy were there continued to be a degree of friction – but that has to be a story for another time.

Notes:

[1] Beatty's proposal for a major carrier-based offensive air operation, which dated from the summer of 1917, had involved converting eight fast (16-20 kts) merchantmen into flat tops. It was never a very realistic proposition, partly because the Admiralty flatly ruled out a diversion of shipping on that scale and partly because the necessary torpedo-carrying aeroplanes did not exist. By the end of the war the Cuckoo was just beginning to enter service but even then the only ships available were the recently completed *Argus* (which could have handled about a dozen aircraft) and the unsatisfactory, take-offs-only, *Furious* and *Vindictive* (the launch platforms of

which were, in any case, deemed to be too narrow for the 45 ft wingspan of the Cuckoo).

[2] George Stanley Trewin was among the earliest of naval aviators having been awarded Royal Aero Club Certificate No 294 at the CFS on 17 September 1912. His utility as a pilot does not seem to have been exploited, however; although he did fly as an observer. When the navy belatedly decided to recognise its back-seaters in the summer of 1917, Trewin became an observer lieutenant. He ended the war as an RAF Observer Officer, one of only three ranked as a major, all of them ex-RNAS because the Army's manning policy had ensured that the military ranks of captain and above were reserved exclusively for pilots. As a result there were no ex-RFC observers ranked higher than lieutenant and, while the newly constituted RAF had acknowledged that this was an unsatisfactory situation, in practical terms it had done absolutely nothing to alleviate it.

[3] The performance of a typical WW I-era U-boat provided a top speed of about 15 kts on the surface using its diesel (originally petrol) engines but much less submerged on batteries – a duration of perhaps 15 hrs at 4 kts (equating to a range of 60 miles) but only an hour at 9 kts, before being obliged to surface to recharge the batteries and purge the atmosphere within the hull. WW I submarines have been described as submersible torpedo boats (or minelayers), rather than the true *sub*marine vessels that they eventually became. In effect, if you could force a 1914-18 U-boat to submerge it was pretty well neutralised.

[4] Jellicoe, *The Submarine Peril* (London, Cassell, 1934).

[5] Six lighter-borne operations were mounted between March and October 1918, five reconnaissances of the Heligoland Bight plus one planned attack on Borkum. All involved three or four Felixstowe flying boats and, on the last two occasions, Sopwith Camels. Three of the first four operations were successful, the other one was cancelled due to weather conditions at the launch position. On the fifth occasion the flying boats proved to be too heavily loaded to take off (this disappointment being partially offset by Culley's shooting down of the L53). The final mission was another failure in that the flying boats were (again) too heavy to get airborne and the launching trestles for three of the four Camels involved had been damaged by the sea.

[6] National Archives AIR1/686.

[7] Although the inter-war Fleet Air Arm was nominally 'of the RAF', in practice 70% of its pilots and 100% of observers and telegraphist air gunners were provided by the RN. Furthermore, while RN personnel serving with air units were fully integrated into the ship's company, the RAF's officers were largely excluded from naval routine and (apart from their technical responsibilities) the employment of off-duty RAF fitters and riggers tended to be restricted to menial tasks. Thus, while personal relationships may have been good, Admiralty policy was clearly intended to establish and maintain as tight a grip as possible on naval air while keeping the air force at arm's length.

RAF COASTAL COMMAND'S ANTI-SHIPPING OPERATIONS IN NORTH-WEST EUROPE, 1940-45

Dr Christina J M Goulter

Christina Goulter is a Senior Lecturer at King's College, London, who teaches at the Joint Services Command and Staff College. Between 1994 and 1997, she was Associate Visiting Professor of Strategy at the US Naval War College. She is a member of CAS's Air Power Workshop and of the RAeS's Air Power Group Committee. She has written widely on maritime aviation, the SOE, intelligence support to air operations during WW II and digitisation of the battlespace and the aerospace platform.

Royal Air Force Coastal Command's contribution to the Allied war effort between 1939 and 1945 is usually thought of in terms of the anti-submarine war. The Battle of the Atlantic was a very close run contest, and Britain was nearly brought to her knees on a number of occasions. There can be little doubt that Coastal Command's aircraft played a vital part in defeating the U-boat menace.[1] However, this was by no means the full extent of Coastal Command's activity. From May 1940, it was conducting an offensive against German merchant shipping in north-west European waters. The chief objective of this campaign was the interdiction of high-grade Scandinavian iron ore, upon which the Germans were entirely dependent for weapons production.

Germany's dependence upon Scandinavia as a supplier of this most basic of raw materials had been known in Britain for some time. So, in the war planning of the late 1930s, the blockading of German sea trade across the North Sea and in the Baltic was identified as a top priority. The chief instrument of blockade was to be the Royal Navy, but, after war broke out, the Admiralty realised that the Navy was unable to meet all its basic commitments, and could not undertake blockading operations. So, the responsibility for attacking German sea trade was handed to the Royal Air Force. Air attack on merchant shipping had never featured to any extent in RAF planning prior to this point. In the

First World War, isolated attacks on single merchantmen occurred only when opportunities arose, and a coherent anti-shipping role was never developed before 1939. The attack on any type of maritime target was not considered as a role for the air force during the inter-war period, as it was assumed that the RAF's main task would be strategic bombing. As a consequence, RAF Coastal Command entered the Second World War without a defined anti-shipping role and without the type of aircraft and weapons suited to offensive operations. As doctrine and equipment cannot be forged overnight, appropriate anti-shipping resources did not become available until the second half of the war, and because blockade is a blunt instrument, the impact of Coastal Command's campaign came too late to be truly decisive. In the first half of the war, the only assets the Command had in its favour were the courage and determination of its crews and good leadership.

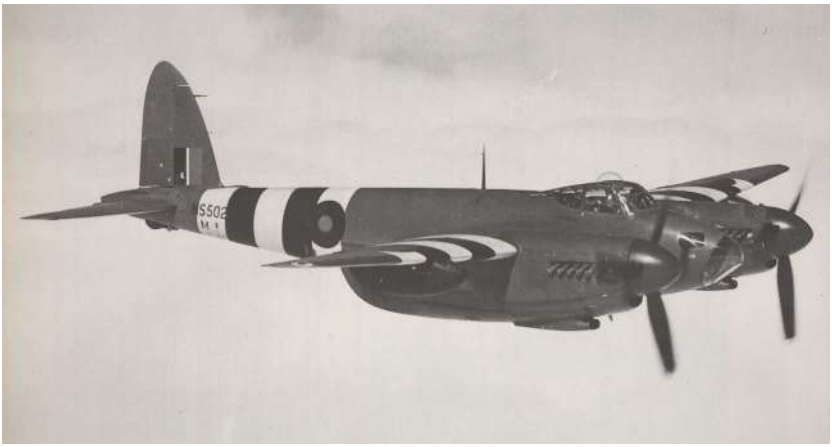
On the outbreak of war, there was no immediate requirement for anti-shipping operations, but Coastal Command was fully engaged in other roles which went some way towards giving some aircrews the type of experience they would need when attacks on merchant vessels were authorised in May 1940. This included anti-submarine reconnaissance around Britain's coastline and anti-raider patrols in the North Sea, to prevent the breakout of major German naval units, such as the *Bismarck*. However, the full extent of Coastal Command's unpreparedness for operations against surface vessels was not exposed until the anti-shipping campaign got underway, and then tactics, training and equipment were very quickly shown to be inadequate. The Command did not even have the benefit of good intelligence at this point in the war. So, for the first phase of the campaign, at least until mid-1941, operations against the enemy's merchant marine were little more than 'needle in haystack' affairs, and when, mostly by chance, targets were found, serious damage was rarely inflicted. It was also a period in which anti-shipping effort was diverted to other operations, such as reconnaissance for naval forces involved in the Norwegian campaign and anti-invasion patrols.[2]

When the anti-shipping campaign opened, effort was concentrated in the upper North Sea and off the Norwegian coast, with the dual purpose of interrupting trade and cutting supply lines to the German invasion force in Norway. Seven squadrons of Blenheims and

Hudsons were tasked with this work, but, in reality, the effort was much smaller than this figure suggests. Poor serviceability rates within Coastal Command, with some squadrons experiencing upwards of 60% of their aircraft being unserviceable at any one time, meant that the anti-shipping component was scarcely more than a paper force. When aircraft did venture out, they also fell easy prey to German fighters and the increasingly heavy anti-aircraft defences being mounted on board German merchantmen. During 1940, the anti-shipping squadrons lost 161 aircraft, for a return of just six enemy vessels sunk and fourteen damaged.[3] This poor performance also reflected Coastal Command's lack of intelligence on the German merchant marine. A traditional source of intelligence, the Embassy or Consulate, proved disappointing, with reporting being too infrequent to build up an accurate picture of shipping movements. Photographic reconnaissance was at too rudimentary a stage of development and its resources too few to be of value at this stage in the war. Nor did the Command have the benefit yet of high grade signals intelligence; the important breakthrough in this area (deciphering the naval 'Enigma' codes) did not occur until the following year.

Coastal Command's poor performance during 1940 led to calls for it to be taken over by the Admiralty. Following discussions in Whitehall, it was decided that Coastal Command would remain within the air force. However, a large measure of operational control was handed to the Admiralty, which would be in a position to dictate priorities in the war at sea. Although this meant that the anti-submarine war was given priority, the anti-shipping role was promised greater resources (including two Beaufort torpedo bomber squadrons and a Beaufighter unit). So, by the spring of 1941, the anti-shipping component of Coastal Command had grown to thirteen squadrons. But, just as these were 'finding their feet', the Beaufort squadrons were transferred out to the Mediterranean in an effort to interdict Rommel's supply lines. However, the debate over the effectiveness of Coastal Command probably saved the Service as a whole by highlighting serious inefficiencies, especially in the area of maintenance, and by applying Operational Research to the problem of extracting the maximum performance out of a limited force.[4]

The year of 1941 was not all 'doom and gloom', in spite of the substantial material weaknesses. The number of enemy vessels sunk



Although the intelligence that it yielded was not confined to maritime operations, wartime UK-based photographic reconnaissance was a Coastal Command responsibility. This is a PR Mosquito XVI of No 544 Sqn in 1944.

doubled over the previous year's total, with twenty-eight being sunk. Over half this figure were claimed in the last quarter of 1941. Coastal Command's improved performance cannot be explained in terms of an improvement in anti-shipping equipment. Nor was there an increase in the number of sorties undertaken to account for the improved interception and attack rate. In fact fewer sorties were flown in the last quarter compared with the previous three months, largely due to adverse weather conditions. The heightened success of the anti-shipping squadrons can only have been the result of vastly improved intelligence. The end of 1941 did, in fact, witness a simultaneous improvement in three principal intelligence sources: photographic reconnaissance, agent reporting and the interception of enemy signals traffic.[5]

Regular photographic reconnaissance of the enemy occupied coastline, between Norway and France, started in mid-1941, when the resources of the Photographic Reconnaissance Unit were expanded from twelve aircraft to an establishment of seventy-two. Most of them were allocated to the bomber offensive over mainland Germany, but the equivalent of a squadron was dedicated to anti-shipping

reconnaissance. Among the aircrews involved in reconnaissance were Norwegians, whose intimate knowledge of their home country's coastline and shipping assisted not only in the rapid location of enemy vessels but also in the identification of individual ships and their cargoes. Many of the reconnaissance sorties were laid on after the receipt of information from agents. Coastal Command still lacked the resources necessary for sustained reconnaissance of the Norwegian coastline and all its fjords, and pinpointing those areas likely to have shipping was an important way of economising on effort. By mid-1941, the Secret Intelligence Service (SIS) had recruited from the steady stream of Norwegians escaping to Britain a small number of men who were sent back to Norway to act as agents reporting on enemy shipping movements. These relayed by wireless telegraphy information from which it was possible to build up a picture of shipping routines, types and volumes of cargoes carried, and coastal *Flak* and fighter defences.[6]

For operations over the North Sea, especially along the Dutch coast, there was far less dependence on agent reporting because of the good photographic reconnaissance coverage of the enemy coastline between France and the north German ports. But, by mid-1941, signals intelligence was also adding vastly to information on shipping in that area. Early in 1941, the cipher being used in German and German-controlled dockyards was broken, and this was an important breakthrough. Dockyard signals traffic provided information on convoy movements up and down the coastline through one dockyard alerting another about the sailing times of vessels and anticipated times of arrival. Using this information, Coastal Command could calculate at what time a convoy was due to pass a particular point on the coastline and mount an anti-shipping strike accordingly. The value being attached to a particular convoy could often be assessed by the type or extent of convoy escorts. It was known through the interception of *Luftwaffe* wireless telegraphy and radio signals that fighter escort was provided for very important convoys. Signals from surface escorts also provided important information. As most escorts used in convoy protection were naval vessels, such as destroyers or minesweepers, their signals were largely undertaken in Enigma cipher. The regular reading of naval Enigma from August 1941 provided intelligence which proved vital, not only for locating vessels, but also

in the process of assessing Coastal Command's efficacy. Signals from naval vessels would report on the number and nature of vessels being escorted and any enemy action encountered *en route* between ports. An Anti-Shipping Assessment Committee found that aircrews' claims tended to be exaggerated, usually three to four times in excess of the actual sinkings or damage sustained by the enemy's merchant marine.[7]

However, the intensification of Coastal Command's offensive in 1941 was not allowed to go unchallenged. The Germans responded by increasing their defences. Vessels no longer sailed individually, but formed into convoys of six to eight vessels with escorts of four to six naval vessels or heavily defended merchantmen (known as Flakships). Among the latter were large merchantmen called *Sperrbrechers* (Barrier Breakers), with guns ranging in calibre from machine-gun up to 105mm. From signals intelligence, it was known that ninety-three such vessels were in operation by the end of 1941. These were the ships the Coastal Command aircrews feared most. Those engaged in torpedo attacks had the most to worry about. Torpedo bombers had to make a straight and level approach to the target, and this is when they were at their most vulnerable. Operational analysis done in 1942 showed that a torpedo bomber crew had a 17.5% chance of surviving its first tour of operations (set at 200 hours for Coastal Command aircrews), and if the aircrew was recalled for a second tour after a rest period, which was common, the figure fell to just three per cent. With 168 aircraft being lost on anti-shipping operations during 1941, morale in the strike squadrons was very low.[8]

For Coastal Command's anti-shipping campaign, 1942 started just as 1941 had ended: squadrons were poorly equipped and suffered from low morale. The Command, as a whole, was acutely embarrassed when it was held primarily responsible for the 'Channel Dash' incident, when the German warships *Scharnhorst, Gneisenau* and *Prinz Eugen* sailed from the French port of Brest to Germany almost unmolested. In the longer term, however, the incident was instrumental in securing more investment in anti-shipping equipment (including the provision of Beaufighters in *Flak* suppression and torpedo bomber roles). There was also a vital review of anti-shipping tactics. The result was the decision to adopt what were known as Strike Wing tactics. The seeds for ultimate success in the anti-shipping campaign had been sown.

When the purpose-built Beauforts were redeployed overseas in 1942, pending the availability of Beaufighters, an attempt was made to plug the torpedo bomber gap with hand-me-down Hampdens transferred from Bomber Command. This one wears the XA code of No 489 Sqn.

Up to the end of 1941, the principal method of attack on German vessels was low level bombing. Some torpedo attacks had been made, when torpedo aircraft were available. But, in both cases, aircraft were suffering crippling losses. Part of the reason for the high loss rate was the poor quality of anti-shipping aircraft available (slow and unmanoeuvrable Hudsons and Beauforts). However, tactics were felt to be the chief problem. The distillation of operational experience gained both in north-west European waters and in the Mediterranean suggested that strike aircraft needed to be escorted to their targets, to protect them against enemy fighters and to suppress ship defences. Further, it was felt that the escorting and strike aircraft needed to be of the same type. The aircraft most suited to all the roles was the Beaufighter, and AOCinC Coastal Command, Air Chf Mshl Sir Philip Joubert de la Ferté, requested an immediate re-equipment programme to the extent of ten Beaufighter squadrons (half in a *Flak* suppression role and half in a torpedo strike role). The first Beaufighter re-equipment of squadrons began in mid-1942, and throughout the summer, Coastal Command worked on developing what would become known as Strike Wing tactics. From the end of 1942, operations against enemy convoys would be undertaken in force, with upwards of thirty-five aircraft. Beaufighters armed with 20mm cannon would lead formations in a *Flak* suppression role, silencing convoy escorts, and these would be followed in quick succession by the main strike aircraft, armed with torpedoes.[9]

The first Strike Wing operation occurred on 20 November 1942, against a convoy located off the Dutch coast. Twenty-four Beaufighters, drawn from two squadrons, were involved, along with a squadron of escorting Spitfires (to deal with the anticipated German fighter opposition). The operation was not considered a success, mainly because only a secondary vessel was sunk and none of the sixteen merchantmen, and three Beaufighters were lost to fighter and *Flak* hits. Two more were written off after they crash-landed back at their base. However, important lessons were learned which contributed to the success of subsequent operations. Among the lessons were that advance reconnaissance aircraft should be sent out prior to a big strike operation to give a precise location of a target, thus enabling the strike force to economise on effort. Second, it was decided that large convoys would be attacked by an absolute minimum of eight 'Torbeaus' and sixteen Beaufighters armed with cannon or rocket projectiles (which were coming into service). Finally, it was agreed that Strike Wings should be escorted by a minimum of two single-engine fighter squadrons.[10]

Strike Wing operations were suspended after the November operation, but were attempted again in April 1943. The first was mounted on 18 April, again off the Dutch coast, and was a resounding success. A large convoy, comprising eight merchant vessels, was attacked, and the largest merchant vessel (5,000 tons) was sunk. The whole attack lasted a mere four minutes, and all the attacking aircraft returned safely to base. It was a major turning point in the fortunes of the strike squadrons, and proved to be a vital fillip for morale. Aircrews were now receiving feedback on the success of their operations by way of a classified in-house publication, known as the *Coastal Command Review*. Instituted in February 1942, this was a major key to increasing aircrew morale. Prior to this point, aircrews had little feel for the strategic importance of their work, and, in the face of mounting aircrew losses, there had been disenchantment with the senior leadership within the RAF, who were perceived to be out of touch with operational reality. What the *Coastal Command Review* succeeded in doing was to show those at the 'sharp end' that the Command was taking very seriously operational problems and that everything was being done to improve the lot of squadrons.[11]

From April 1943, Strike Wing operations became a feature of the

anti-shipping effort, although armed reconnaissance was still being undertaken. Intelligence feed to Coastal Command had gone from strength to strength during 1942 and was now so good that enemy shipping routines were known in detail, as were the movements of specific vessels. Very often, it was sufficient just to send out armed patrols along given points of the enemy coastline to catch known vessels as they slipped in or out of port. Almost all shipping activity on the Dutch, German and Norwegian coastlines was now occurring at night, with vessels seeking the protection of heavily defended anchorages, such as Den Helder, by day. In response, Coastal Command changed its time of operating increasingly to night-time, and dusk and dawn periods, when shipping could be caught leaving or entering ports. The change in German tactics was an important indication of just how seriously they were taking the air threat to their convoys. So, although the number of vessels sunk by the anti-shipping squadrons in 1943 was not substantially greater than previous years (at thirty-two merchantmen and escorts), the fact that the Germans were compelled to change their routines and increase transit times between Scandinavia and Germany also had an important impact on the enemy's war waging capability. Although less tangible as a yardstick of success than sinkings, a dramatic increase in convoy transit times from 15 to 75 days meant that the Germans were not receiving the weight of raw materials they required to sustain their steel industry. Intelligence also showed that the Germans were facing a crisis in their merchant marine, and had adopted an emergency shipbuilding programme.[12]

As 1944 opened, Coastal Command hoped to capitalise on the Germans' weakened position. However, ironically, the success that Coastal Command had achieved in both the anti-shipping and anti-submarine campaigns placed it in a precarious situation. In the planning for D-Day, it was decided that the RAF would provide 27,000 personnel and some 650 aircraft to an Allied Expeditionary Air Force. Nearly half of the 650 total would have to be drawn from Coastal Command. Fortunately for the Command, this did not occur, as later assessments showed that the figures had been exaggerated. Nevertheless, Coastal Command was going to have to suspend its normal anti-shipping activity to provide support to D-Day and the critical establishment period.

The awesome firepower of a Beaufighter strike. This Sperrbrecher*, the* Magedeburg, *fell victim to Nos 236 and 404 Sqns on 13 August 1944.*

Twenty-three squadrons were given the task of keeping the Channel free of U-boats and enemy surface vessels. The Admiralty believed that the principal threats to the invasion fleet would be the enemy's submarines and motor-torpedo boats (E- and R-boats). Fortunately, neither of these threats proved substantial, with no German submarines penetrating the invasion area on D-Day, and E-boat and R-boat activity was restricted to night-time. By mid-June, the responsibility for attacking E-boats and R-boats was handed to the Royal Navy's Fleet Air Arm, and Coastal Command was able to resume its main anti-shipping activity. The first Strike Wing operation was on 15 June, against a large convoy off the Dutch coast. Three vessels were sunk, including the two primary merchant targets of 7,000 and 3,500 tons. From this point onwards, for the rest of the year, enemy shipping losses grew exponentially, so that the yearly total stood at 169 vessels. The odds had definitely swung in favour of the attackers: for every ship sunk, just one aircraft was being lost. This compared very favourably with 1940's figure of twenty-six aircraft per vessel sunk. The scale of success had a dramatic effect on aircrew morale, as one Coastal Command Intelligence Officer noted: 'The spirit in the anti-shipping squadrons is so terrific that one is conscious of it the moment one walks into the Mess…It is something like the

fever that comes to a gambler when he is winning, when he knows he cannot go wrong'.[13]

After the Allies secured a foothold in France, the anti-shipping campaign could resume in full, with efforts being concentrated off Norway. By the beginning of 1945, the enemy's shipping situation had deteriorated to such an extent that there was little commercial traffic to be found, and movements between Scandinavia and Germany were confined largely to the transport of troops and military stores. Hitler had decided that Norway would be maintained as the base for assaults on Allied shipping, and a sizeable proportion of the German U-boat and surface fleet began to transfer to Norwegian waters. Such highly prized assets were to be heavily defended, however. In contrast to the North Sea and Dutch coastlines, where shipborne and shore-based *Flak* were responsible for most anti-shipping aircraft losses, enemy fighters posed the greatest threat off Norway. In the area south of Trondheim, where most anti-shipping activity was focused, the Germans had some eighty-five single-engine fighters, including FW 190s. These accounted for most of the eighty-one Coastal Command aircraft lost in the last seventeen weeks of the war. Strike Wings were often met by upwards of thirty German fighters at a time, and it was not uncommon for two or three Beaufighters out on armed patrols to be 'bounced' by ten or more FW 190s. During one Wing Strike on 11 January, a mixed Beaufighter and Mosquito force based in the north-east of Scotland was attacked by Bf 109s and FW 190s off the southern coast of Norway, causing the loss of one Beaufighter and one Mosquito. The outcome of this operation led to AOCinC Coastal Command asking for extra fighter escort for Norwegian operations (from one to two Mustang squadrons), which was agreed to. However, this was still not sufficient, and the anti-shipping squadrons continued to face mounting losses. One of the worst days in the whole anti-shipping offensive occurred on 9 February 1945 (referred to by aircrews as 'Black Friday'). Thirty-one Beaufighters were despatched to attack shipping sheltering in Forde Fjord (about half way up the south-western Norwegian coastline). Nine Beaufighters and one Mustang escort were shot down. Most of these were claimed by shipborne defences (on board a destroyer, a large *Sperrbrecher* and minesweepers), but two Beaufighters were lost after the strike force was attacked by FW 190s.

Fourteen aircrew members died as a result of this enemy action.[14]

Although the casualty figures for the last months of the war were heavy for Coastal Command's anti-shipping squadrons, the tally of enemy shipping sunk was also impressive (with ninety-two vessels being destroyed).[15] Most of the German shipping activity was limited to traffic supporting the German garrisons in Norway, and Coastal Command responded by increasing its radius of operation to include the Kattegat and Skaggerak (Mosquitos by day and Halifaxes by night). By the end of April, early May, the anti-shipping squadrons had virtually run out of targets, and, so, some aircrews found themselves attacking land-based targets instead, including lighthouses. Finally, at 1445 hrs on 7 May 1945, the order went out from Coastal Command headquarters that no further anti-shipping operations were to be carried out. The war was over. Victory celebrations dominated station life over the following weeks. After the intense excitement of operational flying, most aircrews found it extremely difficult to settle into more sedate duties, and the playing field was resorted to as a means of 'letting off steam' and stirring the adrenaline.[16]

At higher levels within the RAF, attention was now focused on post-conflict assessments of campaign effectiveness, and Operational Research and Weapons Effect teams were despatched to Norway, Germany, Holland and France to make their reports. Their work showed that the claims made for sunk and damaged vessels were exaggerated, but that the total for the war was still impressive: 366 were sunk and 146 were seriously damaged. What was more difficult to assess, however, was the impact that these losses had had on the German economy, and a verdict on this has been possible only recently with the release into the public arena of intelligence and other sensitive archival material.[17] It seems that the anti-shipping campaign against Germany's iron-ore trade caused a 10% fall in steel production between January 1944 and March 1945. While this may not be viewed as a decisive war-winning contribution, it was, nevertheless, ultimately important and undoubtedly contributed to Germany's defeat. It begs the question as to how much more successful Coastal Command could have been had it received the resources it needed at a much earlier point in the war. When making assessments of the efficacy of a particular campaign, it is important also to consider the indirect effects. The Germans were compelled to tie up substantial

defensive resources to protect their convoys, including at least 150,000 Service personnel in ship defence (escort vessels and shore-based batteries), some 120 *Luftwaffe* aircraft between Norway and France in a convoy cover role, and thousands of guns (ranging in calibre from machine-gun up to 105mm). These were resources that the Germans would otherwise have employed either on the Western or Eastern fighting fronts, not to mention against the Combined Bomber Offensive. Coastal Command suffered heavy losses to achieve victory in both the Battle of the Atlantic and in the anti-shipping campaign, to the extent of 5,863 aircrew (741 aircraft in the anti-submarine role and 876 during anti-shipping operations). It is a sacrifice rarely mentioned in histories of the Second World War.

Notes:

[1] Coastal Command was responsible for sinking 185 U-boats during the Battle of the Atlantic, out of a total of 326 sunk by Allied land-based aircraft. Land-based aircraft as a whole claimed 41.5% of all U-boats sunk during the war. AHB: 'Coastal Command's War Record', Table A.

[2] National Archives AIR 10/5208. 'Despatch on the Air Operations undertaken by Coastal Command, from September 1939-June 1941', by Air Chief Marshal Sir Frederick Bowhill, dated May 1947, p2f.

[3] AHB 'Coastal Command's War Record', Table I, Coastal Command Casualties, September 3rd 1939 to May 8th 1945'; National Archives AIR 41/73. 'RAF in Maritime War', Appendix XV, 'Enemy Shipping Losses by Air Attack'.

[4] See C Goulter, *A Forgotten Offensive: Royal Air Force Coastal Command's Anti-Shipping Campaign, 1940-1945* (Frank Cass, London, 1995), especially pp125, 132-143.

[5] *Ibid*, pp147-148.

[6] *Ibid*, Chap 5.

[7] *Ibid*, pp152-153.

[8] *Ibid*, pp155-156.

[9] *Ibid*, pp178-184.

[10] *Ibid*, pp184-186.

[11] *Ibid*, pp175-176.

[12] *Ibid*, see pp284-286 and Chap 7, generally.

[13] H Bolitho, *Task For Coastal Command* (London, 1944), p110. See also Goulter, pp122, 215-229; AHB 'Coastal Command's War Record', Table F.

[14] Goulter, pp254-255.

[15] AHB: 'Coastal Command's War Record', Table F.

[16] Goulter, Chap 8.

[17] *Ibid*, Chaps 8-9.

BLENHEIMS AND BEAUFORTS

by Flt Lt Roy Nesbit

Roy Nesbit joined the RAFVR on the outbreak of war and was commissioned as an observer. Having survived forty-nine Beaufort sorties with No 217 Sqn, he spent some time instructing in Africa before moving to SEAC to fly Dakotas. Following demob in 1946, he read economics at London University in preparation for a successful career in business. Since the 1980s he has written more than twenty well-regarded books, most of which deal with aspects of RAF operations in WW II.

My brief was to describe the roles of these two types as maritime strike aircraft in the Second World War, prior to the formation of special Strike Wings. I served operationally in Beauforts as an RAFVR air observer, this function being a combination of navigator, bomb aimer and air gunner. We were pushed through our training as quickly as possible, partly in order to replace second pilots who were acting as navigators, and thus help to increase the number of first pilots in Coastal Command squadrons.

The Blenheim I light bomber caused a sensation when it was introduced in 1937, partly because it was much faster than the biplanes it replaced. It could carry 1,000 lb of bombs, had a crew of three and was armed with two machine-guns. It became the only type to serve in all five Commands – Bomber, Fighter, Coastal, Army Co-operation and Training. The Blenheim IV was introduced in 1938, with more powerful engines and a blister gun under the nose.

There were no Blenheims in Coastal Command at the outbreak of WW II but they eventually equipped thirteen squadrons, some for fairly short periods. Four Blenheim IVF squadrons were transferred from Fighter Command in January and February 1940, this variant being fitted with a four-gun pack under the belly. The role of these squadrons was mainly ‘trade protection’, ie escorting convoys and protecting fishing fleets. Two more Blenheim squadrons were transferred from Army Co-operation Command in July 1940. These

Until 1941 much of the anti-shipping campaign was conducted by the Blenheims of No 2 Gp, like this Mk IV of No 40 Sqn. (MAP)

were also Mk IVs, intended primarily for reconnaissance, but they also served as light bombers.

Apart from these transfers, seven other squadrons were either re-formed or re-equipped with Blenheims within Coastal Command. Five of these had Mk IVFs, the other two having plain Mk IVs. They were employed on anti-shipping work, convoy escorts or bombing enemy ports. Most of the thirteen squadrons in Coastal Command were soon re-equipped with Hudsons or Beaufighters. Several were posted to overseas locations.

In addition, Blenheim IVs of Bomber Command's No 2 Gp were engaged on maritime operations, primarily against enemy convoys off the coasts of Norway and Holland. They made numerous attacks and the crews claimed many successes, but intelligence analyses demonstrated that these were exaggerated. The sad facts were that ships did not always sink, even when straddled with four 250 lb bombs, although they were often slightly damaged.

The losses sustained by Blenheims on anti-shipping work were far greater than their successes but the attacks made on ports, usually at night, caused considerable worries to the enemy. Also, a remarkable achievement occurred on 11 March 1940 when a Blenheim of Bomber Command's No 82 Sqn, flown by Sqn Ldr M V Delap, came unexpectedly across the U31, a Type VIIA submarine, off Borkum. This U-boat had made very successful war cruises and was undergoing post-refit trials. Delap dived down and dropped four

A pair of Beauforts of No 42 Sqn. (MAP)

bombs, which sank it immediately. This was the first U-boat to be sunk by the RAF. The Germans raised it from shallow water and were able to return it to service, but it was finally sunk on 2 November 1940 by HMS *Antelope*, during its next war cruise.

It might be thought that Blenheim and Beaufort squadrons formed the first Strike Wing but this was not actually the case, although both types did sometimes attack the same targets at different times. The Beaufort I torpedo bomber began to enter service with Coastal Command about two months before the first Blenheims. It had a crew of four, was armed with two machine guns and later with a blister gun, and could carry either a torpedo or up to about 1,650 lb of bombs. There were eventually four squadrons, two of which replaced Vildebeests, one Ansons and one Blenheims.

The first machines were dogged with problems concerning serviceability and the higher speed of dropping torpedoes. Operational work did not start for several months. The Mk I was fitted with Taurus engines and could not fly on one, although the later Wasp-powered Mk II could do so. The squadrons were employed on torpedo and dive-bombing attacks on ships, low-level bombing of enemy ports and mine-laying outside enemy harbours. Many operations took place in broad daylight, without fighter escort or *Flak*-suppressers, but others were scheduled for dawn or dusk.

Seen here at LG16, this Beaufort belonged to No 39 Sqn, one of two such units resident in the Mediterranean theatre

Casualties were extremely heavy, rated as the worst in the entire RAF at this period, but there were some successes. The most prominent of these occurred on 6 April 1941, when Fg Off Kenneth Campbell flew one of five Beauforts of No 22 Sqn which took off to attack the battleship *Gneisenau* in the outer harbour of Brest. In very adverse weather, he was the only one to locate the target and he dropped a torpedo, which blew a huge hole in the ship's side, before being shot down by 20mm *Flak* from the end of the mole. German divers subsequently recovered the bodies of the crew and they were given a military funeral. Campbell was awarded a posthumous Victoria Cross. On 7 April 2000, this Victoria Cross was presented in perpetuity to No 22 Sqn by Kenneth Campbell's elder brother, in a ceremony at Saltcoats in Ayrshire. The only stipulation was that it was to be regarded as an award to all four members of the crew.

From March 1942, all four Beaufort squadrons were posted to Ceylon to help counter the threat posed to India by the Japanese Navy, but only No 22 Sqn reached its destination without hindrance. The others, Nos 217, 42 and 86 Sqns, were detained en route at Luqa by the AOC Malta, AVM Sir Hugh Lloyd, to help defend the island and attack Axis convoys reaching North Africa. The Beauforts were then thrown against these vessels again and again, sinking many of them but suffering grievous losses in the process.

There were already two Beaufort squadrons based in the Middle East, Nos 39 and 47 Sqns. Towards the end of June 1942, six of No 39 Sqn's aircraft joined the Beauforts already at Malta. They were

commanded by Sqn Ldr (later Wg Cdr) Patrick Gibbs who eventually took over all of the surviving Beauforts and crews that were still on the island to create a single squadron. On 20 August 1942, No 227 Sqn was formed at Luqa from Beaufighters transferred from Nos 252 and 248 Sqns, and placed under the command of Wg Cdr D Ross Shore.

Nos 39 and 227 Sqns then formed the first Strike Wing in the RAF, with the Beaufighters suppressing enemy *Flak* while the Beauforts came in with their torpedoes. These attacks were beyond the range of Spitfires and the heavy casualties continued. However, these operations appear to have provided the model for the larger Strike Wings which were to be formed in the UK, consisting initially of Beaufighters and 'Torbeaus', supported by Spitfires.

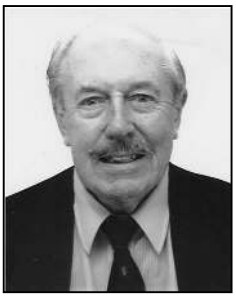
Three examples may serve to illustrate the work of Beaufort crews in the Mediterranean. On 15 June 1942 a Beaufort of No 217 Sqn, flown by Fg Off Arthur H Aldridge, became detached from a formation sent out to intercept the Italian battle fleet. As it happened, Aldridge came across the fleet before the others and made a solo attack, torpedoing the heavy cruiser *Trento*. The ship was already sinking when she received another torpedo, fired by the submarine HMS *Umbra*, and went to the bottom.

On 28 July 1942 a Beaufort of No 217 Sqn flown by a South African, Lt Edward T Strever, was shot down during an attack on a convoy off the west coast of Greece. The four crew members were picked up by a Cant floatplane and imprisoned in Sapienza. On the following day they were being taken in another Cant to Taranto when they managed to overpower their armed guard and take control of the aircraft. It was flown to Malta where it alighted off St Paul's Bay, although damaged by Spitfires. This was probably the world's first skyjack!

On 26 October 1942 the Axis forces defending their positions at El Alamein, commanded by Rommel, had only three days' fuel left and were dependent on the arrival in convoy of the Italian tanker *Proserpina*. This was torpedoed and sunk near Tobruk by Beauforts of No 47 Sqn based at Gianaclis in Eqypt, in company with Bisley light bombers of No 15 (SAAF) Sqn. The Axis forces were then forced to withdraw.

THE STRIKE WINGS OF RAF COASTAL COMMAND

Sqn Ldr Patrick J Fry



Pat Fry enlisted in the RAF in 1941. Having learned to fly, courtesy of the US Navy, he flew Beaufighters with No 1578 SD Flt in North Africa and with No 236 Sqn at North Coates. He remained in the RAF after the war, his peacetime flying experience including tours on Spitfires, Meteors, Venoms and Hunters with Nos 504, 41 and 54 Sqns and the Fighter Weapons School. He left the RAF for commercial aviation in 1961, finally retiring twenty years later with some 18,500 hours in his log book.

In the early part of WW II, after the Blitz, the offensive anti-shipping elements of Coastal Command were largely equipped with aircraft transferred from Fighter and Bomber Commands, mainly Blenheims, Hampdens and Hudsons, with the Beaufort being the purpose-built torpedo bomber. Fg Off Kenneth Campbell was stationed at RAF North Coates, from September 1940 with No 22 Sqn. The squadron was detached to St Eval and on 6 April 1941 he and his crew, Sgts Mullen, Scott and Hillman, attacked the battlecruiser *Gneisenau* in Brest harbour and their torpedo, dropped from 50 feet at a range of 500 yards, hit the ship below the waterline, putting it out of action for over a year but they were shot down by ground fire estimated to be from nearly 1,000 guns. Two other Beauforts with torpedoes and three with bombs failed to find their target. Campbell was awarded a posthumous Victoria Cross.

Such early strike forces flew many brave and courageous missions, but their tactics were severely impeded by having to operate in small numbers, flying aircraft that lacked adequate performance, reliable weapons and aiming aids, without fighter cover and at a very low altitude delivering mainly bombs and .303 inch machine-gun fire. The Beauforts were no match for the heavily armed convoys, harbours and German fighters and their casualty rate was the highest of all operational units in the RAF, losing 648 aircraft most of them manned by a crew of four.

A rocket-armed Beaufighter TF X of North Coates' No 236 Sqn wearing full D-Day warpaint. (MAP)

Merchant ships carried, on what Swedish sea faring captains called the 'Gold Run', cargoes of iron ore from Sweden, and molybdenum, aluminium and nickel from Norway and Finland to feed the German munitions factories of the Ruhr and Saar valleys. The task of the strike wings was to destroy these cargo ships and their naval escort vessels whilst *en route* to German and Dutch ports; it was considered to be a first class air victory by May 1945.

In November 1942 the strike wings were reorganised with different tactics and, most importantly, re-equipped with Beaufighters. They were armed with four 20mm Hispano cannon with 1,000 rounds of ammunition, including tracer, and eight rocket projectiles (RP) – the early 60 lb explosive heads had a high gravity drop and were later replaced by 25 lb armour piercing solid heads which were highly successful. The combination of a harmonisation range of 600 yards for the fixed gunsight, cannon and RP release range produced a very effective weapons system, outstanding at low altitude against shipping. Alternatively, the 'Torbeau' was armed with four 20mm cannon and a Mark XV Torpex-filled torpedo fitted with a Monoplane Air Tail. Compared to earlier versions, this had far greater explosive power and better flight characteristics after dropping. A third option, the 500 lb bomb, was rarely used as it had proved difficult to drop accurately and they were also unpopular because the racks on which they were carried blocked the pilot's downward escape hatch.

At this time Wg Cdr 'Nebbie' Wheeler took command of No 236 Sqn (cannon and RP) at North Coates and developed large formation attack tactics together with No 143 Sqn (cannon only) minimising

enemy ships *Flak*, by saturating them with continuous cannon fire from 1,500 ft down to break off point. The torpedo aircraft of No 254 Sqn, at their dropping height of about 180 feet, were slightly astern and faced less *Flak* and were able to make a smooth drop. In addition, Fighter Command provided escorts to deal with Me 109 and FW 190 opposition. Operations in 1943 led by Wg Cdr Wheeler using these new tactics attacked and destroyed a number of ships in convoy off the Dutch coast and set the stage for the success of the wing for the remainder of the war.

The third change of tactics was brought about by enemy shipping moving from port to port by night to reduce their casualty rate, making it necessary to attack them in their 'safe' harbours. Sqn Ldr Bill Tacon set the precedent with an attack from Davidstow Moor to the Gironde River near Bordeaux on 24 August 1944 when the destroyer *Z24* and a large torpedo boat, the *T24*, were sunk by eighteen Beaus of Nos 236 and 404 Sqns using 25 lb armour-piercing RPs which amazed the British Admiralty. This was followed by an attack on Den Helder harbour by forty Beaus of Nos 236, 254, 455 and 489 Sqns on 12 September. I was Tacon's No 2 on both strikes. Bill was shot down in flames at Den Helder and became a POW. On the 23 September Wg Cdr Dave Cartridge's No 254 Sqn led the wing into Den Helder losing four Beaus out of seventy-three; two days later another four were lost out of sixty-five. Finally on 17 January 1945 we attacked Den Helder again, losing six out of thirty-two Beaus.

The North Coates Strike Wing operated as the largest anti-shipping force of WW II until May 1945, destroying 150,000 tons of shipping and 117 vessels, but at a cost of 120 Beaufighters and 241 aircrew. The odd one was a Group Armament Officer who went along for the ride, poor chap. The other strike wings comprised: Nos 144 and 404 (Canadian) Sqns, which operated from Strubby and Dallachy and lost seventy aircrew; Nos 455 (Australian) and 489 (New Zealand) Sqns at Langham and Dallachy, which lost seventy-one aircrew; and No 143 Sqn which moved from North Coates in October 1944 to form the Mosquito VI-equipped Banff Wing along with Nos 235, 248 and 333 (Norwegian) Sqns – they lost eighty-seven aircrew. In all the nine squadrons sank 215 vessels totalling some 300,000 tons.

Our missions covered the entire coastal regions of Norway, Denmark, Germany, Holland and France so our targets could be

A Mosquito VI of No 143 Sqn being prepared for a sortie from a snowbound Dallachy airfield. (MAP)

anywhere between Bergen and Bordeaux. A squadron usually consisted of twenty aircraft, twenty pilots, twenty Nav(W)s and, depending on serviceability, we could generally put up between nine and fifteen aircraft for an operation. Our vic formations (Leader and one aircraft on either side) built up to a sizeable formation, sometimes involving two wings joining forces at a rendezvous point. Just before initiating an attack, the anti-*Flak* aircraft would climb to a little over 1,500 ft and, to avoid collisions close to the target ship during the converging dive, the wingmen would ease out to about 100 yards. The break away at the harmonisation range of 600 yds for the anti-*Flak* Beaus helped to avoid barrage balloons and rocket-propelled piano wire.

On 9 February 1945, 'Black Friday', nine Beaufighters, mostly from No 404 Sqn, and one Mustang were shot down by FW 190s; the Germans lost five aircraft. On 2 May 1945 the Banff Wing sank two U-boats; two days later Nos 236 and 254 Sqns of the North Coates Wing sank another four – these were the last RAF attacks of WW II.

The above information has been derived from my personal experience as a member of the North Coates Strike Wing in 1944-45 and my position since 1988 as Chairman of the RAF North Coates Strike Wing Association.

MORNING DISCUSSION

AVM Baldwin. We have talked a lot about operations in the Mediterranean and North Sea. I wonder whether you have come across any parallels with what was going on in the Pacific.

Dr Goulter. An interesting question; I have not done a great deal of work in that area, although it is an aspect that I hope to explore in greater depth one day. That said, there certainly was some exchange of ideas between operators in different theatres. Indeed, the tactics conceived in the Mediterranean, which lead to the establishment of strike wings in north-west European waters, provide a classic example of such cross-fertilisation. Lessons learned were also passed on to the Americans, notably feedback on the use of different kinds of ordnance, the effectiveness of 20mm cannon and rockets, for instance, leading, apart from dive-bombing, to the virtual abandonment of bombs as anti-shipping weapons.

A weapon that we have not mentioned, HIGHBALL, was another case of an inter-theatre transfer. Barnes Wallis' HIGHBALL was an anti-shipping bomb, operating on the same 'spinning and bouncing' principle as the UPKEEP weapon used against the Ruhr dams. Intended for use in home waters, it was eventually deployed to the Far East for use against the Japanese but the war ended before it became operational.

Sir Michael Stear. I would just make the point that the use of 3-inch rockets, as described by Pat in his account of the attack on the Gironde when two pretty substantial German warships were sunk, gave the Royal Navy considerable food for thought. It was clear that its own ships, which were regarded as well-built and close to impregnable, were actually very vulnerable. It was simply a matter of finding the right combination of weapons and tactics and one feels that Coastal Command might have achieved even more if it had not been treated as such a Cinderella. Even so, there was a read-across in that Typhoons were also able to exploit the capabilities of rockets in other fields.

Anthony Furse. Towards the end of 1942 or early '43 the Americans in the Pacific, specifically V Bomber Command under Kenney, completely wiped out a convoy of Japanese merchantmen using skip bombing. Can anyone explain why the RAF never used skip bombing

in either the Mediterranean or the North West?

Sir Michael Stear. As a weapons instructor, I spent some time skip bombing, with the USAF, as well as the RAF, and can confirm that it can be very effective, but it wasn't really new. Naval captains back in Nelson's day knew that bowling Yorkers could be a good way to take out a ship, particularly if you could knock down the main mast. In practice, I suspect that a lot of the bombs dropped by Blenheims and other aircraft at low level were effectively 'skipped', but I doubt whether there was any record of exactly how the damage was caused and what the effect was. Does anyone have a better angle on the Americans and skip bombing?

Furse. I think actually Kenney's bombing system involved delayed action fuses so they drove the aeroplane straight at the ship and were safely over the other side and away before the bomb went off.

Peter Symes. My personal recollections are of the Portreath Strike Wing. Could any more be said about the significance of the operations over Biscay and of the effectiveness of the Tsetse Mosquitos using a 57mm gun?

Goulter. Is everyone familiar with the Tsetse? It was a Mosquito armed with a six-pounder cannon which was primarily intended as an anti-submarine weapon. The intensity of activity over the Bay of Biscay fluctuated, not least because it was a very dangerous area in which to operate in obsolescent aeroplanes like Hampdens which were relatively easy prey to long-range German fighters. But Biscay was not really a hunting ground for the anti-shipping squadrons. Most of the work against convoys took place off the coast of mainland Europe, between Holland and Norway; the main significance of Biscay was that it had to be crossed by U-boats transiting to and from the Atlantic and their bomb-proof pens in French ports.

Robin Woolven. I was the last Development Officer on the Air-Sea Warfare Development Unit, which was the successor to the Coastal Command Development Unit, and when we closed it down in 1970 there were six large steel containers of CCDU reports which made fascinating reading. Are any of your future projects likely to cover the work done during that period, because there were some interesting projects, spinning windscreens for aircraft for instance, and the

airborne lifeboat, and a lot more that were not successful.

Goulter. Well, the first thing we need to discover is what happened to those records. If they still exist I would certainly be very interested in them because much of what was achieved operationally by the aircrew was due to the efforts of the back room boys whose achievements, while equally important, do not attract the degree of acknowledgement that they deserve.

Sir Michael Stear. Is AHB perhaps aware of these records?

Seb Cox. No! I doubt whether they have survived. The lesson, of course, for any serving officers present, is that if you have documents that ought to be preserved, you should actually send them to *me*. Writing to higher formations suggesting that papers should be saved does not always do the trick.

(***Note.*** *Robin Woolven subsequently wrote to the effect that he had found that most of the CCDU/ASWDU reports to which he had referred were safe in the National Archives, catalogued under AIR 65.* ***Ed***)

AVM John Herrington. During her talk, Christina referred to the Vildebeest; perhaps, as an ex-OC 100 Sqn, I could expand a little on that. Two torpedo bomber units, Nos 36 and 100 Sqns, were based on Singapore and by the mid-1930s both were flying the Vildebeest, These biplanes should have been replaced by Australian-built Beauforts but, because of production problems, that never happened so, when the Japanese appeared in 1941, it was still 'open-cockpits, at 70 mph – if you were lucky'. Like the Swordfish that were being sent to attack the German cruisers coming up the Channel, which was happening at pretty much the same time, the loss rate was appalling and after two days the force was reduced to less than 50% of its strength; the two squadrons were merged which allowed them to keep going for a few more days. They did inflict some damage on the enemy but only a fraction of what they might have achieved had they had modern aircraft and, and just as importantly, had they been properly escorted. I just wanted to get that on the record because it was a significant exploit in the annals of the RAF's wartime anti-shipping operations.

Frank Diamond. There was a mention earlier of a Barnes Wallis-weapon. Was that the one that was to have been used by No 618 Sqn?

Goulter. Yes, HIGHBALL.

Dr Hugh Thomas. Perhaps I can expand on that. I am involved with No 618 Volunteer Gliding School – we fly motor gliders from Odiham. We are in touch with the 618 Squadron Association whose Flt Lt Des Curtis has written a book, *Most Secret Squadron*, in which he describes the HIGHBALL trials work carried out by the unit, the training it carried out in Scotland and its eventual deployment to Australia. It also covers the squadron's more conventional operations, including the sinking of the U976 off St. Nazaire by a pair of Tsetse Mosquitos. Incidentally, the wreck was eventually located by French divers and about ten years ago there was a reunion between veterans of No 618 Sqn and survivors of the U-boat crew.

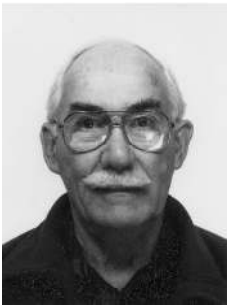
(Another concise, but comprehensive, account of the HIGHBALL concept and its development can be found in Stephen Flower: A Hell of a Bomb*: London, Tempus, 2002; pp63-89.* ***Ed****)*

Richard Bateson. On 1 July 1940 three Spitfires of No 72 Sqn shot down a Heinkel 59 which was bearing Red Cross markings; two of the crew were actually carrying Red Cross *Ausweise.* Has anyone found any information on the sequence of events that led up to a decision to shoot down German Red Cross-marked aircraft?

Air Cdre Graham Pitchfork. When it was investigated, a He 59 that had been forced down on the Goodwin Sands, was discovered to have had photographic equipment on board and, as a result, Churchill told the Germans that if any more were found they would be shot down and within a fortnight a man called Webb on No 217 Sqn actually did shoot one down off Jersey. The decision was taken on the basis that it was thought that these aircraft were conducting photographic reconnaissance missions while carrying out their humanitarian duties.

MET RECCE

Wg Cdr Bryn Lewis



An Air Ministry meteorologist since 1941, Bryn Lewis enlisted in the RAFVR two years later to join the met recce force, subsequently flying with Nos 518, 519 and 521 Sqns during the war and Nos 202 and 224 Sqns after it. He was later recategorised as a navigator, flying as such in Lancasters and Shackletons with Nos 120 and 240 Sqns, Canberras with No 12 Sqn and Vulcans with No 617 Sqn. Among other interests, he still teaches navigation and meteorology to ATC cadets.

Good afternoon. That is not a weather forecast, merely a salutation. But, how good are our weather forecasts today? While we may still have some grumbles, the complaints that were being made some sixty years ago were long and strong. Senior RAF officers, particularly at Bomber Command, were much concerned with the poor accuracy of weather forecasting and this view was endorsed by the senior meteorologists at the Air Ministry. So what were they going to do about it? It was generally agreed that airborne reconnaissance would be invaluable, but where were the aircraft, and the crews, to come from? Both were in short supply and fully committed to operational tasks.

However, the pressure increased, due to the poor results being achieved by the bombers, and the losses of crews and aircraft because of bad weather. Icing, contrail heights, jetstreams, cloud heights and amounts were all unknown quantities over the continent.

So, in 1942, the Air Ministry authorised the formation of a few Met Recce Flights equipped with Blenheims based around the UK. But these were only partly successful, because of the limited range of the aircraft, the lack of meteorological expertise and the fact that the single pilot was too busy, as was the navigator, to observe, record and encode the weather observations.

The next step was to form squadrons using some spare Hampdens, Hudsons and Venturas, and to add an additional crew member - the Meteorological Air Observer(MAO). The squadrons were based at

Among other types, late in the war, No 251 (Met Recce) Sqn at Reykjavik operated a handful of Warwicks, like this one.

Wick, Bircham Newton, St Eval, Brawdy, Tiree, Reykjavik and Gibraltar.

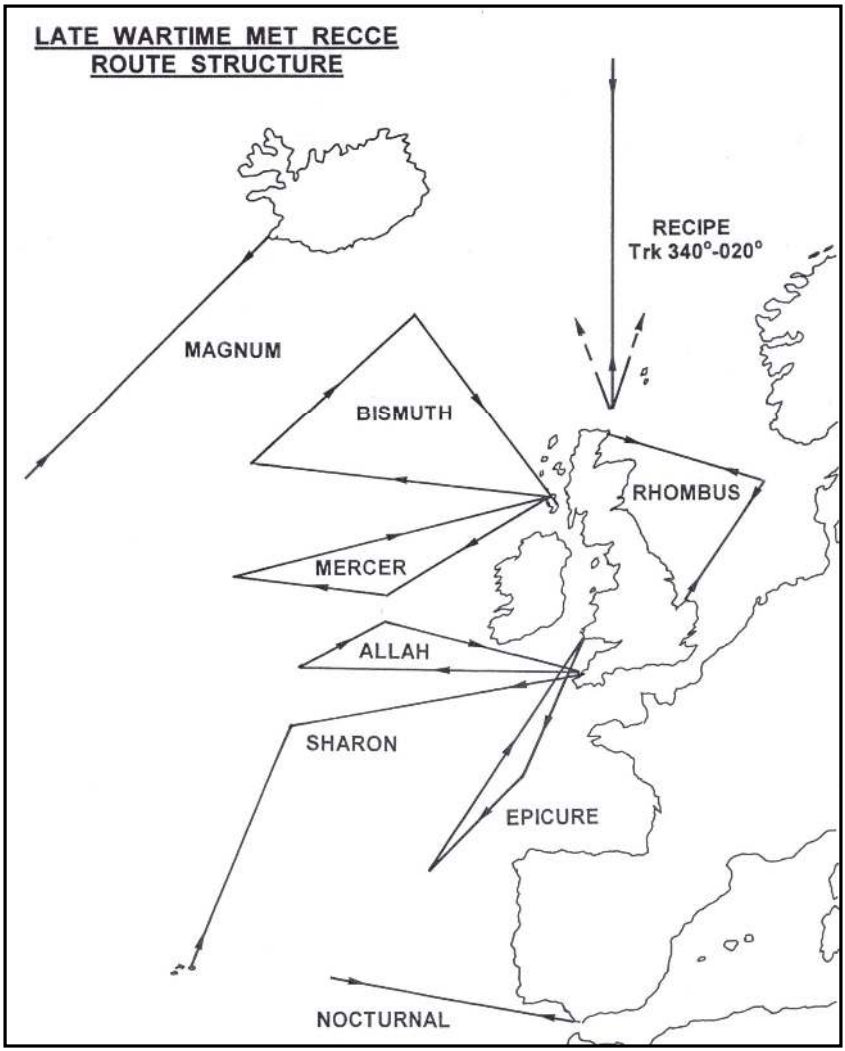
The MAOs were found by asking meteorologists who had volunteered for aircrew service, but had been denied entry through being in a reserved occupation, to apply for this new category.

I was one of those and enlisted in 1943 at Lords Cricket Ground, feeding at the London Zoo. The Air Ministry Order announcing the new category (AMO A.973/42) had stated that on the second day of service we were to be promoted to sergeant. But the staff at the Air Crew Reception Centre would have none of it – young sergeants telling the corporal Drill Instructors where to get off! Whatever next?! Induction complete, it was off to Manby for a short air gunnery course followed by basic navigation at Millom, ending up at Aldergrove to be introduced to codes, instrumentation and the sortie profile. Thus, after only two months, we were operational.

I was sent to No 519 Sqn at Wick, then to No 521 Sqn at Bircham Newton and, in late-1943, to No 518 Sqn at Tiree equipped with Halifaxes. The accompanying map shows the standard routes that were being flown between mid-1943 and mid-1945.

The Halifax had a crew of eight: two pilots; a navigator; a flight engineer; three WOp/AGs and the MAO. On No 518 Sqn, apart from members of the homegrown RAF, our crews included a mixture of Canadian, Australian and New Zealand personnel, plus two Polish meteorologists who had escaped their country in 1939.

The instruments fitted for the MAO, whose station was in the nose


LATE WARTIME MET RECCE
ROUTE STRUCTURE
RECIPE
Trk 340°-020°
MAGNUM
BISMUTH
RHOMBUS
MERCER
ALLAH
SHARON
EPICURE
NOCTURNAL

The Halifax was the mainstay of Coastal Command's long-range Met Recce Force. This one is a post-war Mk VI of Gibraltar's No 224 Sqn; prior to 1945 most Met Halifaxes were Merlin-engined Mk Vs. (MAP)

compartment, were an aneroid barometer, a psychrometer (mounted on a strut outside the fuselage), an ASI repeater, a compass repeater and an altimeter.

The profile flown on the MERCER route (the others were similar) was a westerly leg into the Atlantic for 700 nm at a height of 950 millibars (mb) roughly 1,500 ft or so depending on the sea level pressure (SLP). If the SLP had been 950 mb, then we would have been flying at wave top height! An observation was made every 50 nm and at every fourth the SLP was measured. This was done by letting down to about 30 feet above the water, setting that height on the altimeter and reading the SLP off the pressure sub-scale. The pilots quite enjoyed doing this exercise in daylight when the Atlantic was blessed with a light breeze and no low cloud. But at night with a gale blowing and very low cloud it was a different matter!

I recall that one of the initial aids issued to assist in this procedure at night, was a small tin can dropped from the aircraft, and timed till a small flash was seen as the can exploded. A table would give height against time – it was not the most trustworthy of aids and we were grateful when it was eventually succeeded by the radio altimeter.

Each observation made by the MAO recorded: visibility, both vertical and horizontal; dry and wet bulb temperatures; cloud type, amount, base and top; precipitation; wind velocity at both sea level and at height flown; and the incidence of icing and turbulence – and there was plenty of *that* over the Atlantic.

At the terminal point an ascent was made to 500 mb, about 18,000 ft, zig-zagging on short legs, and levelling out every 50 mb

(roughly 2,000 ft) to record temperature readings, cloud base, tops and types and the presence of icing. Many times I reported 100 degrees of frost (-70°F)

On reaching 500 mb, that height was maintained for 400 nm on the reciprocal leg home, and observations continued to be made every 50 nm. We then descended back to sea level, using the same stepped procedure as in the climb, to fly the rest of the homebound leg at 950 mb.

The weather observations were figure coded, and then encyphered using a 'one time book' and transmitted to base by the wireless operator. My wife was one of the WAAF operators who received these messages, often sent under very difficult atmospheric conditions.

Was it all worthwhile? There is no doubt that all the meteorological reconnaissance was much appreciated by the forecasters, and their predictions improved significantly. Mr Churchill saw fit to send a special 'Thank you' signal. And many of you will recall General Eisenhower's dilemma in 1944 as to whether, after the previous day's weather had been so unsuitable, he should make D-Day 6 June. After studying the observations made over the Atlantic, Gp Capt Stagg, the senior British meteorologist, advised Eisenhower that the conditions would be just acceptable and so D-Day took place on 6 June.

Altogether some 16,000 Met sorties were flown, and about 180 MAOs were awarded their 'M' brevet by the Air Ministry – but not until fourteen days before the end of WW II! Sadly some twenty of these men lost their lives. None of these losses were due to enemy action, most will have been caused by the atrocious weather that the crews often encountered.

The Met squadrons claimed that, whatever the weather, they flew their sorties 'when even the birds were walking.'

MARITIME AIRPOWER - A DARK BLUE PERSPECTIVE

Cdre Toby Elliott

Toby Elliott joined the RN in 1963 and spent most of his career in front-line appointments. A submariner by trade, and an ASW specialist, he commanded the submarines Otter, Resolution *and* Trafalgar*, the Tenth Submarine Squadron, the Second Frigate Squadron and took part in the Gulf War as captain of the frigate* Brilliant*. His final appointment was as the Director of Fleet Operations at Northwood. Since his retirement he has been Chief Executive of the Ex-Service Mental Welfare Society (better known as Combat Stress).*

Maritime Air Power, from any perspective, even a dark blue one, is a big subject and not one to which I will be able to do full justice in the time allotted to me. Therefore, although I will touch on some of the big issues surrounding the Fleet Carrier, I will concentrate on one important aspect of the business and that is anti-submarine warfare.

My personal interest in military aircraft stems from my early childhood, when my grandfather, Maj Jimmy Elliott RFC, used to talk about his flying experiences on the Western Front during the latter stages of WW I, illustrated by beautifully made models of all the British and German aircraft which were involved, with which he used to demonstrate the scraps in which he and his squadron seemed to spend their time, conducted over No Man's Land of course.

My grandfather also brought me up on a rich diet of William Heath Robinson, so my early impressions of what his war was all bout tended to be illuminated such imaginative concepts as the 'Aero Biffer' and the 'Subzeppmarinellin'.

I was also struck by the similarity between our two professions whilst reading the recent *Times* report of the unveiling of the Coastal Command memorial in Westminster Abbey. Peter Davies writes:

> 'Maritime patrolling was, perhaps, a far cry from the glorious deeds of Fighter Command or the ultimately overwhelming destructive capacity of Bomber Command, and it came less to

> public attention. Most Coastal Command aircrew had to become inured to the monotony – and danger – of long flights over trackless oceans often in vile weather.'

Well, for 'aircrew' read 'submarine crews', and the nature of the job is just as described; it is only the sortie length that is slightly different.

Looking at maritime air power from a dark blue point of view, it is necessary to go right back to the beginning. In the early years of the 20th Century, British military thinking about the potential use of the aeroplane lagged far behind that of the main European powers, particularly the French. In 1910 the Chief of the Imperial General Staff had described aviation as 'a useless and expensive fad' whilst the First Sea Lord estimated that the naval requirement would be for two aircraft in total. However, the government was forced to bow to public opinion, and in early 1911 the War Office was directed to set up an Air Battalion of the Royal Engineers. Later in the same year there was further evidence of the utility of military air power when the Italians conducted aerial reconnaissance and aerial bombardment against Turkish targets. Prime Minister Herbert Asquith directed that the whole issue be examined by the Committee of Imperial Defence, which resulted in the creation of a new flying organisation comprising two operational wings and a school. Established under a Royal Warrant of 13 April 1912, the notionally joint-Service Royal Flying Corps was intended to embrace all aspects of both naval and military flying.

It will come as no surprise that the apparent subordination of all forms of naval aviation to an Army corps was much resented by the senior service, and the Admiralty, independently, and without authority, set up its own flying branch, the Royal Naval Air Service, although that name was not formally introduced until July 1914.

During WW I the competition for resources between Navy and Army was fierce and, in 1917, when General Smuts recommended that the two Services should be amalgamated, there were those, most notably Trenchard, who saw the introduction of a third competitor as being singularly unhelpful. Well, the rest is history, and there is a very interesting book to be written about the ups and downs of the primary resource driven battle which has lain behind the development of the

United Kingdom's maritime air power from those early days right up to the present. As Lord Trenchard foresaw, this has proved not always to be in the best interests of either of our Services, dark or light blue, nor always in the best interests of inter-Service relations! However, as a sharp-end man, I relish the achievements of the gallant airmen who have contributed so much during the ninety years since all of this really began, whatever the colour of their uniforms.

Jeff Jefford has already spent some time on WW I but I will offer a couple more vignettes – if only to underline the breadth of capability that is required at sea and how soon that was recognised. For instance, as early as 1915 Lt Cdr Martin Nasmith, CO of the submarine E11, was flown over his area of dived operations in a Farman before setting off to penetrate the Dardanelles and 'run amuck' in the Sea of Marmara. Nasmith, whose exploits won him a VC, described the purpose of his flight as being 'to look at the jumps'.

But, for the marine aviator, the main theatre of operations was in the North Sea and around the coastline of the UK, where the German threat came from the Zeppelin and the U-boat. The War Cabinet was particularly concerned that U-boats operating from Flemish ports might disrupt the supply system supporting the army on the Western Front, since all stores had to cross the Channel by sea.

Following Lt S D Culley's first successful take off of a Sopwith Camel from a lighter towed by a destroyer, he was to use the same technique of forward deployment to shoot down the last Zeppelin of the war to be destroyed in air combat. Clearly, this was an extension of the tactics advocated by submariners who believed in projecting maritime power well ahead of the surface forces they were trying to protect. Two years earlier, in 1916, an attempt had actually been made to combine the two concepts by using submarine-borne aeroplanes. This had involved two Sopwith Schneider seaplanes being carried on the deck of the submarine E22 whence they were floated off to get airborne under their own power. The experiment worked, to the extent that the aeroplanes succeeded in taking off and flying home, but several practical problems had been encountered. Unfortunately, the E22 was sunk by a U-boat the following day, which brought the trials programme to a premature end and left the difficulties unresolved. The idea was taken up again in 1928 when the submarine M2 was converted to serve as a seaplane carrier but when she foundered, with

the loss of all hands, in 1932 the Submarine Service decided that aviation was best left to others and went on to plough its own distinctive furrow.

As we know, the Battle of the Atlantic was one of the decisive campaigns of WW II. During the early years of this, the longest battle, the shortage of long-range land-based aircraft to fill the North Atlantic 'gap' compounded the scarcity of surface escorts and the lack of the escort carriers, or merchantmen fitted with flight decks, which would eventually permit a convoy to mount its own anti-submarine patrols. Coastal Command had only two squadrons of long-range aircraft in 1942 (twenty-eight aircraft), not because of a general shortage, but because Bomber Command continued to win the battle for resources, with priority being given to attacking German industrial cities.

As Peter Padfield puts it in his book *War Beneath the Sea*:

> 'In truth there had been no reasoned basis of the policy; it had been dictated by the belligerent prejudice of Churchill, his advisers, Lord Cherwell – who before the war had advised against the development of radar – the former Air Force Chief, Lord Trenchard, and the dominant "bombing group" in the Air Staff, whose tunnel vision was most notably expressed by the new Chief of Bomber Command. The failure of the Admiralty to make a reasoned case did not help their cause. They had diluted the urgency of the argument for long-range aircraft for Coastal Command by mixing it with issues of naval command of bombers operating over the sea and naval training for Coastal Command Aircrews. Above all they had failed to point out the idiocy and profound historical ignorance of the bombers' claim that bombing German cities was "offensive" while protecting convoys was "defensive".'

It was estimated that it would have taken forty long-range aircraft, preferably, but not in the first instance necessarily, fitted with centimetric radar, to close the air gap south of Greenland and so make the U-boats' task on the principal supply routes from America practically impossible. The person to feel sorry for was the AOCinC Coastal Command, Air Mshl Sir Philip Joubert de la Ferté, whose memory was said to be as long as his name, and whose pleas for aircraft were dismissed by the Air Staff because, they said, he was

asking the impossible, and who was blamed by the Admiralty for not pressing his case hard enough. Eventually the aircraft were provided, and the air gap closed – that, plus the fitting of radar to maritime reconnaissance aircraft was to contribute greatly to the defeat of the U-boat.

Turning now to the post-war era, the attention of the Naval and Air Staffs was frequently focused on a fundamental question: how best to deliver maritime air capability in the future? This was during a period when the Fleet Carrier, with its multi-roled air group was considered to represent the epitome of maritime air power. Of course, in some navies this has always remained the case. It seems to me that this period must have been the heyday for those fortunate enough to have been flying, when such great aircraft as the Buccaneer and Phantom, together with organic AEW and ASW aircraft, were operated off the decks of these large ships, and the Royal Air Force had equally impressive and capable aircraft operating from shore bases. However, changes in foreign policy, particularly the withdrawal of our forces from East of Suez, were to cause the demise of the Fleet Carrier and almost lead to the end of fixed wing flying in the Fleet Air Arm, with what was seen by the RN as a fatally flawed decision being announced in 1966.

This was a very difficult interlude for those who were working in the Ministry of Defence. From a personal point of view, I experienced something of the genuine concern which was being felt in the surface fleet in 1970, when I was serving aboard an ASW frigate. We were exercising the new Tactical Air Support of Maritime Operations (TASMO) procedure, with Buccaneers flying out of Lossiemouth to attack ORANGE surface forces which were simulating Soviet warships armed with anti-ship missiles operating in the Greenland-Faeroes-UK gaps, and I well remember the very long wait for these aircraft to arrive on target, this is if they were able to make it at all before simulated missile release. Not a comfortable feeling for a Service which still keenly remembered such events as the loss of the *Prince of Wales* and *Repulse* to Japanese land-based aircraft when this Task Group lacked any form of air cover whilst operating off the east coast of Malaya. It was, of course, not sensible for these ships to have been exposed in this way, but it was the lack of maritime air resources that lead to this sad event in the first place.

More recently the very difficult funding issues with which the Ministry of Defence has been faced have generated bitter disputes between Naval and Air Staffs, over such issues as the aircraft carrier and its associated air group. In the late 1970s we had the debate about the *Invincible* Class CVSs and their Sea Harrier FRS1 aircraft. These aircraft, along with the RAF's Harriers, represented a great capability at the time (and still do), but it was a pity that the ships, and therefore the size of their embarked air group, could not have been any bigger. In 1981 the now infamous Nott Defence Review put even this limited capability at risk. Had it not been for the timely reminder of the crucial need for embarked air power provided by the Falklands War, this class of ship had been destined for disposal abroad or the breaker's yard. But it was also the Falklands War that brought home the vulnerability of surface ships to attack by air-launched anti-ship missiles, as well as to the iron bomb and gunfire delivered by aggressively flown modern aircraft. Despite the heroic efforts of the embarked combined Harrier Force to establish and maintain air superiority and provide support for troops conducting ground operations, it was a very close run thing. But there would have been no air cover at all if our two small carriers had not been available.

Even more recently, in 1993, during an incredibly frustrating period when the Italians refused to grant basing rights to the RAF ground attack aircraft which had been assigned to provide air support for UK troops on the ground in Bosnia, it fell to Sea Harriers operating from carriers in the Adriatic to meet this task. For the Sea Harrier ground support was by no means its primary role, but it was better than nothing.

But I fancy that much good has resulted from this tricky situation – and I had a hand in it. In 1993 I was the Deputy Director of Naval Operations and, as such, I sat through countless hours of Balkans briefings on a daily basis. I had just been reading about the Falklands War and I had been impressed by the role played by the RAF Harrier GR3s of No 1 Sqn, embarked in HMS *Hermes*. Clearly, this concept could be employed again to solve the current problem.

By 1993 the far more capable Harrier GR7 was available and it was just the right aircraft for the task in Bosnia. Having done a few checks with my Fleet Air Arm experts, I well recall the day that I suggested to the Director Air Offensive, that we should deploy a

squadron of GR7s afloat in the Adriatic. I will not repeat what was said in response – something about a dark blue plot to steal his Harriers – and he did not accept my proposal. But I had good reason to press the case – the ten GR3s of No 1 Sqn had put on a fine show in the Falklands and the Balkan campaign provided a golden opportunity to repeat the exercise.

We persevered, but it took something like 18 months before all was ready and the first deck landings took place. I also remember being aboard to witness the first operational deployment of GR7s, together with their supporting staff, to HMS *Ark Royal* at sea in the Adriatic. This event represented a really significant enhancement of our capability, and one which could be made available to any future Joint Commander. It was also a convincing demonstration of what can be achieved when inter-Service rivalries are set aside in the interests of achieving the right force mix for the job in hand.

We entered the era of the Permanent Joint Headquarters at about the same time as this significant initiative was being implemented and since then the pace of change has been very rapid. We now have the Combined Harrier Force – and the AOC 3 Gp RAF is a rear-admiral! – and, in the current context of joint force expeditionary warfare, there seems to be unanimous recognition of the utility of the aircraft carrier and its relevance to world-wide operations.

The UK is now planning to build two Fleet Carriers (CVF), which will operate the Future Joint Combat Aircraft (FJCA) based on a UK/US collaborative development of the STOVL Joint Strike Fighter. This new aircraft is expected to replace the Harrier from 2012, and will be flown by pilots of both Services. This combination of the flexibility of air power mixed with the flexibility of sea power really does provide a significant force multiplier. It may have taken the best part of a century to get this far, but it is great to see it happening.

To round off, I shall focus on just one aspect of maritime air power – anti-submarine warfare – ASW. First we need to remind ourselves of the amazing technological advances that have been made. In the air, maritime patrol aircraft (MPA) have evolved from the Felixstowe flying boat of WW I via the Sunderland and Liberator of WW II through the early post-war Lancaster and the later Shackleton to today's highly capable Nimrod.

In much the same timeframe, our submarines had evolved from the

relatively primitive 'submersible gunboats' of the 1900s to the modern Nuclear-Powered Ballistic Missile Submarine (SSBN), very quiet, with sophisticated sensors and great endurance. The Cold War opposition had made similar strides, of course, and, with its Northern, Baltic and Black Sea fleets operating in the Norwegian Sea, the North Atlantic and the Mediterranean, the Soviet submarine fleet was formidable in both its size and its capability.

The first generation of Russian Nuclear-Powered Cruise Missile Submarines (SSGN) were quite 'agricultural', very noisy and thus detectable on passive sonar at great range. But they were to spend billions and billions of roubles developing, building and deploying a wide range of extremely potent and impressive submarines. By the early 1980s the Russians had their *Victor* and *Akula* Class Nuclear-Powered Attack Submarines (SSN) which demonstrated that the Soviet submarine builders had finally caught up with the West in terms of stealth and capability. Sadly, they were helped in their endeavours by some terribly damaging spy scandals, the most notorious being known as the Walker-Whitworth case in which the Soviets learned of the extent to which their submarines were vulnerable to detection and tracking by allied ASW forces, and thus what they needed to do to achieve the same level of sonar advantage as was being enjoyed by American and British ASW units. When these new submarines eventually appeared in the Northern Fleet's ORBAT they were a very different kettle of fish to the boats that we had had to deal with before. They were very quiet, well armed, handled in a thoroughly professional manner and were on a par with the best that either the USN or Royal Navy could put up against them. The *Akula* Class, for instance, was capable of deploying and remaining undetected for the entire duration of its patrol, the only evidence of its being at sea being its absence from its berth.

But there were others, like the *Delta IV* SSBN, which was designed to sit under the ice-cap until ordered to launch; clearly, very difficult to detect unless picked up as it deployed from its home port. Then there were the *Typhoon* Class boats, star of the film *Hunt the Red October*, and the *Oscar IIs*, like the ill-fated *Kursk,* bristling with anti-ship missiles. In the highly complex water structure of the Norwegian Sea, which is so favourable to the submarine commander determined to avoid detection, boats like these were capable of simply

disappearing. These formidable vessels really did represent very difficult ASW targets.

A nuclear submarine will remain deep for the vast majority of its patrol, rendering it undetectable by the radar carried by MPA. It is, therefore, the acoustic and non-acoustic signatures of the submarine which have to be exploited. For both sides it was the development of even quieter submarines and the need to counter this with even more sophisticated sensors which was to cost so much money, and that, plus the huge costs of the strategic deterrent programme, became a major contributory factor in the economic collapse of the Soviet Union, and a cost which was to have a major affect on the ability of many of the western allies to maintain properly balanced force levels.

But it was not just the cost, but the very clear indication that allied ASW forces, and those of the United States and Great Britain in particular, had the capability to track and to target Soviet SSBNs deploying from their bases into the North Atlantic, which was to prove so dispiriting to the higher command of the Soviet Navy.

Much of what went on is still shrouded in secrecy, but for some years it has been in the public domain that the success of the western allies lay in its superior intelligence capability, not least in the system known as SOSUS (Sound Surveillance System). This system provided the cueing (the where to go to find the needle in the haystack) needed by mobile ASW platforms, MPA, submarines and surface forces, to permit them to close the target within passive sonar range, for instance by laying a field of sonar buoys, and thus to locate and track Soviet submarines as they deployed into the Norwegian Sea or the North Atlantic.

In the 1970s and ‘80s there was a constant flow backwards and forwards by Soviet SSNs and SSBNs into the western Atlantic Missile Patrol Areas, and to and from the Mediterranean. As I have said, in the early days these targets were extremely noisy, and there were rich pickings to be had from allied SSNs and by MPA, flying out of Keflavik, Kinloss, St Mawgan, the Azores, Bermuda and airfields on the US mainland. Towards the end of this period, which went on well beyond the end of the Cold War, the well-handled targets became much quieter and became a real challenge for the allied ASW teams.

The main allied players were USN P-3 Orions, RAF Nimrods, towed array-fitted ships, like the British *Leander* Class ASW frigates,

and American and British SSNs. Each of these units could function by itself, but more often they took part in highly complex ASW operations. It was very real, and some of it was 'whites of their eyes' stuff, which demanded the highest of standards of vigilance and the utmost professionalism by the participating crews.

Thus far, this aspect of the Cold War has perhaps been best exposed by the novels of Tom Clancy, although there is a great deal of information in the public domain, released mainly by the US Government. It was a long, drawn out campaign, made exciting for those who took part in it by the nature of the highly secret operations in which we were participating, by the rapid developments in the technology being applied to the sensors and weapons systems which we used and by the routine testing of our professional skills in a great game which was little short of how we thought we would actually have to fight if deterrence had failed.

All of this involved countless flying and dived hours, all carefully co-ordinated and directed from the Joint ASW Headquarters which enjoyed the best of, often real time, intelligence support. The rewards, when they came, were worth it – there was, for instance, enormous professional satisfaction to be gained by a Nimrod crew which succeeded in locating an *Akula* which had been missing from its berth for some time and then handing it on to an SSN or a towed-array frigate which might escort it all the way home. All of which adds up to an outstanding example of how successfully air and sea forces can operate together.

Without any doubt, these combined ASW operations were one of the true successes of the Cold War and for those of us involved, both dark and light blue, and for our close friends and allies in the USN submarine and MPA fraternities, and all of those many people who provided the superior C3I support, without which nothing on such a scale would have been achieved, it has to be a source for great satisfaction.

MARITIME PATROL IN THE PISTON ENGINE ERA

Air Cdre Bill Tyack

Bill Tyack joined the RAF in 1962. Trained as a navigator, he flew in Shackletons with Nos 210 and 42 Sqns, before a lengthy involvement in trials and evaluation work on the Nimrod, much of it at Boscombe Down but including a stint at the Atlantic Undersea Test and Evaluation Center in the Bahamas. His later tours, with operational requirements and policy staffs, continued to have a strong maritime flavour.

Introduction

The Royal Air Force used several types of maritime patrol aircraft in the period between WW II and the introduction of the Nimrod at the end of the 1960s. However, the story of this era is really the story of the Shackleton. I wish to acknowledge the help and information that many people have given me while preparing this paper. In particular, Jeff Jefford and the Newark Air Museum were most helpful. Any errors or omissions are my responsibility.

The Early Years

During WW II long-range maritime aircraft, such as the Liberator, had played a vital role in winning the Battle of the Atlantic, but, as John Terraine says, 'the end arrived none too soon in the maritime war.'[1] Towards the end of the war the Germans had developed the Types XXI and XXIII submarines, which had a higher underwater speed and greater battery capacity. They had also perfected the schnorkel (a Dutch invention) that enabled a submarine to run on diesel engines and charge its batteries while submerged, with only the small schnorkel head exposed above the surface. These advances enabled U-boats to continue operations in home waters, despite Allied dominance of the air and surface, until the end of the war. To quote Terraine again, 'Thus by 1945 the wheel had turned full circle: having evolved from a blunt and ineffectual weapon into a deadly killer of submarines, at the end of the war the anti-submarine aircraft was – for want of an adequate method of long-range detection of submerged

A Lancaster GR 3 of No 38 Sqn. (MAP)

boats – almost back where it had started. The fast schnorkel submarine had emerged from the Second World War technically, if not militarily, triumphant.'[2]

Therefore, at the end of the war the submarine remained a formidable weapon and Britain, which had twice almost suffered defeat at the hands of this threat, was alert to the need to retain an effective anti-submarine capability. Moreover, Britain still had substantial overseas commitments, where the many secondary roles of maritime aircraft would prove invaluable. However, under the terms of the Lend Lease Act, at the end of hostilities the very-long-range Liberators and Fortresses, which had played such a large part in the Battle of the Atlantic, had been returned to the USA.

The operational requirement for a replacement that would emerge as the Shackleton, OR 200, had already been written in outline in late 1944, but there was a need for a stop-gap; so some Lancaster Mk 3s were rapidly converted first for air-sea rescue duties and then, with the addition of ASV 13 radar, to the general reconnaissance role.

Meanwhile, the first signs of the Cold War were appearing as the Soviet Union annexed, rather than liberated, large swathes of Eastern Europe. It was obvious that the defence of Western Europe against potential Soviet aggression would rely on massive reinforcement both of men and equipment from the USA. So it was vital to be able to protect the North Atlantic sea lines of communication from submarine attack. At this time the West overestimated both the rate at which the Soviets would build new submarines and how fast they would adopt

2 × sqns Sunderland GR 5	Calshot
3 × sqns Lancaster GR 3	Leuchars & St Eval
1 × sqn Lancaster ASR 3	St Eval
1 × sqn Halifax GR 6 (Met)	Aldergrove
1 × sqn Mosquito FB 6	Thorney Island
1 × sqn Beaufighter TF 10	Thorney Island
3 × sqns Sunderland GR 5	Ceylon, Hong Kong, Singapore
1 × sqn Lancaster GR 3	Malta
2 × sqns Beaufighter TF 10	Ceylon, Singapore

Table 1 – RAF Maritime ORBAT 1946.

German advanced submarine technology. In 1946 US Naval Intelligence predicted that the Soviets would have a force of 300 'Type XXI' submarines by 1950.[3] However, by late 1946, with the post-war run down almost complete, Coastal Command had only nine squadrons in the UK. (Table 1) The Command was just over one third the size it had been on 3 September 1939. Therefore, as a further stopgap while the Shackleton was being introduced, under the terms of the Mutual Defense Assistance Program (MDAP) the United States loaned the RAF fifty-two Lockheed P2V-5 Neptunes.

In fact, by 1951 the *Whiskey* Class submarine was just beginning to appear. This was based on a pre-war Soviet design (the Stalinetz), was less capable than the German Type XXI and initially did not incorporate a schnorkel. However, in 1952 the more capable *Zulu* Class appeared, incorporating the new technology, and over the succeeding years the Soviets built up a powerful force of attack submarines, designed to interdict the sea lines of communication, and of cruise missile-firing submarines, specifically targeted against the US Strike Fleets. Meanwhile, in 1949 the Soviets detonated their first nuclear weapon, which raised the spectre of submarines armed with nuclear missiles. This came to pass in 1957 when the first Soviet ballistic missile submarine, a converted *Zulu*, put to sea. Then, in the following year, three new classes of nuclear powered submarines appeared: the *Hotel* ballistic missile submarine; the *Echo* cruise missile submarine and the *November* attack submarine.[4] By 1966, twenty years after the end of the war, the Soviet Navy contained 350 conventional and fifty nuclear-powered submarines. Of these, forty

2 × sqns Sunderland GR 5	Pembroke Dock
3 × sqns Shackleton MR 1	Ballykelly, St Eval
3 × sqns Shackleton MR 2	Ballykelly, St Eval
2 × mixed sqns Shackleton MR 1 & 2	Aldergrove, St Eval
4 × sqns Neptune MR 1	Kinloss, Topcliffe
1 × sqn Hastings Met 1	Aldergrove
1 × sqn Sunderland GR 5	Singapore
3 × sqns Shackleton MR 2	Gibraltar, Malta

Table 2 – RAF Maritime ORBAT 1956.

were armed with ballistic missiles and forty with cruise missiles.[5]

This build up of a powerful Soviet submarine force reinforced the need for Britain and her NATO allies to maintain an effective anti-submarine warfare capability to allow NATO free use of the oceans, while denying the same to the Soviets. So by 1956 the Maritime ORBAT (Table 2) consisted of a mix of Sunderlands, Neptunes and Shackletons, plus the Hastings meteorological aircraft.

The Sunderland

The Sunderland flying boat had entered service in 1938 and served with distinction in the anti-submarine and general reconnaissance roles throughout the Second World War. After the war the Sunderland Mk 5 continued in service with Nos 201 and 230 Squadrons at Pembroke Dock until 1957 and in the Far East for another year, until it was finally withdrawn from service. During this time, it took part in the Korean War and the Berlin Air Lift. In 1949 Communist Chinese forces shelled HMS *Amethyst* on the River Yangtze. The attack killed and injured many of the crew, including the ship's doctor. A Sunderland of No 88 Sqn was sent from Kai Tak to land alongside the ship and transfer an RAF doctor and medical supplies.[6]

The Sunderland had a heavy defensive armament, with ten guns in nose, dorsal and tail turrets and two in the beam lookout positions, to compensate for its slow maximum speed of 187 kts. However, the maximum bomb load was only 2,000 lb and its maximum still air range some 2,600 nm. Therefore it did not provide the capability that the post-war RAF sought in a long-range maritime patrol aircraft.

The Neptune

The Neptune entered service with the United States Navy in 1946.

The RAF operated the P2V-5 version (designated Neptune MR 1) from 1952 to 1957, based at Kinloss and Topcliffe. With a bomb load of up to 8,000 lb (two homing torpedoes or twelve depth charges), the AN/APS-20 search radar, a searchlight for night operations in the starboard tip tank and a still air range of nearly 3,500 nm it was a capable aircraft. When they arrived the Neptunes had guns in nose, dorsal and tail turrets. The Royal Air Force removed the nose and tail guns from half the fleet and fitted a long tail carrying Magnetic Anomaly Detection (MAD) equipment. MAD detects anomalies in the Earth's magnetic field caused by large metal objects, such as a submerged submarine. It has a limited detection range, so it is used for relocation, rather than initial search. Very precise flying at extremely low level above the sea is required for MAD to be effective.

The Evolution of the Shackleton

There is no shortage of published information on the Shackleton; for example the excellent books by Chris Ashworth[7] and Barry Jones.[8] The Shackleton Association[9] website is a mine of information and several aircraft are preserved in museums and private collections.

When the requirement for a new long-range maritime patrol aircraft was raised in 1944 the Royal Air Force was preparing to shift the focus of its operations from Europe to the Far East and what was expected to be a long battle to defeat Japan. So the requirement was conceived as a new long-range version of the Lincoln for both the bomber and maritime reconnaissance roles. However, with the early end of the Pacific War there was time to refine OR 200 and develop a new design, the Avro Type 696, which would be a significant improvement over the Lincoln. The most important features of OR 200 (Issue 2) in March 1946 were: a range of 3,000 nm with 6,000 lb of weapons; sufficient space for a large amount of electronic equipment; and a much better environment for the crew to enable them to remain effective throughout very long flights. The first Shackleton was delivered to No 120 Sqn on 30 March 1951. The build up was rapid, with seven squadrons in service by the end of 1952. Over the years a total of 178 Shackletons was built for the RAF, plus four prototypes and eight Mk 3s for the South African Air Force. The type evolved through three marks of airframe, and three phases of equipment upgrade. There were also two training variants and the

Shackleton's final guise was that of an airborne early warning aircraft, which remained in Service until 1991, giving an operational life of forty years. Throughout its career the Shackleton's development had three main thrusts: adequate range and endurance with a useful weapon load to 'close the Atlantic Gap'; equipment upgrades to keep pace with developments in the threat; and the never-ending search for crew comfort. The aircraft was also dogged by problems with structural fatigue and there were several schemes to extend the airframe's life.

The Shackleton MR 1

The Shackleton had a large fuselage cross-section, to accommodate crew and equipment, and a capacious bomb bay. The wing centre section was that of the Lincoln; the outer wings and undercarriage were from the Tudor civil transport. The tailplane originated from the Lincoln, but the size of the fins was increased during development to something more like those of the Liberator. Four Rolls-Royce Griffon Mk 57s provided power, each with twin contra-rotating De Havilland propellers. The Griffon, with a lineage stretching back to the Schneider Trophy R-type engine, had been developed to meet the Royal Navy's requirement for a more powerful engine than the Merlin for operations from aircraft carriers. The contra-rotating propeller arrangement was designed to avoid torque-induced swing during take-off from a carrier and, more importantly, on overshoots. On the Shackleton the contra-rotating propellers provided a very efficient way of converting the power of the Griffons into thrust. For self-defence the aircraft had a Bristol B17 mid-upper turret, with twin 20mm Hispano cannon. The MR 1 had a wingspan of 129 ft, an empty weight of 49,600 lb and could mount a four-hour patrol at a radius of 780 nm from base.[10]

As originally designed, the Shackleton had 20mm cannon in a barbette on each side of the nose, with the gunner sitting alongside the bomb-aimer on a bench seat in the transparent nose, and a Boulton Paul rear turret with two .50 calibre machine guns. However, the nose barbettes proved ineffective and the rear turret caused centre of gravity problems and neither went into production. The prototype was also fitted with an air-to-air refuelling receptacle for Flight Refuelling Ltd's looped line system, but the requirement for this was dropped and

A Shackleton MR 1 of Gibraltar's No 224 Sqn poses against the rugged backdrop of the Rock. (MAP)

it was not fitted to production aircraft

The primary search aid was the ASV 13 centimetric radar in a chin radome. The detection range was about 40 nm on a destroyer, 20 nm on a surfaced submarine and 8 nm on a submarine conning tower in Sea State 1. In rougher conditions, the range would be much less. The early Shackletons had transparent radomes that offered a clear view of the radar scanner. The other search aid was AUTOLYCUS, designed to detect the exhaust fumes from a submarine's exhaust. The system worked in an academic sense and it was possible to detect an exhaust trail and home upwind along the trail to reach the source. However, in practice there were just too many other sources of exhaust fumes, such as merchant ships; so the false alarm rate was much too high for effective operational use. Perhaps the MR 1's most reliable search aid was the Mk 1 eyeball. The aircraft was well provided with lookout positions, in the nose, the cockpit, the astrodome, the mid-upper turret and special look out positions on either side of the beam. Visual search remained an important and effective capability throughout the life of the Shackleton.

Sonobuoys were carried for localisation of a submarine submerged before a direct attack could be made. A sonobuoy is a cylindrical device consisting of a flotation buoy, a hydrophone to detect noise in the water and a radio transmitter to send the sonar signals back to the aircraft. The sonobuoy is released from the bomb bay, a small

parachute retards its fall and on striking the water it releases the hydrophone, which sinks to the end of its cable. At the same time the aerial is erected and the buoy begins transmitting whatever sounds the hydrophone receives. When the Shackleton first entered service these sonobuoys were short-range and omni-directional. It took about 15 minutes flying a cloverleaf to lay the standard POBRY[11] pattern of one buoy on the datum and four others at 2 nm spacing around it. The datum buoy had to be overflown before each subsequent buoy was laid to ensure that the relative positioning was as accurate as possible. In order to track a submarine the sonics operator needed to hear it on more than one buoy. He would confirm that it was a submarine signature and then estimate the relative signal strength on each buoy. The navigator used these relative strengths to construct a fix, based on the signal strength being inversely proportional to range from the buoy.

The Shackleton MR 2

The specification for the MR 2 version of the Shackleton was issued in December 1949, before the first production MR 1 had flown. It was to incorporate many of the features that had been proposed for the MR 1, but had not been fitted, not least better sound-proofing for the crew. When it entered service in 1952, the MR 2 had a longer nose, with twin 20mm Hispano cannon in a Boulton Paul Type L turret and a prone bomb-aimer's position. The dorsal turret was retained initially, but was removed in 1956. The radar scanner was relocated aft of the bomb bay in a retractable dustbin that had three positions: up for take off and landing; search for normal operation; and fully extended in the attack position, used when the bomb doors were open. This provided much better radar coverage in all flight conditions and while manoeuvring. The tail wheel was retractable and the aerodynamic tail fairing contained an additional lookout position. However, the MR 2 was some 2,000 lb heavier than the MR 1. Therefore, despite its aerodynamic improvements, it had a still air range of only 2,780 nm and a radius of 670 nms for a four-hour patrol.

Phase I Modifications

In 1957 fatigue tests and calculations showed that the fatigue life of the Shackleton was only 3,600 flying hours. This led to a series of modifications to strengthen the structure and extend the life of the

Structural strengthening
ASV 21 radar
BLUE SILK Doppler radar and GPI 4
Tactical plotting table
VHF homer
IFF Mk 10
Radio altimeter Mk 5
ILS and zero reader
Autopilot Mk 10

Table 3 – Phase I Upgrade.

aircraft. As far as possible these structural modifications were undertaken at the same time as the equipment upgrades, which were planned in three Phases. The first Mk 2 Phase I aircraft were delivered to squadrons in 1959, containing the modifications listed in Table 3. The most important feature of Phase I was the introduction of the ASV 21 radar, which was a derivative of the H2S Mk 9. The ASV 21 was more reliable and more effective than the ASV 13 and it was later fitted to the Nimrod MR 1. However, shortly after the Phase I modifications even more worrying fatigue calculations led to a crash programme to strengthen the centre-section wing spar.

Phase II Modifications

The next modification programme was already in hand and the first Phase II aircraft were delivered in 1961. These incorporated a large number of avionic upgrades (see Table 4) including the Mk 1C sonics system, with active and passive directional sonobuoys, and the

Structural strengthening
Mk 1C sonics
ORANGE HARVEST ESM
GREEN SALAD VHF homer
VIOLET PICTURE UHF homer
Sonobuoy homer
TACAN
Ability to carry 3 homing torpedoes

Table 4 – Phase II Upgrade.

A Shackleton MR 3 of No 206 Sqn letting it all hang out. (MAP)

ORANGE HARVEST radar intercept equipment, with its distinctive 'spark plug' antenna on top of the fuselage This had a narrow band capability to intercept metric and centimetric radar. Modifications also permitted the carriage of three homing torpedoes; either the passive Mk 30 that homed on radiated noise from a submarine, or the active Mk 44 that transmitted a sonar signal, which would be reflected from the target, rather like underwater radar.

The Shackleton MR 3

In 1952 Avros had proposed another development with a greater fuel load, the MR 2A, which they originally claimed would be able to patrol for seven hours at a range of 1,000 nms from base. In the event this was highly optimistic and when OR 320 was issued in January 1953 it called for a patrol time of 3½ hours at 1,000nms, carrying a war load of nearly 8,000 lb and with 20% fuel reserve. The requirement to be able to operate over the Indian Ocean was added in March 1953 because the South African Air Force had expressed interest in buying some Shackletons.

The resulting aircraft entered service with both the RAF and the SAAF in 1957. Although the MR 3 looked very similar to the MR 2, it was really a new aircraft, with redesigned wings (similar to those of the Argosy), tip tanks, a different centre-section spar, a new nose, a new tail plane and, of course, the nose-wheel undercarriage. At 57,800 lb empty weight it was considerably heavier than the MR 2, but it carried more fuel so it had a still air range of 3,660 nm and could mount a four-hour patrol at a range of 970 nm from base.

Structural strengthening
Soundproofing
Stronger undercarriage
Fuel jettison
SARBE homer
Gyro magnetic compass Mk 7
Nuclear depth bomb capability
2 × Viper turbojets in MR 3

Table 5 – Phase III Upgrade.

During development, the design had revealed poor stalling characteristics, with little warning of an impending stall, and the prototype tragically crashed after stalling and entering an inverted spin. The stalling characteristics were ameliorated before production, but the crews had to wait until 1969 for a satisfactory stall-warning device.

Phases III Modifications

The final modification programme was developed in the 1960s, with Phase III versions of both the MR 2 and the MR 3 reaching squadrons in 1966 (see Table 5). The most significant aspect of this programme was the major modification of the armament system to carry and release nuclear depth bombs, which offered a higher probability than homing torpedoes of destroying modern high-speed, deep-diving Soviet submarines. There were also substantial structural modifications, which in the case of the MR 3 amounted to a virtual rebuild, and a fuel jettison capability.

From the beginning of the MR 3 programme, it had been realised that some form of assisted take off would be needed in order to meet the requirement for operation at maximum all-up-weight of 100,000 lb from a 6,000 ft runway in tropical conditions. Various schemes, including rocket-assisted take off, were investigated and eventually the decision was made to fit a Bristol Siddeley Viper 203 in the rear of the outboard engine nacelles as part of the Phase III programme. The Viper produced 2,500 lb of thrust and was surprisingly tolerant of running on high octane AVGAS, rather than AVTUR. However, this led initially to a restriction that the Vipers could only be run for a maximum of five minutes, to provide additional power for take-off.

2 × sqns Shackleton MR 2	Ballykelly
5 × sqns Shackleton MR 3	Ballykelly, Kinloss, St Mawgan
MOTU[12] Shackleton T2 & T4	St Mawgan
4 × sqns Shackleton MR 2	Aden, Gibraltar, Malta, Singapore

Table 6 – Maritime ORBAT 1966.

Eventually they were modified to enable them to run at 92% for up to four hours. This meant that they could be used after heavy weight take-offs to save running the Griffons at maximum continuous power for long periods. They could also be used to enable the aircraft to maintain medium altitude, if necessary for overland flights and, more often, to provide additional power when operating at very low level at high weights. By this stage the Maritime ORBAT consisted of twelve Shackleton squadrons, as shown in Table 6.

Other Equipment Tested on the Shackleton

Throughout the life of the maritime Shackleton the Air Sea Warfare Development Unit (ASWDU) conducted trials on new equipment that was intended for the aircraft, including most of the modifications already mentioned. However, ASWDU also undertook extensive trials on devices that did not enter service on the Shackleton, such as infrared line scan, the Jezebel low-frequency long-range passive search sonar system and MAD. The very 'noisy' electromagnetic environment on the Shackleton caused too many false alarms on MAD.

The People

But what of the people who flew and maintained these aircraft? They were, I suppose, like any other grouping of RAF aircrew and ground crew: full of life and sometimes mischief, normally good-humoured, but occasionally irascible. They often affected a rather casual attitude to the minutiae of Service life, but under the surface they were dedicated professionals. Coastal Command did not have a glamorous role and its people were envious of the funding, equipment and prestige that the V-Force and Transport Command rightly enjoyed. However, being the poor relations instilled a sense of camaraderie and they took a perverse delight in, for example, being asked to move from a table in the Transit Mess at Luqa because that was for Transport crews and had butter on it whereas Coastal crews

had to make do with margarine.

When I joined my first squadron in 1965 many of the aircrew had flown Lancasters against 'The Big City'; many others were veterans of flying boats. I remember being highly impressed by an entry in the logbook of one master signaller, which recorded a Catalina flight out of Sullom Voe with 24 hours night for a total sortie length of some 26 hours. Notwithstanding the limitations of our equipment, we were highly trained; we were professional and maritime flying taught us perseverance. In retrospect, perhaps we sometimes pushed the 'can do' spirit too far. The 3 April 1966 was a Friday. Crew Six of No 210 Sqn was duty crew and had arrived at work at 0800 hrs. At about 1630 we were tasked with taking some spares to Bodø in northern Norway. During the course of the evening and night we declared three aircraft unserviceable after engine start – we were going through a bad patch with engines. We finally got airborne after 0400 hrs on the Saturday morning and landed at Bodø 12 hours and 10 minutes later. Shackletons rarely went anywhere in a straight line so we had completed a surveillance exercise en route. Bodø is an interesting airfield, with mountains on three sides. Neither pilot had landed at Bodø before; it was dusk and there was a snowstorm in progress. When we landed the Norwegian authorities insisted that we hangar the aircraft, because conditions were getting worse. However, they could not find the Shackleton towing arm, so we taxied the aircraft into the hangar on the two inner engines with members of the crew moving the propellers of the outer engines so that they would clear the tailplanes, fins etc of the many small aircraft already in the hangar. I can truly say that I learned about flying from that. I will leave for another occasion the story of how the same crew tried to push a Shackleton uphill at a different Norwegian airfield.

A Shackleton crew in the 1960s consisted of two pilots, two navigators, a flight engineer, an air electronics officer and four air electronics operators. The crew that I joined was one of the early Constituted Crews. This meant that an experienced first pilot, first navigator and air electronics officer had joined up with the remainder of the crew, who were all first tourists, as they completed their conversion course at the MOTU. The crew then stayed together for a full tour. It cannot have been a bad apprenticeship; of that crew two of us reached air rank and one made group captain. Three of the NCOs

were commissioned and one became a minor captain of industry. Because we flew such long sorties and spent a great deal of time away from home on detachments, the crew of five officers and five SNCOs was the social unit, from which life-long friendships were formed.

During this period the powers-that-be adopted a policy of posting former fighter pilots to Coastal Command as Flight Commanders and Squadron Commanders, presumably to inject some sparkle into the Cinderella organisation. Many of them were, indeed, larger than life characters and certainly gave us some interesting moments, usually associated with the rather different power requirements and stalling characteristics of a Hunter and a Shackleton at high angles of bank at low level.

Anti-Submarine Action

Radar was our main anti-submarine search sensor. The task was to search a patrol area with radar so as to detect a submarine during its relatively short schnorkelling period, typically 20 minutes every few hours in the more modern boats. A submarine schnorkel would offer a target echoing area of about one square metre, which ASV 21 might detect at up to 15 nm in very favourable conditions but at much shorter range in the sea states normally experienced in the North Atlantic. Another difficulty was that submarines had radar intercept equipment that could detect ASV radar at a much greater range than the radar could detect the submarine. So it became a game of cat and mouse, on top of hunting for a needle in a haystack. We used various tactics such as switching the radar on intermittently for short periods and/or scanning it in a sector behind the beam of the aircraft, in an attempt to counter the range advantage enjoyed by the submarine. The hope was that we would detect the submarine before it had time to submerge in reaction to intercepting the aircraft radar. We could then home onto the radar contact for a direct attack or, if it had submerged, lay sonobuoys on the datum to relocate and attack. We practised this endlessly, homing onto radar buoys located near the main maritime bases or onto a skid target towed behind RAF marine craft that produced a wake effect similar to that of a snorting submarine. Each homing culminated in a visual attack with practice bombs, aimed by the pilot from a height of 100 feet in daylight or the bomb-aimer from 300 feet at night.

Let me take you through a typical action. It is a dark night over the North Atlantic. A Shackleton crew has been airborne for eight hours on a radar search for conventional submarines that intelligence suggests are transiting through the aircraft's patrol area. It has been a quiet, boring patrol, broken only by endless cups of coffee, a fry-up shortly after take off and a nourishing helping of 'Honkers Stew' a couple of hours ago. The crew is starting to think about the long transit back to base. Suddenly the radar operator reports a small radar contact that he assesses as a possible submarine. The captain calls 'Action stations, action stations; turning on' and the crew is galvanised into action. The first pilot turns onto the contact and homes on under the direction of the radar operator. The co-pilot selects maximum boost on the Griffons and the flight engineer starts the Viper engines to give additional power for safe manoeuvre at low level. The W/T operator sends a POSSUB message with details of the contact. Meanwhile the tactical navigator sets up his plotting table to follow the homing and take over control to the datum if the contact disappears. (If the contact disappears this offers some collateral evidence that it might be a submarine.) He checks the settings on the weapon control panel, sets up the sonobuoy pattern on his plotting table and confirms the sonobuoy serial numbers (equating to radio frequencies) with the sonics operators. The routine navigator goes to the nose and checks the low-level bombsight. Anybody spare will man lookout positions in the tail and in the beam. At three miles the pilot selects the bomb-doors and camera doors open. The radar scanner is lowered to the attack position. The pilots gradually descend to the attack height, paying close attention to the radar altimeter. At one mile a sequence of flares is fired to illuminate the target. These are 1.75-inch calibre pyrotechnics fired from dischargers in the beam upwards and to the side of the aircraft. If the bomb-aimer sights the target he gives directions to the pilot and releases the weapons; in the early years this would have been a stick of depth charges, but in the 1960s it would be a passive Mk 30 homing torpedo and a Mk 44 active homing torpedo. Releasing the weapons also fires a series of six 1.75-inch photoflashes and triggers the K24 camera to record the results of the attack. The observer in the tail reports the results of the attack. An active Mk 1C sonobuoy and a smoke/flame marker are dropped with the weapons to enable relocation and re-attack of the target, if

necessary. If the bomb aimer does not sight a target, only the sonobuoy and marker are dropped on the datum, followed by a passive sonobuoy 2,000 yards further on. The pilot then flies the aircraft in a teardrop, overflies the datum sonobuoy using the sonobuoy homer, which feeds signals to the zero-reader display. On top of the datum sonobuoy the navigation plot is updated and 2,000 yards beyond another passive sonobuoy is laid. The crew then track the target using bearings on the submarine's radiated noise from the passive sonobuoys and fixes from the active sonobuoy. Other sonobuoys are laid as required. Once the tactical navigator has an attack solution he steers the pilot to a drop point and releases homing torpedoes ahead of the target.

Of course the scenario I have painted is entirely imaginary. It is one that we played out in countless exercises and training sorties, but there is no instance of a Shackleton ever dropping anti-submarine weapons in anger. During the piston engine era maritime crews spent countless sorties searching for and tracking Soviet submarines, but, thankfully, the Third Battle of the Atlantic never happened. The only examples that I can find of operational ASW patrols that could have led to combat were those flown in 1956, in the Mediterranean, by Nos 37 and 38 Sqns to protect HMS *Eagle* and other ships during the Suez campaign. However, maritime aircraft gave distinguished service in a variety of other roles and campaigns. They and their crews were truly Jacks-of-all-Trades, as outlined below.

Maritime Surveillance

General maritime surveillance was the most common operational role, using radar, radar intercept and visual searches to detect, identify, report and track naval or merchant shipping. This formed part of routine peacetime intelligence gathering and maritime crews used handheld cameras to take pictures for intelligence purposes. It was also used to demonstrate sovereignty and latterly as part of the fishery protection task. Maritime surveillance was also an element in many campaigns. Sunderlands of Nos 88, 205 and 209 Sqns flew patrols from Iwakuni in Japan during the Korean War. Shackletons patrolled around Cyprus during the campaign against EOKA to search for boats smuggling weapons. Similar patrols – the Kuching Recces – were flown during the Confrontation with Indonesia in the mid-1960s.

From March 1966 to March 1971 Shackletons operated out of Majunga in the Malagasy Republic (formerly Madagascar) to provide surveillance for the Royal Navy ships conducting Operation MIZAR, the United Nations' oil blockade of Rhodesia.

Weather Reconnaissance

Bryn Lewis provides an account of specialist meteorological operations elsewhere but it should be recorded that, as a matter of routine, wherever they went, maritime aircraft sent, to their operating authority, hourly weather reports that could be factored into the overall meteorological picture. Shackletons were also used in support of all the UK nuclear weapons tests in the late 1950s – at Monte Bello Island and then the series of GRAPPLE Operations at Christmas Island, and Operation ANTLER at Maralinga in Australia. The tasks were weather reconnaissance, surveillance to ensure that the test areas were clear of intruders and post-explosion air sampling.

Search and Rescue

Search and Rescue (SAR) was a vital role for maritime patrol aircraft. Indeed the initial conversion of the Lancaster in 1945 had been solely to cover the SAR role. The Lancaster ASR Mk 3 was equipped with a lifeboat carried in the bomb bay, which could be dropped by parachute. The system had been developed and used during the war and Uffa Fox, the renowned sailor, designed the final Mk 3 version. The lifeboat was tested on the Shackleton, but, because of problems with clean separation from the aircraft, it was not used operationally. Instead the Shackleton carried the Lindholme Gear to drop to survivors. This consisted of three canisters connected by 600 yd of line. The middle container held a multi-seat dinghy, which inflated automatically on hitting the water and the other two held survival equipment. There was also a version – the Container Land Equipment – for use over land, principally deserts, that dispensed with the dinghy.

Throughout the period there was at all times one crew, and often two, in the UK on standby at one hour's notice for SAR duties. SAR standby was held wherever there were maritime aircraft. For example, the permanent Shackleton detachment on Gan in the Maldives was largely to provide SAR cover over the Indian Ocean. SAR scrambles, when they came, were often to conduct a search for a crashed aircraft

or aircrew who had ejected. In this case the primary search would usually be conducted with the radio homing equipment designed to detect transmissions from the SARAH or SARBE emergency beacons carried by military aircrew. However, if a light aircraft or a fishing boat were missing a visual search would be the only option. Shackletons were often scrambled to provide top cover for an SAR helicopter on a long-range mission. There were also pre-planned sorties to provide airborne SAR for Royal Flights. For example, in September 1951 the newly arrived Shackletons of No 120 Sqn flew from Iceland to provide airborne SAR cover for the first Royal transatlantic flight by the then Princess Elizabeth and the Duke of Edinburgh, at the beginning of their tour of Canada.

Transport

It is not generally realised that maritime aircraft were widely used for transport duties. For example, Sunderlands were used in Operation PLAINFARE, the Berlin Airlift, landing on the Havel. Shackletons were fitted with harnesses and crash positions for thirty-three people, and could carry freight panniers in the bomb bay. A Shackleton with a skeleton crew could transport sixteen fully equipped soldiers and Coastal Command squadrons were used in the trooping role during several operations; for example to ferry troops to Cyprus during the build up for Suez, reinforcing Cyprus during the EOKA troubles and the reinforcement of Jordan in 1958. Sometimes we carried unusual cargo. I remember ferrying a team of RAF Police dogs from Ballykelly to St Mawgan. Unusually, and in deference to canine sensitivities, we took a direct route. However, we did the full 10 hours on the return trip! In addition, the Lindholme gear could be used to drop small items such as mail or spares to Royal Navy ships. ‘Shack Post’ also made regular drops to the Atlantic Weather Ships. The Shackleton’s good carrying capacity enabled us to self-ferry spares and maintainers for many small detachments, minimising the requirement for support from Transport Command. We routinely ferried spares to other Shackletons that had gone unserviceable overseas. A Shackleton could carry a complete Griffon engine in its bomb bay, using specially modified bomb doors. The Shackleton was not the most serviceable of aircraft and sometimes these rescue missions turned into farce, when the rescuer went unserviceable and

had to be rescued in turn. I remember a new CO arriving at Ballykelly to take command of No 210 Sqn in 1966 to find that he had one aircraft unserviceable at Ballykelly, one aircraft airborne on its way to Bodø in Norway with spares and the remainder of the squadron unserviceable at Bodø.

Colonial Policing

The final major role was colonial policing. Until 1956, Bomber Command Lincoln's were available to support ground forces in the Arabian Peninsula, but that year the task was passed to Coastal Command. After working up in the new role, No 42 Sqn sent a detachment to Khormaksar, in Aden, flying its first operational mission on 13 January 1957. From then on there was a permanent Shackleton presence in the area until 1971. No 37 Sqn was based at Khormaksar from August 1957 until September 1967, while other squadrons sent detachments to the region throughout the period, operating at various times out of Bahrein, Masirah and Salalah in Oman, and Sharjah in the Trucial States. The tasks were many and various: photo reconnaissance; communications relay; air observation; vehicle convoy escort; supply dropping; leaflet raids and coastal reconnaissance to interdict gun running. However, the aircraft were ultimately there to provide a 'big stick' in the form of more offensive tasks such as bombing and strafing with the 20mm nose guns. Some aircraft also carried a Bren gun in the starboard beam lookout. Fifteen 1,000 lb bombs or fifty-two 20 lb bombs (or an equivalent mixed load) could be carried at a time.

By September 1957 the Shackletons had dropped more than 530 1,000 lb bombs and the focus of attention shifted from Aden to the Oman. Operations were centred on the Jebel Akhdar; routine targets were the dams and water systems needed to irrigate the tribesmen's crops, but specific attacks were also made under the direction of Forward Air Controllers. The campaign lasted from August 1957 until February 1959. During this period Shackletons flew 429 sorties dropping 1,500 tons of bombs and firing 700,000 rounds of 20mm ammunition. There were further short term bombing operations in 1960, 1961 and 1962. During 1964 operations were focused on the Radfan, with Shackletons mainly undertaking harassing operations by night, dropping small bombs and flares. Although things were

A Shackleton MR 2 of No 37 Sqn engaged in 'ColPol' duties somewhere over the Arabian peninsula.

relatively quiet after this and No 37 Sqn was disbanded in 1967, a permanent detachment, mainly sustained by the MR 3 squadrons from Kinloss and St Mawgan, was based in Sharjah until late 1971. From there the crews flew anti-gun-running patrols and practised medium level bombing with 1,000 lb bombs. The coastal patrols (Operation BRONZE) flew, from the Strait of Hormuz, south along the Omani

coast at 100 feet above the beach, and back again, conducting a visual search for signs of suspicious activity, which would be radioed to the Trucial Oman Scouts. I clocked up many hours in the nose gunner's seat, which was the ideal lookout position, and a sighting by my crew resulted in a capture by the Trucial Scouts.

Airborne Early Warning

The final version of the Shackleton, which entered Service with No 8 Sqn in 1972, just as the maritime Shackletons were phased out, was the airborne early warning conversion of the Mk 2. This was equipped with the AN/APS-20 radar (the same type of radar that the RAF's Neptunes had carried) removed from the Royal Navy's AEW Gannets. The conversion of the Shackleton to this role was an 'interim solution' until a modern AEW aircraft was procured. The trials and tribulations that preceded the RAF's eventual acquisition of its Boeing Sentries is another story, but the upshot was that the Shackleton gave the country another nineteen years of yeoman service in its new role, before finally standing down in July 1991.

The Replacement

Various other versions of the Shackleton were proposed in the 1950s, but never got beyond the drawing board. One such was the MR 4 intended to meet a Canadian requirement for a long-range patrol aircraft. This design retained the Shackleton's nose, cockpit and outer wings, but everything else would have been new. It had a wingspan of 131 ft and a massive single fin and would have been powered by four compound piston/gas turbine engines, Wright Duplex Cyclones or possibly Napier Nomads. In the 1960s the search for a Shackleton replacement became more serious and a whole range of solutions was proposed. These were mostly conversions of existing aircraft, such as the VC10, the Vanguard and the Trident, but some more esoteric designs were proposed, such as a variable geometry aircraft. Eventually, the limits of Shackleton fatigue life meant that a very rapid solution was needed and a version of the Comet, that became the Nimrod, offered the quickest solution.

A Personal Assessment

It is difficult to sum up such a fascinating era, dominated by one of the most distinctive aircraft that the RAF has flown. The Shackleton

has been called many names, most of them unflattering, but it was a much-loved aircraft. Despite the noise and the draughts, it was surprisingly comfortable to fly in at low level, because of the very flexible wing. The role was challenging and the camaraderie on Shackleton squadrons was second to none. However, in essence, the Shackleton was an aircraft built with WW II technology that required a great deal of loving care (though not the term they would have used) on the part of our ground crews. The engines and avionics were temperamental and the hydraulic system was notoriously unreliable. Nevertheless, on detachments our ground crew somehow always managed to keep the aircraft going. Although the Shackleton had no real handling vices, once the stalling characteristics (of the MR 3, in particular) had been sorted out, pilots did require a certain amount of brute force, as well as skill, to fly her. Despite all this, the Shackleton gave valiant front line service in a variety of roles for forty years and she remains, in my view, quite simply the Queen of the Skies.

Notes:

[1] John Terraine, *The Right of the Line – The Royal Air Force in the European War 1939-1945* (London, 1985), p455.
[2] *Ibid*, p456.
[3] Jan Breemer, The Submarine Gap: Intelligence Estimates 1945-55, 1986, pp100-105.
[4] Jan Breemer, *Soviet Submarines Design Development and Tactics* (Surrey, 1989).
[5] Institute for Strategic Studies, *The Military Balance 1966-1967* (London, September 1966).
[6] A E Ross (Editor), *Through Eyes of Blue – Personal Memories of the RAF from 1918* (Shrewsbury, 2002), p197.
[7] Chris Ashworth, *Avro's Maritime Heavyweight: The Shackleton* (Bourne End, 1990).
[8] Barry Jones, *Avro Shackleton* (Marlborough, 2002).
[9] www.shackletonassociation.org.uk
[10] Various sources give different figures for range and endurance, probably because of differing assumptions about fuel reserves. The figures quoted in this account are taken from Appendix E to Ashworth's book (*op cit*). Still air range is to dry tanks, while patrol radius assumes an operational war load and 20% fuel reserves.
[11] So called because the sonobuoys were colour coded (corresponding to radio frequency) and laid in the order Purple, Orange, Blue, Red and Yellow.
[12] The Maritime Operational Training Unit formed a (later two) shadow squadron(s) in wartime.

NIMROD OPERATIONS IN THE COLD WAR

Sqn Ldr I M Coleman

Ian Coleman graduated from Cranwell as a navigator in 1970. Following an initial tour on Britannias, he instructed at No 6 FTS and the OCTU. He then joined the maritime world to fly four Nimrod tours, one of them with the OCU, interspersed with staff appointments at St Mawgan and Northwood plus a five-year stint as RAF Staff Officer to Flag Officer Sea Training. His final appointment before retirement in 2002 was as OC Ops Support Sqn at Lyneham.

A TV producer wrote of the Nimrod force: 'it has mainly concentrated on air sea rescue missions, its achievements largely unknown to the outside world'. Though admittedly indeed 'largely unknown' to the public and, it must be said apparently to much of the rest of the RAF, there was, as we shall see, a great deal more to Nimrod operations during the Cold War than Search and Rescue (SAR).

The Nimrod

Taking over the tasks previously flown by the Shackleton, the first Nimrod entered squadron service at St Mawgan in October 1969, making it a Coastal Command aircraft until the Command's disbandment parade on 27 November. The aircraft were truly hand-built; some were longer or wider than others by an inch or several and a panel, such as a wing root fillet, from one aircraft was unlikely to fit another.

Fifty four Mk 1 Nimrods were eventually ordered, however, the Mk 1 was designed as a stop gap. In fact the story of the Nimrod is one of continual development where sensors and stores are concerned, with major inputs at the time of the Falklands and Gulf Wars. Assessment of the threat to be posed by the Soviet Navy in the mid-1970s onwards indicated a need for better sensors and equipment. Advances were in the pipeline, but much of the equipment of the Mk 1 replicated that of the Shackleton. New equipment would go into the rebuilt Mk 2, which had a lengthy gestation, though the Mk 1 did have

provision for some later features, such as the Searchwater radar scanner. The first Mk 2 flew in April 1977 and entered service in August 1979. The fleet was about halfway through conversion when the Falklands War occurred, but the RAFHS has heard about that period in a previous seminar.

The Nimrod had a relatively high transit speed (400 kts, M0.69) and the ability to loiter as the fuel burned off, on three, or even two, engines that would give it a flexibility and speed of reaction much greater than its predecessor.

The flight deck was 'Comet', with two pilots and a flight engineer. The first pilot might be the aircraft captain, but on most squadrons there would be about six pilot captains, two navigator captains and one AEO captain. A budding co-pilot could thus convert to first pilot with a back-end captain and get on top of his responsibilities for flying the aircraft before getting to grips with calling the tactical shots as well. The flying controls were pure 1950s too. They were powered by hydraulic servodynes from multiple hydraulic systems with much built-in redundancy, using a lethal traditional fluid. Certainly after flying home with a leaking system and a haze in the cabin, you had a headache for days.

The shortened Comet 4 fuselage had an underbody containing the radar scanner at the front and a full length, heated, unpressurised bomb bay. Rolls-Royce Spey engines replaced the Comet's Avons with some 'reaming out' of the wing root housing. The Spey proved to be very reliable and normally gave advance warning of problems. Given the engine location, asymmetric flying was almost an academic exercise.

Aft of the flight deck was the toilet, forward door and then the two hemispherical beam lookout positions. With poor flight deck downward visibility, the ability to lean into the window and see down almost vertically was most useful when looking for dinghies and the like. As the window distorted photographs taken through it, it was opened inwards and upwards to reveal optically correct fresh air. Being forward of the engines, the view was also unaffected by jet efflux, though one had to take care not to drop light meters down the intakes.

Next came the Radio Operator's position. He had two HF radios and a LF receiver. Across the aisle were the Routine Navigator

A Nimrod MR 1 in the early, pre-1980s, grey/white colour scheme.

(Route Nav) and Tactical Navigator (Tac Nav) positions. The Route Nav operated the navigation equipment and carried out fixing with beacons, the radar, LORAN, astro or (from 1982) Omega. On the Mk 1, the routine navigator's system was largely analogue, derived partly from the TSR2 project. The first generation inertial platform had to have what was called a 'run align'. One set the true heading of the runway on the box and selected it to 'run' as the aircraft rolled down the runway, giving it its heading reference. After a last minute runway change at Gibraltar, I can personally vouch for the fact that it did not work well when set up backwards. The reversionary mode was the Doppler system and if that failed one could set in the estimated wind.

A most useful oddity was the Routine Dynamic Display (RDD). This projected an arrow, which was aligned with a chart taped to the table and gave an instant indication of the position and heading of the aircraft. By manipulating the illumination switch whilst running the arrow into a matchbox, the nav could convince gullible visitors that that was where he kept the arrow for safety!

The Tac Nav controlled the battle, usually initiating sonobuoy drops and managing the weapons. Feeding the large circular Tac Screen (supposedly the largest CRT of the time) was a new digital computer with 64K of memory. Including the two acoustic systems, this gave the aircraft a whacking 192K – or a bit more than a floppy disc! The programme itself was run from a tape drive which you had

to reload to access the Search and Rescue (SAR) version. One could designate markers and positions, receive data from all the sensors and throw it all into a Kallman filter to arrive at a target position to attack, whilst giving computer steers to the pilots' instruments. And it worked. Tactically, the drift of the system was noticeable, so one always homed to the radio signal of a related sonobuoy or to a smoke marker before attacking. The next generation inertial platform on the Mk 2 was far more accurate.

On the Mk 1, the Tac Nav would release the active and passive localisation sonobuoys of the Mk 1C system from the bomb bay. The 'Stage 2 Trainer', inhabited by ancient aviators who passed the time growing copious quantities of tomatoes, could also simulate these from the ground. To drop a dummy buoy; you had to move a buoy indicator 'biscuit' to a vacant position on the store layout map for the bomb bay. You could get this wrong and drop a real buoy. As the Mk 1C active buoys cost the same as an Austin Mini, this was not encouraged. The aircraft could be conned on to attack the target by the Tac Nav using either the computer algorithm or a manually plotted backup chart with the RDD. This was because on the Mk 1, the RDD was separate and unaffected by computer failure. On the Mk 2, the RDD went through the computer, so if this failed, the RDD did too! So much for progress.

The weapon load could comprise elements from the old Mk 44 and newer Mk 46 American ASW torpedoes, with the British Stingray torpedo coming later on the Mk 2. There were also the standard Lindholme ASR gear, dinghy pairs, Containers Land Equipment (CLE), mail containers, 5-inch reconnaissance flares, explosive Anti Submarine Target Indicators [ASTI – replaced by the acoustic Signal Underwater Sound (SUS)] and smoke and flame floats (SFF). Harpoon missiles arrived during the Falklands War.

On notable occasions, two 550 lb Special Weapons could be carried. Although the real things never came out of their store, practice 'shapes' were used for exercises. Once the source of great secrecy and a host of pedantic mandatory procedures, two of these practice Nuclear Depth Bombs (NDB) are now on display at Hendon's RAF Museum.

The navigators' centre panels were arranged so that either chap could carry out functions such as ordering buoy reloads to the

launchers, or drop a smoke marker from the retro gun at the rear of the aircraft. The navs would normally take turns each trip to fly as Route or Tac Nav.

Next sat the AEO (Air Electronics Officer) who co-ordinated the sensor operators as well as masterminding the tactical comms, including secure voice circuits. On the Mk 2, he also had a simulator to run a virtual submarine through the acoustic system, and a simulator for the Harpoon missile. The seat he sat in was known as 'Martel'. Early on in the Mk 1 days, two underwing strong points were used for carrying the Nord SS11/AS12 short-range, wire-guided missile. This was controlled by a joystick at the co-pilot position, using a flare on the missile for reference. It was in service for a short while and the plan was to replace it with the TV-guided version of Martel, as fitted to the Buccaneer, controlled by the AEO. This project got no further than naming the seat position!

Aft of the AEO on the starboard side were the positions for the Acoustics Co-ordinator and two operators (the 'Wet' team). On the Mk 1 a separate set was in place for the analogue Mk 1C buoys. On the Mk 2, the new specialised attack buoys (CAMBS and Barra) were processed in the mainstream acoustic system. During a search, the three-man 'Wet' team would monitor sonobuoys. At the call of 'Action Stations' or 'Camera man up', two would leave and man the beam lookouts and take any hand-held photos needed.

On the port side was the radar 'tent' of the ASV 21 radar, inherited from the Shackleton, and a direct descendant of the wartime H2S. The daylight screen of the Searchwater on the Mk 2 replaced this. On Searchwater, the ability to measure the length of the contact to within 7 feet and get a radar 'outline' enabled searches for specific targets to be carried out much more efficiently. However, a container ship fully loaded with containers did look like an aircraft carrier, and a Japanese fish factory ship like an Argentinean Type 42 destroyer! In service now for twenty-five years, Searchwater is still one of the finest maritime radars in the world. It also occupied an empty space in the Mk 1 known as Linescan, another equipment that never made it. The AUTOLYCUS exhaust trail sensor too only made it as far as a green light at the nav station, illustrating the continual development to meet the evolving threat.

The last position was the ESM (Electronic Support Measures)

operator. The ESM was the French ARAR/ARAX on top of the fin, replaced eventually by the LORAL YELLOW GATE system on the wing tips. The complexity of this equipment was such that the dry team was increased from three to four to operate it, the radar and radio. The ESM operator also monitored the MAD (Magnetic Anomaly Detector) – the sting at the back that detected anomalies in the earth's magnetic field such as a submarine – or a wreck.

Next was the ex-Shackleton galley, including the infra-red grill that was not used as it set off the smoke alarms. For a short time in Mk 1 days, a loadmaster was carried to look after the galley and load the sonobuoy launchers. This was not a success and the 'spare' dry man carries out those duties, though others may help during quiet spells. The ordnance area at the rear of the aircraft contained the sonobuoy racks, the four sonobuoy launchers and the retro-marker launcher. This French designed cannon fired a wooden smoke float out backwards, using a variable charge proportionate to the aircraft's groundspeed.

Squadron Organisation

There were four operational Nimrod units, Nos 120, 201 and 206 Sqns at Kinloss and No 42 Sqn at St Mawgan. In addition, No 236 OCU at St Mawgan could produce crews. No 203 Sqn had Mk 1s in Malta before it was disbanded. Each squadron had eight or nine crews. The squadron executives were not supposed to be 'crewed up', but manpower shortages (or an occasional lust for glory) often meant that they were.

Each week one of the squadrons was Duty Squadron. One crew was held on one hour's standby, one on six-hours and the remaining six or seven at twelve-hours. As most taskings resulted in an on-task duration of about six hours, once the first crew had taken off, the relief crews could fill in behind at six-hourly intervals. If the need to fly two aircraft simultaneously was flagged up early, we would put two crews on six-hours. It was a matter of pride to cover all the tasks given to you as Duty Squadron. However, the other squadrons' crews not on leave were deemed to be at twenty-four hours' notice.

Search & Rescue

The Search and Rescue (SAR) commitment was covered by the one-hour crew and a dedicated airframe on the SAR pan. One took

over the aircraft at 0900hrs. The unclassified equipment, headsets and the like would be fitted, tested and stowed, and the galley checked. Pre-stocked with dry rations, rather than frozen meals, on SAR tasks a traditional 'Honker's Stew' could be cooked, the recipe for which was to open all the tins, empty them into the pan and heat! Having checked the aircraft, the crew would then take over the two minibuses and spend the morning on the squadron and then stay in their respective messes until hand-over next day. A call out was announced over the Tannoy with the call 'Dinghy, Dinghy, Dinghy, Search and Rescue to Immediate Readiness' (or 'Scramble' if very urgent).

The AEO would throw the crew classified document bags out of his window while we started the minibus. One morning a visiting group captain found the window open and, mindful of energy conservation, flicked it shut just as the first bag got airborne. There is something maliciously satisfying about the sound of breaking glass!

The NCOs would go straight to the aircraft and start winding things up, whilst the officers routed via ops to drop off the captain, first navigator and AEO to get details. On rare occasions one might discover at this stage that the mission was not SAR, but a national emergency task such as investigating a submarine sighting that did not fit in with current intelligence and the SOSUS (Sound Surveillance System) plot.

One might provide top cover for a Sea King lifting an injured sailor. We would find the vessel and vector the helicopter directly to it and maintain communications between all parties. One Greek supertanker was reporting his position a whole degree of latitude in error, so our intervention made all the difference. We carried two full Lindholme Gears (a dinghy and two supply containers), plus three dinghy pairs. The Nimrod had little to help visual drops, but old Shackleton techniques were passed on. On at least two occasions pilots have dropped a dinghy pair that straddled the wreck with the joining line across the ship. Whilst SAR was important, it was a small part of a crew's year.

The squadron programme was organised on a rolling two-week basis. Much effort went into the programme, but Week Two seldom bore any resemblance to the original plan by the time it arrived. Training sorties were carried out within the NATO command structure, so if you flew off Norway you would receive a tasking Form

Green from Bodø or Stavangar. While Northwood issued Greens for UK waters (and Pitreavie for some exercises), Brest, Lisbon, Gibraltar, and Keflavik would issue tasking for their areas. Rota in Spain also issued tasking, but not if you were taking off or landing at Gibraltar! All allied MPA were deconflicted from each other and had each other's details. This worked well with most nations.

TAPESTRY

Another regular task, until it was 'privatised', was Operation TAPESTRY, the patrolling of the UK's fishery areas checking that fishing boats were licensed. Reading a number under the flare of the bow in a high sea state was quite a feat. If the boat was found to be fishing illegally, the 'Belenos' procedure was carried out where each photo frame was witnessed and entered as evidence. Once a month or so, we would patrol the outer area around Rockall. The power of some of the winter gales and the constant severe turbulence was quite something. On one trip everyone was sick except for the first pilot. Cunningly the AEO asked him to make a round of teas. The trick worked, as soon as Biggles was sat in the galley, he was violently ill!

Exercises

There were several major and numerous minor NATO and national exercises during the year. Some, like the three Joint Maritime Courses (JMC) – descendant of the Joint Anti-Submarine School (JASS) at Londonderry – were termed 'cockpit' exercises, meaning that they were designed for unit training. You might be tasked against a conventional submarine that was constrained to give detection opportunities. You would practise the radar 'Deter' or 'Detect' policies and having attacked, bring in the helicopter and practice those procedures before the frigate joined in. That anyway was the theory! The later days of such exercises would involve more complex evolutions in support of a naval group and might also include vectoring Buccaneers against ships or providing targeting for surface launched missiles.

The other sort of exercise was designed for the benefit of the Command and Control chain. Interaction was not guaranteed, especially if the admiral decided to take his nuclear carrier north through the Straits of Messina at 30 kts at night, and outside his designated exercise area, to avoid the opposing ships south of Sicily.

Whilst we were exercising with an Italian submarine, one of the carrier's S-3 Vikings met us head on. Another near death experience!

TACEVAL

One could not avoid TACEVAL (Tactical Evaluation). The Supreme Allied Commander Europe (SACEUR) had a multi-national inspection team that evaluated each individual station's readiness for war, although they never inspected the headquarters! SACEUR issued volumes of documentation and required copious standards to be met. All NATO-assigned RAF units participated in these events. However, the Nimrod force was allocated to the Supreme Allied Commander Atlantic (SACLANT). Although he issued standards to be met in the maritime scenario, his requirements were less stringent. To HQ Strike Command (STC), No 18 Gp was annoyingly different enough already with its with a three-star, dual-hatted AOC at a time when STC was trying to get AOCs down to one-star. To have been excused TACEVAL as well was just not acceptable, so we had to play in the SACEUR scenario.

This lead to some mild amusement during the exercises. The Allied Command Europe (ACE) standard required combat aircraft and their supporting infrastructure to be housed in hardened accommodation. SACEUR funded this; SACLANT, initially, did not. The Canadian Chief Umpire asking to see our hardened Ops Room would be shown our normal Ops Block with the windows masked with black plastic sheet and labelled 'sandbagged', with a diagram showing how the sandbags would be positioned. This was acceptable and allowed a 'pass' with caveats to be registered in that area. This overlooked the facts that, firstly, the building could not withstand the weight of that number of sandbags; secondly that it would take the RAF's entire stock of bags and then some to sandbag Kinloss alone; and thirdly that it would take the entire station three months, doing nothing else, to fill the bags using virtually all of Findhorn beach! Given the timescales attributed to surprise attack, it was all rather academic.

Efforts were made to exercise critical wartime procedures such as loading the NDBs with air raids under way. Some meaningful sorties might be flown, but it was largely the ground infrastructure that was under examination. The survival fly off was also practised, with all flyable aircraft being scrambled to an airborne hold to escape the

arrival of the nuclear fallout cloud. This was only a taxi-scramble with no one actually taking off as, in the real event, safety margins would have been reduced, peacetime air traffic regulations dispensed with and unserviceable aircraft taken off on three engines or with vital systems inoperative. This was a welcome point in the exercise for aircrew as we sat on the far side of the airfield for a few hours whilst the nuclear cloud descended, leading to ENDEX! Critically, everything was tuned to meet the demands of a two-to-three day exercise. Much of the stance taken to achieve that tick-in-the-box would not have worked in a protracted conflict. These exercises did keep everyone on their toes where personal drills were concerned, and today the Service has introduced Collective Training (CT) to re-establish individual proficiency.

Cold War

All the training was orientated towards fighting a hard maritime battle against the Warsaw Pact, with intelligence reports showing that the Soviet Navy was a significant threat. From our senior commanders downwards, we all knew we would have a tough task, and not enough Nimrods. With hindsight, it appears that 'sexing up' is not new, as the threat was apparently 'spun' to ensure Congressional support for US weapons programmes. Much of the Soviet ORBAT was incapable of activation due to its decrepit condition or a severe shortage of trained crews. However, their later generations of nuclear submarines were a very different matter. They truly did pose a severe threat. No matter, at the time we believed what we were told and strove accordingly.

The Soviet surface fleet did contain some impressive units which, if deployed, were shadowed by NATO air and naval forces. The usual Nimrod technique was to approach the task group 'Emcon Silent' – that is with all emitters, like radar, switched off – and descend to low level to get as close as possible before being detected. This might enable you to photograph a missile on a launcher during a drill, an aircraft hangar or lift open or other such items of intelligence value before they had time to square it away. You hoped that your detection would tempt them to flash up the radars to keep tabs on you. If the equipment did light up, the Nimrod ESM operator would have a field day recording all the parameters for ELINT (electronic intelligence). It was whilst trying to provoke a reaction from the aircraft carrier *Kiev*

that we were run down by an RC-135. It was a very close call; he admitted that he was covert and was relying on his sensors to pick up our radar. It had never occurred to him that we might not be transmitting either. We would have been transmitting if the US had told us, the UK, that he was going to be there!

The Soviet Navy in the Mediterranean had no base from which to operate, so anchored in sheltered places just outside territorial waters. We conducted training detachments to Gibraltar, Sigonella and Akrotiri from where we would check these anchorages. The Soviets often maintained submarines in the Med. In early days it might have been a *Juliett* Class SSG or, later, a *Charlie* SSGN. Finding the submarine would be a bonus, so, spotting a periscope astern of a Soviet Auxiliary entering an anchorage, we pounced and filled the water with active sonobuoys and smoke floats. After a minute, Inspector Clouseau came up on the NATO ASW Common Frequency and said, 'Zank you very much, I was on zee secret mission'. Well, a kill's a kill!

The Soviet's vast fleet of auxiliaries also merited close examination. The intelligence gatherers (AGIs) would appear and monitor naval exercises and missile firings. One such, *Okean*, would often be found in international waters off the Malin Head, attempting to monitor our movements in and out of the Clyde. Another regular visitor was a *Sorum* tug that stayed in the lee of the Shetlands as a contingency to aid any Soviet vessel in trouble in the Atlantic. There were many hydrographic survey ships and it is believed that the Soviets had completed a most comprehensive charting of the Atlantic, vital to submarine navigation. There were also a small number of specialised ships attempting to gather data on the SOSUS system or perhaps, during escalation to war, attempting to disrupt it, so knowledge of their whereabouts was vital.

I have mentioned the benefits of a covert approach to a vessel to gain intelligence. I must stress that all Nimrod covert operations I know of were conducted in international waters and indeed, often with extra safety margins imposed by the Foreign Office. One Falklands War modification that was useful in the Cold War was the ability to conduct air-to-air refuelling (AAR). Now, with the aid of a Victor or VC10 off Norway, we could do the covert approach trick in Ivan's back yard, the Barents Sea. Here one might encounter new warships or

A Typhoon *Class SSBN of the Soviet Navy.*

see submarines on surface trials. To see two *Typhoon* SSBNs a mile apart was some sight. The Soviets were accustomed to patrols by the Norwegians, but used to send up a fighter to identify us. Whilst some crews took magnificent photos of MiG-31s bristling with new missiles, all I ever received was helpful advice from Ivan on '243' – the international distress frequency! Perhaps fuel was rationed. Despite the potential seriousness of various encounters, I never experienced anything more aggressive than legal niceties from the Soviets.

Though the Doomsday scenarios had hordes of Soviet aircraft pouring through the 'Gaps' into the Atlantic, we seldom saw much activity. Early on in the era, a Bear Delta might fly into the North Sea and later there were occasional patrols by the Bear Foxtrot ASW variant. On these occasions, we might try to get a Nimrod into the same area to see what they were up to. The Bears used to deploy in pairs to Cuba whence they could, impressively, return in one go to a base in the Kola without refuelling on the way back. One day we intercepted the lower of a home-bound pair. The Bears were talking on an international chat frequency, obviously all about a 'run ashore' in Cuba. As we closed for a photo, the higher Bear spotted us. 'Oh ho, Neemrod!' he said. There were four big puffs of black smoke as the throttles of our Bear were pushed through the gate and the RAF's jet-powered finest found that it was incapable of keeping up with the propeller-driven opposition!

Tracking Soviet Nuclear Submarines

The core Cold War activity for the Nimrod force was, as said, largely unknown to the public and to much of the rest of the RAF. It was to maintain surveillance of the Soviet submarine fleet. During the Cold War, the Soviets sent their nuclear submarines out into the Atlantic on a regular basis. In the event of a crisis, they would obviously be a danger but the assets to be protected at all costs were the SSBNs of our nuclear deterrent. Their patrol areas were highly

classified and, as we had no need to know the details, we didn't. Positioned by SOSUS cueing, our task was to pick up the target and track it as covertly as possible, handing him on from aircraft to aircraft until handing over to other nations' MPA or until other assets were in the trail.

This was done covertly to disguise as much as possible strengths and weaknesses in equipment capabilities and tracking techniques. Also, if it became apparent that aircraft tracking always began in particular areas, that would indicate areas of good SOSUS cueing from which it would be possible to build up a picture of the overall effectiveness, or otherwise, of that vital system. This cat and mouse game carried on throughout the Cold War.

The first aircraft laid a barrier of passive omni-directional Low Frequency Analysis and Recording (LOFAR) sonobuoys (the Jezebel system), which would pick up the submarine noise on the hydrophone and relay it by radio link to the aircraft. Most tracking was based on discrete frequencies produced by the power plant, machinery and generators of the target. These frequencies, or their harmonics, would pass as noise into the ocean through the hull. Later, with more computer processing, a buoy that also gave a bearing (DIFAR) was used too. The buoy spacing was such that the submarine could not go through without being detected. One would update the water conditions by dropping a bathythermal buoy, which dropped a thermometer on a line and radioed back the temperature profile. Based on this, one would decide the cable length to set on the sonobuoys.

Having detected the submarine on the barrier, it was then tracked by a series of sonobuoy patterns such as the five-buoy chevron. Once detected, an assessment of target position, course and speed could be made by getting more buoys in contact and comparing the received frequencies. This utilised the familiar Doppler shift principle of train whistles or racing cars. The frequency is higher when the target is coming towards you, is at the centre frequency as it passes (Closest Point of Approach or CPA) and is lower as it goes away. Once one had established the centre frequency, geometry allowed you to work out the angle the target was to a buoy. The speed was assessed from measuring known gearing or propeller blade readings or, after a full CPA had taken place, giving the maximum frequency shift against a formula.

If your assessment was good, he would CPA one pattern and, before he faded there, would fade in on the pattern ahead. On my last tracking sortie I achieved the equivalent of a 'hole in one' when the submarine scraped along the buoy cable and cut off the hydrophone. On return I basked in some glory. My ever-tactful Lead Wet whispered in my ear that he would keep quiet about the fact that it was a wing buoy, not the pin buoy, that had been run down by the target! To hand-over covertly involved leaving specific radio channel buoys indicating your assessment of the target. The off-going aircraft was required to be at least a stipulated distance down an outbound track from one of these buoys, whilst the incoming aircraft had to 'on-top' that buoy to tie it into his system and was not allowed to descend until a specific time and only along another specified vector. It was a rigid and very necessary procedure that has seen us safely through many operations.

Later in the era, we were sometimes instructed to carry out a 'passive attack' at the end of the sortie. A tight attack barrier of passive sonobuoys was dropped ahead of the target and the dropping of a weapon simulated. This involved over-flying the target on the attack run and, in reasonable sea conditions, he would detect the over-flight. To be within a button push of doing exactly what you would do in war, gave a huge feeling of achievement. Whilst other Cold War warriors studied target maps, we were actually up against our potential foe, day after day.

The basic Doppler tracking technique worked well for thirty years. By the end of the Cold War the targets were much quieter, but other techniques to exploit the sound in the ocean had been developed. Over the years the aircraft acoustic operators, the navigators and AEOs built up impressive levels of ability. In addition, the highly classified world of SOSUS produced some officers who gained an almost sixth sense for the patrol patterns of the Soviets. On several occasions, when devoid of reliable intelligence, these men have directed the aircraft to gain contact. Such skills are perishable and in the modern world with the occasions where they are needed sparse, we are looking back to a golden age of expertise.

MARITIME ATTACK OPERATIONS

Air Cdre G R Pitchfork

Following an initial Canberra tour in Germany, in 1965 Graham Pitchfork, a Cranwell-trained navigator, was seconded to the FAA to fly Buccaneers. Thereafter his career was inextricably linked with that aeroplane, culminating in command of No 208 Sqn. He later commanded RAF Finningley and RAF Biggin Hill before a final tour as Director of Operational Intelligence. Since retirement he has written several books on aviation-related topics and is a regular contributor to the Daily Telegraph's obituary column.

A Defence Review initiated by the Labour Government in 1964 had a significant impact on the UK's capability to engage in maritime air warfare. The cancellation of CVA 01, the Royal Navy's follow-on fixed-wing aircraft carrier, was soon followed by an announcement that, as the Navy's four old fixed-wing aircraft carriers were withdrawn in the early 1970s, the RAF was to assume the responsibility for land-based air support of maritime operations – soon to be called Tactical Air Support of Maritime Operations, or TASMO for short. This heralded, not only the re-emergence of an anti-surface ship role for the RAF, but also an obligation to provide air defence for the Fleet, and we will hear more of that later.

The F-111, itself a replacement for the already cancelled TSR2, was also a casualty of Dennis Healey's axe. As a replacement, he announced that twenty-six Buccaneers had been ordered for the strike role to be followed shortly afterwards by an order for seventeen additional aircraft, together with a further sixty-four to be transferred from the Royal Navy as its Fleet Air Arm squadrons disbanded.

Before considering the RAF's maritime attack operations using the Buccaneer we should look briefly at the development of the aircraft.

The advent of the Cold War in the early 1950s heralded a major shift in the Soviet Navy's capability from a purely coastal defence force to a global naval super-power posing a major threat to the security of the vital seaborne trade of the Western Powers. Pre-

A pair of No 12 Sqn's Buccaneers investigating a Soviet Kirov Class cruiser.

eminent in the Soviet shipbuilding programme was the development of the 17,000-ton, heavily gun-armed *Sverdlov* cruiser.

The surprise element of an attack aircraft flying at very high speed and very low level beneath a target's radar cover had been recognised by the staff of the Naval Air Warfare Division and in 1952 they realised that this was the answer to the threat posed by the *Sverdlov.* This culminated in the issue of Naval Air Requirement NA 39 the following year, which specified that the aircraft should have an operational profile with a 400-mile radius of action, with a descent from high level to very low level just outside the detection range of a target's radar, followed by a high-speed low-level dash to and from the target.

It was the design submitted by the Blackburn Aircraft Company that was selected to meet the naval air staff's requirement and the Buccaneer, as the aircraft was subsequently called, flew for the first time on 30 April 1958. The aircraft was developed very quickly and entered squadron service with the Fleet Air Arm in January 1963, less than five years after its first flight – a remarkable achievement for

such a complex aircraft that embodied a number of new technical innovations.

The Mk 1 version of the Buccaneer was underpowered but by 1965 the Spey-engined Mk 2 had arrived on the scene to offer a greatly enhanced performance, particularly in range, and the four FAA squadrons had all converted to this version by the end of 1966 – ironically, just as the Defence White Paper was published announcing the impending demise of the aircraft carrier.

The aircraft cruised at low level at 420 knots and accelerated to an attack speed up to 580 knots flying at 100 feet. The aircraft was equipped with an internal bomb-bay, which carried four 1,000 lb bombs or two tactical nuclear weapons. There were four hardpoints on the wings, which carried a variety of stores including bombs, rockets, anti-ship missiles and overload fuel tanks. In later developments, electronic counter measure pods, laser target designators and air-to-air missiles were carried on the wings.

After that brief look at the Buccaneer and its capabilities, let us return to the maritime role. In late 1968, Honington was identified as the future home of the RAF's Buccaneer Maritime Wing and the first element, No 12 Sqn, was re-formed on 1 October 1969. It was tasked with providing TASMO, in particular the attack of Soviet Navy Surface Action Groups (SAG). The area of operations assigned to the squadron was the eastern Atlantic, from Gibraltar to the North Norwegian Sea. To cover this vast area, the squadron regularly deployed to Forward Operating Bases (FOB) at Lossiemouth, Stornoway and St Mawgan, which, in conjunction with air-to-air refuelling, allowed the aircraft to extend its already long range beyond a 1,000-mile radius of action, allowing it to cover the whole of the assigned area of operations.

When No 12 Sqn re-formed in late 1969, the RAF had not been involved in the attack of surface warships since the WW II days of Coastal Command's Beaufighter and Mosquito Strike Wings. The initial tactics devised for the RAF's maritime squadrons followed closely the principles of the tactics employed by the Strike Wings at the end of the war. Put simply, a defence suppression element went in first to be followed by the precision attack sections. Indeed, when we produced the first tactics manual, we copied the tactics of the Strike Wings and simply scored out the words Beaufighter and Mosquito and

replaced them with Buccaneer. This simple expedient allowed us to get started and we modified the tactics as we gained experience.

With the RAF's role being to provide TASMO, a very important organisation was established as the focal point for training, doctrine and the development of maritime air procedures. I refer to the Joint Maritime Operational Training Staff or JMOTS as it became widely known. By 1970 it was established at RAF Turnhouse where a series of annual courses – known as JMCs (Joint Maritime Courses) – were run, and these carried on for the next twenty-four years.

JMOTS was such a fundamental aspect of the RAF's maritime warfare capability that it is worth pausing for a few moments to expand on its role. Although the JMC was a national course, participation by invited NATO ships and aircraft allowed joint procedural training in addition to providing the Buccaneer squadrons with different and realistic targets. Each JMC started with a series of discussion periods and briefings at Turnhouse, before ships sailed from the Firth of Forth when they immediately came under simulated air attack as basic tactics and procedures were practised as the ships sailed to the main exercise area. Buccaneers were in constant demand as 'targets', providing a ship's operations staff and its missile and gun crews with a very potent and realistic 'enemy'. Once the naval force was in position north of Scotland, the exercise moved into a five-day operational phase representing the transit of an Anti-Submarine Task Group through the United Kingdom Air Defence Region (UKADR) towards the Shetland Islands and Scandinavia. The ships moved along a predetermined track designed to ensure maximum interaction with submarines, maritime patrol aircraft, air defence fighters, airborne early warning aircraft and attack aircraft.

The early JMC exercises in the 1970s provided an ideal scenario for No 12 Sqn to develop tactics and procedures. It was a steep learning curve and the aircrew often felt that the 'bomber' syndrome of the air staffs stifled their initiative – until the early 1980s, the Buccaneer squadrons came under the control of No 1 (Bomber) Gp. I well remember my Station Commander briefing some senior officers at Strike Command that the Buccaneer was 'not a mini-Vulcan, but a maxi-Hunter.' He was right. However, as experience was gained, the full capability of the Buccaneer became more understood and accepted by the hierarchy, and the support of higher formations was excellent.

The JMC exercises themselves became more sophisticated and responded quickly to developments and the changing capabilities and tactics of the Soviet Navy. In later years, JMCs took place off the South West Approaches and others off Gibraltar.

However, before we get ahead of ourselves, let us return to the early days and consider the problems we were confronted with. By the late 1960s the increasingly sophisticated anti-aircraft defences of Soviet warships dictated that a stand-off weapon was needed for defence suppression and for precision attacks but, in 1969, the chosen weapon – the Martel missile – was still some years from entering service so the tactics employed initially were based on the use of unguided conventional bombs and rockets – not very different from WW II.

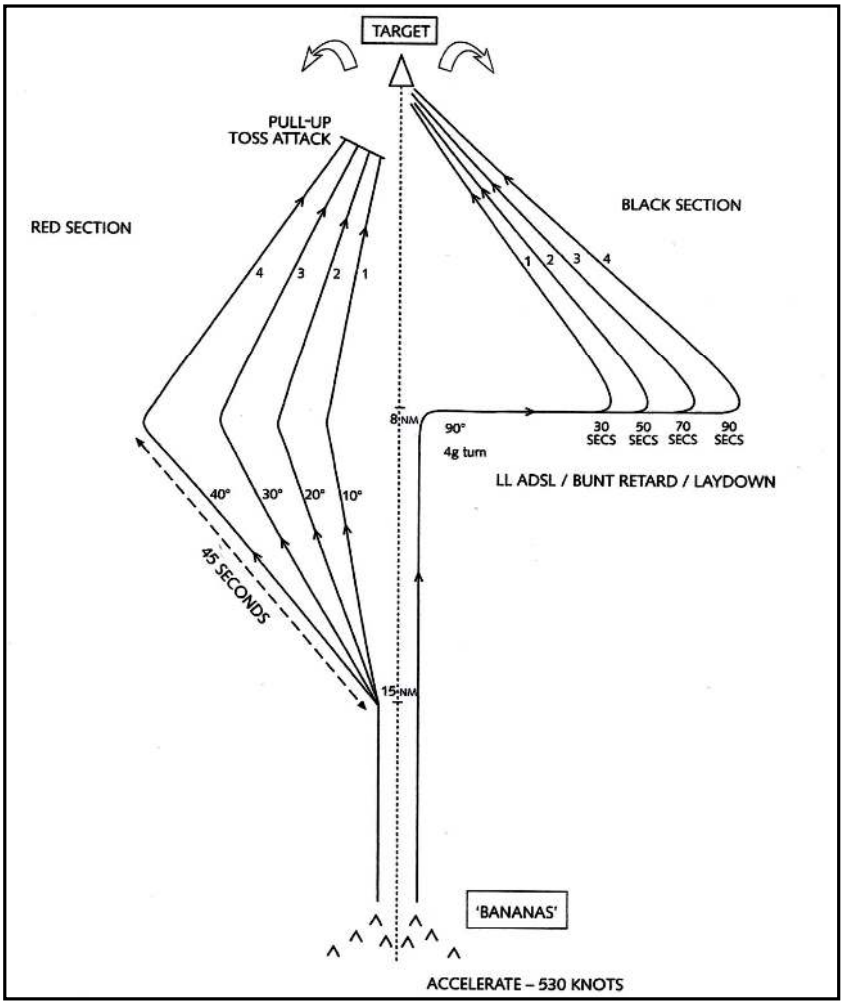
The major problem for an attacking force operating at long range was locating the target. The world's oceans cover vast areas and ships can easily 'disappear' so our first task was to set about devising tactics to locate surface vessels. Here, the newly formed Central Trials and Tactics Organisation played an important role – its first major study was one addressing this very problem. Their recommendations were trialled in the Mediterranean during the largest RAF maritime exercise ever held since the war. In November 1970, ten Buccaneers deployed to Luqa in Malta for Exercise LIME JUG. Amongst others participating in the exercise were Victor radar reconnaissance aircraft of No 543 Sqn and the two units devised a system to identify target shipping based on the continuous plotting of radar contacts. With their long endurance, the Victors maintained a continuous patrol of the exercise area plotting all ship contacts. After a few hours a picture emerged that identified shipping on routine passage, and others that were manoeuvring or operating as groups, permitting the latter to be singled out. Their positions were passed by secure code to a Buccaneer aircraft flying a low probe (LOPRO) to identify potential targets. Once identified, the Victor shadowed the force and broadcast the coded position continuously at regular and frequent intervals. The Soviet Navy obliged by monitoring this large exercise and numerous 'interceptions' were made against Soviet warships, providing invaluable experience for crews who were new to maritime operations.

The method of 'shadow support', devised during LIME JUG,

formed the basis of more refined procedures over the next twenty-five years. Vulcans of No 27 Sqn were tasked exclusively with maritime radar reconnaissance. Their crews became expert at identifying targets in a cluttered sea area and new methods of passing coded dispositions were developed. Canberras and Buccaneers flying LOPRO sorties were often launched to identify the targets selected as possibles by the Vulcans. Shackleton AEW aircraft were sometimes used to provide Tactical Direction (TACDI), although this was a secondary role for them. With the demise of the Vulcans in 1982, the Nimrod, equipped with the Searchwater radar, assumed the task and, with its other sophisticated aids, it was able to provide a surface picture (SURPIC) and give accurate range and bearing information of the target.

With large areas of ocean devoid of enemy activity, the standard profile adopted by a Buccaneer maritime attack formation was a Hi-Lo-Hi. This had the added advantage of extending the range to as much as 600 miles radius without refuelling, although this range was regularly extended with the assistance of Victor tankers. Whenever possible, formations were made up of six or eight aircraft and during the transit to the target area, all the crews listened out on the radios for the latest information on target locations broadcast by the shadowing aircraft. Radio and radar silence was maintained to avoid giving away their approach to a target. At a range of 240 miles from the target the Buccaneer formation started an 'under the radar lobe' descent to sea level in order to stay outside the enemy's radar cover. By monitoring the passive radar warning receiver during the descent the formation was able to remain outside the enemy's detection range. At 30 miles the leader 'popped up' and the navigator switched on his BLUE PARROT air-to-surface radar for two or three sweeps during which time he identified and 'marked' the target before descending back to 100 feet. The lead navigator then had to inform the rest of the formation and this created problems.

During the attack, only the lead aircraft transmitted on radar. The navigator selected the most likely radar return as the target and the aircraft was turned to place this radar return dead ahead. To identify the target to the rest of the formation all that was needed was a pre-briefed range – normally 20 miles – and a simple codeword to tell the rest of the formation when to switch on their radars. The codeword? 'Bananas!' It was never changed, and it became the trademark attack



The classic early Buccaneer-era eight-ship iron bomb anti-shipping attack profile.

call of the Buccaneer force – usually followed by a 'split!'

At the pre-sortie briefing one of a number of co-ordinated attack profiles, designed to provide a co-ordinated attack, was selected as the primary option depending on the defences of the planned target. We called them 'Alpha' attacks. The leader could change the option at

short notice if weather or enemy ship dispositions dictated different tactics, and the new Alpha attack was broadcast with the 'Bananas' call. However, they all employed the same basic principles – suppress the enemy defences before hitting the target with the lethal weapon.

The aim of the Alpha attacks was to maintain the element of surprise by remaining outside the radar horizon of the enemy ship for as long as possible followed by a series of pre-planned splits to confuse the target defences and delay the lock-on solutions for their radar-laid anti-aircraft defences. Once we had penetrated the target ship's weapons engagement zones, we used the exceptional low-flying performance of the Buccaneer to fly at high speed and ultra-low level while sustaining high-g manoeuvres to increase the tracking problems of the enemy radars. The first attacks were delivered from a toss delivery at three miles on converging headings. Each 1,000 lb bomb was fused to explode at a height of 60 feet above the target, the aim being to destroy the fire-control radars and incapacitate the missile and gun crews. In the meantime, the attack force had turned starboard through 90^{o} before rolling in to release four to six 1,000 lb bombs independently from a low-level dive or laydown attack that provided the killing blow. Timing was critical if aircraft were to avoid the debris from the preceding attack. The obvious weakness of this attack was the vulnerability of the aircraft – particularly those that carried out the precision attack.

Co-ordinated attacks were also practised at night, but with formations of four aircraft operating at a minimum height of 200 feet, which, at 580 knots, required considerable concentration and careful monitoring of the aircraft's excellent radio altimeter. The principle was similar to the day profiles, but the precision low-level bombing was avoided and the preferred delivery mode was a toss attack, giving a degree of 'stand-off.' The 4g recovery from the toss delivery, which required a 135^{o} angle of bank, and the formation rejoin in the very dark conditions, were very exciting, demanding and disorientating.

Less well-defended targets, such as Fast Patrol Boats (FPB), were attacked using Lepus illumination flares thrown by the lead aircraft of a pair. As they approached the target, the Number Two aircraft dropped astern. The Leader tossed the flares to place them ahead of, and beyond, the target and the second aircraft attacked with SNEB rockets or, occasionally, bombs, with the target silhouetted in the light

lane created by the flares.

The answer to the need for a stand-off weapon was the Martel missile, which was available with either a passive radar homing seeker or a TV seeker coupled to radio command guidance. Martel was one of the first Anglo/French military collaborative projects, with the French primarily responsible for the development and evaluation of the Anti-Radiation (AR) version and the UK having similar responsibilities for the TV missile system. The TV-guided missile became the primary attack weapon for the maritime Buccaneer force. The TV version of the missile had a 350 lb semi-armour piercing, radar-fused warhead to penetrate ships' hulls.

The missile was launched from the delivery aircraft at 100 feet and 500 knots at 15 miles range from the target and, after release, the weapon climbed to its mid-course phase at about 2,000 feet, which was necessary for target acquisition and to maintain the data link with the launch aircraft. TV imagery from the missile's camera was relayed back to the navigator by the data link, which then transmitted control inputs made by the navigator using his joystick. He maintained the cross wires over the aiming point by giving up/down and right/left commands until impact. It required a lot of practice and we spent many hours on a simulator. Martel was a very effective weapon in its day and the radar version remained in service as a defence suppression weapon until the aircraft went out of service.

Soon after Martel entered service, the Buccaneer force was the first in the RAF to receive the Paveway laser guided bomb (LGB). A Pavespike laser designator pod carried on a wing pylon provided the laser marking. The pilot pointed the aircraft at the target allowing the navigator to acquire it on his TV screen. The pilot was then free to manoeuvre the aircraft. At three miles the accompanying bombers tossed their LGBs as the 'spike' navigator tracked the target. As the bombs reached their apogee, he fired the laser and the bombs homed on to the light reflected from the target. Many of you will have seen how effective this was during the first Gulf War when the Buccaneers marked targets for the Tornados, in addition to marking for their own bombs.

In 1980 it was decided to move the UK-based Buccaneer force to its spiritual home at Lossiemouth, which had itself been transferred to the RAF in September 1972. First to move was No 12 Sqn in

November 1980, control being transferred to No 18 (Maritime) Gp, and No 208 Sqn arrived in July 1983. As the navy had discovered, Lossiemouth was an ideal location for the maritime squadrons, being close to its likely wartime operational area and to the excellent local air-to-ground weapons range at Tain. Although small – some forty aircraft – the wing provided SACLANT with his only dedicated land-based maritime strike/attack element, and it became the major anti-shipping force in the North East Atlantic region.

No 12 Sqn continued to employ both versions of Martel, and formations continued to use target information from Nimrods and to adopt modified versions of the 'Alpha' attacks with AR Martels fired for defence suppression followed by a salvo of TV Martels. The arrival of No 208 Sqn, equipped with AR Martel and the Paveway LGBs provided another capability. Two aircraft carried AR Martels and these were fired if the target continued to transmit with its radars. The bombers, armed with two Paveway 1,000 lb LGBs, tossed the bombs from two to three miles. Once the target was marked, the 'spiker' turned away at some eight miles and the gimballed head of the Pavespike continued to track the target as the laser was fired until the bombs impacted. The bombers were particularly vulnerable throughout the profile unless the AR Martels had been successful, so, during the recovery, chaff was dropped and the navigator made the appropriate selections on the Westinghouse active jamming ECM pod. Against less well-defended targets, such as intelligence-gathering ships, vital re-supply support ships and amphibious shipping, the LGB provided a heavy weight of bombs with an accuracy that had not previously been attainable.

Aircrew flying on maritime squadrons during peacetime and periods of transition-to-war enjoyed a big advantage over their overland colleagues. There were regular opportunities to come face-to-face with the threat and to carry out photographic and radar reconnaissance. Buccaneer aircrew had been able to view the formidable array of Soviet warships from the 1960s and had never failed to be impressed by the huge advances in their capability. It could be a chilling experience to approach a *Sverdlov* cruiser, the Buccaneer's intended adversary in the earlier days, although the later generation of cruisers and destroyers encountered on almost every exercise posed a far greater threat. Such encounters occurred

Sea Eagle-armed Buccaneers of No 12 Sqn.

throughout the North Atlantic and in the Mediterranean and a great deal of intelligence was gathered, in addition to reminding the crews of the scale and capability of the threat.

Throughout the early 1980s the 'blue water' Soviet Navy continued to develop as a potent force, and the arrival of increasingly effective surface-to-air missile systems posed a very serious threat to any attacking aircraft that approached within 15 miles. As we have just seen, the tactics of the Buccaneer Wing had changed little from the Honington days and were still based on third-party shadow support followed by a co-ordinated attack. It came as a relief to the aircrews of both squadrons when, in 1983, plans to fulfill Air Staff Requirement 1012 were announced. The core of this upgrade was a modern inertial navigation system, an improved secure radio, new ECM equipment and chaff and flare dispensers. Full compatibility for the Sidewinder AIM-9G or -9L was also included. Of even greater significance was the announcement that the aircraft would be made compatible with the new British Aerospace Sea Eagle missile.

Sea Eagle was a long-range, anti-shipping missile powered by a turbojet engine. The inertial navigation (IN) platform was the core element in the system. The Buccaneer's IN provided the Sea Eagle

system with essential navigation inputs, including an accurate target position from the shadowing aircraft. This gave enormous flexibility for inventing new tactics and delivering weapons on different axes. With a range of 60 miles, four times that of Martel, Sea Eagle was a genuine 'fire-and-forget' missile which followed a sea-skimming flight profile, remaining radar silent until it estimated that it had penetrated the radar horizon of the target, at which point, it began to climb. It then switched on its I-band active homing head, selected its target and resumed its sea-skimming profile before slamming into the target just above the water line, and less than two minutes after first alerting the ship of an impending attack. As a true 'sea skimmer', flying at 10 feet, it was a very difficult target to engage. The 506 lb blast fragmentation warhead was significantly more powerful than that of Martel. Each aircraft could carry four missiles which, when launched simultaneously, gave a formation tremendous firepower greatly in excess of any Martel-equipped formation.

One of our most experienced pilots commented 'The Buccaneer force had been awaiting the introduction of Sea Eagle with impatience. For too long we had been attacking ships with iron bombs and a very temperamental Anglo-French missile. Both weapons were outdated but, more importantly, relied on the attacking aircraft breaking the radar horizon to launch or release. Our planned attrition rate against Soviet SAGs was eye watering and, come the war, a Buccaneer maritime crew's longevity was zero.'

With the advent of the Sea Eagle missile and the aircraft's avionics update this gloomy outlook disappeared. We attacked from way beyond the radar horizon and had the ability to carry out co-ordinated attacks against surface ships from multiple axes, to saturate ship defences, and to ensure missile strike times within 10 seconds, despite formation splits of up to 40 miles. Tactics were designed that would work in any weather day or night, to inflict maximum damage with minimum risk to the attack formation – indeed, the Buccaneers returned to base without the target having any sort of contact with a six-ship Buccaneer package. The age of the silent ship killer had well and truly arrived. It was a far cry from the rocket and iron bomb days.

The need for third party targeting was always a key element of successful attacks against shipping and the methods devised during the early exercises in 1970 with the radar-reconnaissance Victors

appeared archaic, but they had laid the foundations for all the later, upgraded techniques. The enhanced capabilities of the Nimrod had considerably improved the techniques and accuracies, but the combination of the Nimrod and the Buccaneer with its avionics upgrade brought the 'shadowing' business to new levels of effectiveness. Excellent joint work between the two forces in building up the surface picture and tactical direction for the Buccaneers, resulted in the joint award of the prestigious Wilkinson Sword.

By late 1990, the two Buccaneer squadrons had been working together as a Maritime Wing for over seven years, and the avionics update and the introduction of Sea Eagle had made it a very potent anti-shipping strike force. However, suddenly, this ultra-low level maritime attack aircraft found itself going to war – at medium level and overland – but that is another story.

On their return from the Gulf War, having performed in an outstanding manner, the Buccaneer force was at the height of its capabilities, twenty-eight years after first entering squadron service with the Royal Navy. The embodiment of the new equipments under ASR 1012 and the new tactics based on the tremendous hitting power of Sea Eagle had made the Buccaneer the most powerful anti-shipping attack aircraft in NATO. The upgrade programme had been completed in 1989 and it was visualised that the force would remain in service until the end of the 1990s. However, the end of the Cold War had generated a number of defence reviews, resulting in some Tornado GR 1 aircraft being declared surplus to requirement. Plans were drawn up to equip two squadrons with these aircraft, modified to carry Sea Eagle, and to use them to replace the Buccaneers in the maritime role.

The steady run down of the Buccaneer force started in October 1991. To acknowledge its outstanding RAF service over many years, the aircraft was chosen to lead the Queen's Birthday Flypast in 1993, just a few months before it was withdrawn from service. On 31 March 1994, No 208 Sqn ceased to be declared to NATO and the Buccaneer's thirty-two years of operational service, twenty-five with the RAF, were over.

LAND-BASED MARITIME AIR DEFENCE

Air Cdre Ian McBride

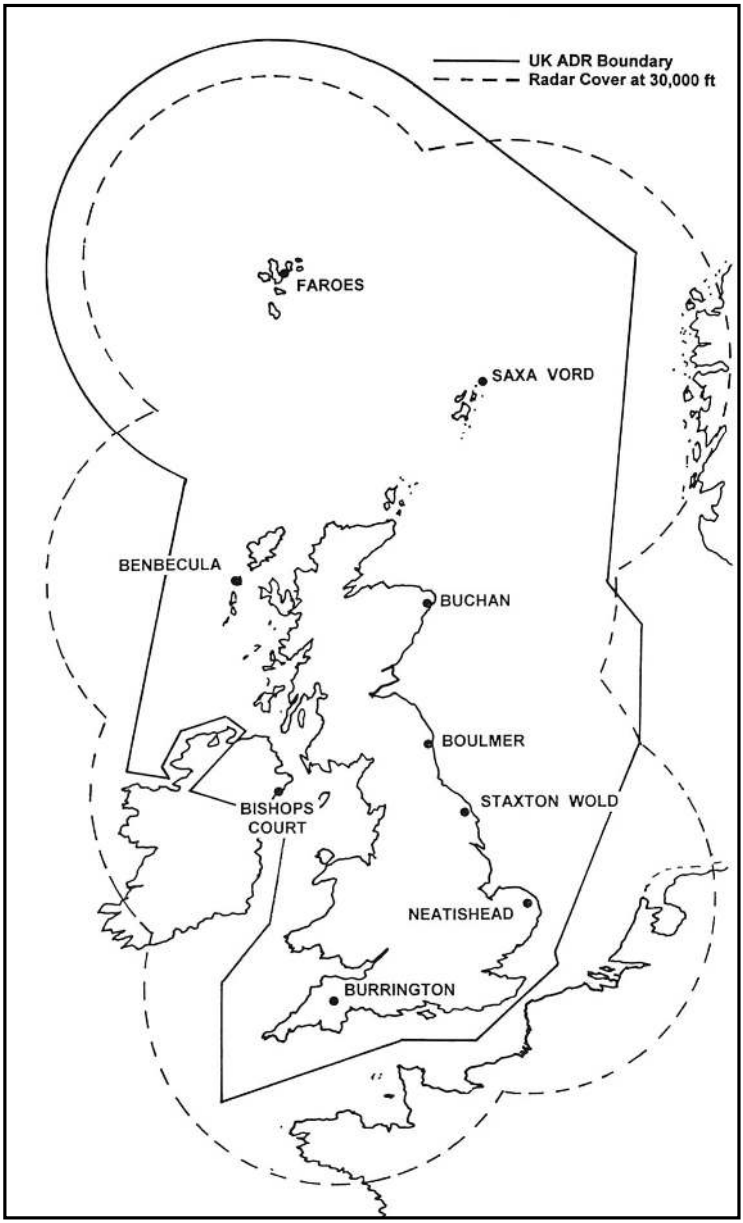
Ian McBride began his career as a fighter pilot on the Lightnings of No 74 Sqn in 1965, eventually becoming an instructor on type before converting to the Phantom and commanding first No 43 Sqn and then RAF Wildenrath. Other tours included a spell in the USA and two with what is now the Air Warfare Centre. His final appointment, at the time of the first Gulf War, was as Director Air Defence. Post-the RAF he spent ten years with FR Aviation before becoming an independent Defence Consultant.

The sole justification for my being here today is the very happy and fulfilling two-and-a half-years that I spent in command of No 43 Sqn (The Fighting Cocks) between 1978 and 1980. For much of that time it was the sole SACLANT-assigned unit within No 11 Gp although, as you will hear later, No 8 Sqn also spent a great deal of time on maritime air defence work. The fighter element of the Tactical Air Support of Maritime Operations (TASMO) force was augmented in 1980 by the assignment to SACLANT of No 29 Sqn based at Coningsby.

This afternoon I will examine the AD TASMO task from its inception up to the present day, spanning just short of forty years. Because TASMO is still a 'live' task, however, there will be some areas which I may have to treat with some discretion, but, with luck, you will not notice these.

The Task In Outline

The simplest way to summarise the air defence task is to describe the area within which we generally operated. There was a tacit agreement that our assignment would be limited to maritime air defence within the UK Air Defence Region, or ADR, which to all intents and purposes coincided with NATO Area 12. Radar coverage at medium level (30,000 feet or so) matched the ADR boundary with uncanny accuracy if one took Pole Star, a Danish unit on the Faeroes, into account. This radar station was an essential element of our



Radar coverage of the UK Air Defence Region (ADR) at 30,000 ft.

operations in the northern part of the ADR but, because it was a NATO unit, we were sometimes a bit coy about admitting the extent of its contribution to national tasks. Indeed some people were unaware of its existence, let alone its involvement. The radar coverage picture changed dramatically at lower levels with no contiguous cover in the main areas of interest and large gaps just where we did not want them.

With the passage of time, and the improvement in co-ordination which came with experience, we started to range beyond the ADR and sometimes even supported maritime forces operating inside the Arctic Circle. Training exercises ranged from the ubiquitous and day-to-day MACEX (Maritime Co-ordination Exercise) to the Joint Maritime Courses, or JMCs, which have already been mentioned by others today. Annual EASTLANT or SACLANT exercises would normally involve the passage of the Strike Fleet or a Marine Amphibious Group from WESTLANT to Northern Norway which would be diplomatically routed through the Iceland-UK Gap within range of UK TASMO forces. These latter exercises generated our more challenging missions and, not surprisingly, the greatest level of Soviet interest. There would be regular overflights of participating Task Groups and this activity created an additional, but not unrepresentative, layer of Command and Control interaction because both SACEUR and SACLANT had an interest in what was going on and both deployed assets to prosecute the task. As we all got better at it these tasks almost became one with SACLANT and SACEUR assets moving seamlessly between the two similar, but organisationally different, functions.

The RAF assumed the AD TASMO task when a refit of HMS *Eagle* was cancelled and the ship de-commissioned, its fixed wing assets (other than Gannets) being transferred to the RAF for land-based support. Prior to this epoch-making event the RN and other surface forces which worked closely with them had been used to getting protection from their own home-grown local team. Organic Air Wings, able to perform a wide spectrum of roles with impressive equipment and well-trained, experienced crews had been capable of providing a very good service. Collocation of air direction officers and fighter crews conferred great operational advantages and created a close-knit team which was always playing at home. The down side was that the Fleet Air Arm had a global role and as it had grown smaller it had been spread increasingly thinly across the task area.

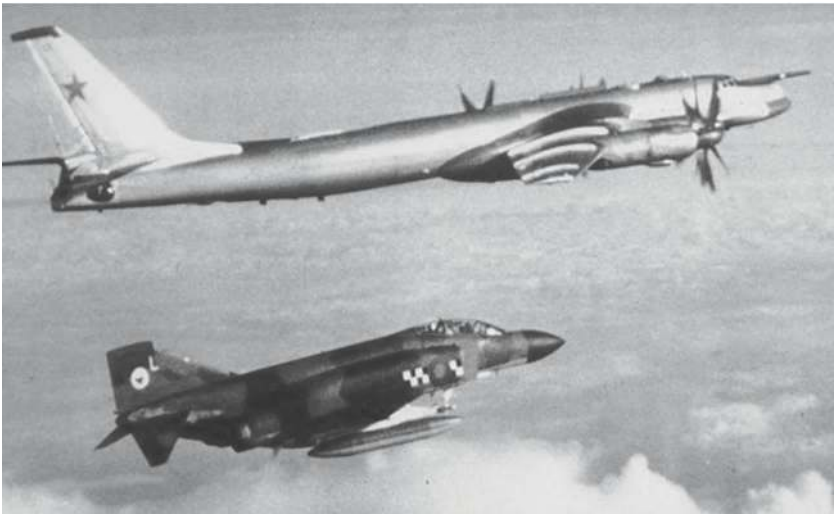
Furthermore, its training flying was sometimes limited by port visits and/or lack of diversions and, when it finally folded, most of its fast-jet expertise, not unexpectedly, transferred to the Sea Harrier force. The RAF had provided some crews to support the RN during the wind-down of conventional fixed wing operations but, for reasons best (and only) known to Barnwood, or its lineal descendent, little of this expertise found its way to the RAF's AD TASMO force.

The Air Assets Employed

Whilst the RAF was able to match the RN's equipment and crew availability, indeed even assign a greater level of resource to the task, there was one fundamental limitation which our land-based posture could never overcome – the fourth dimension – time. It is axiomatic, and utterly undeniable, that a Phantom sitting cocked on the waist catapult of a carrier steaming through the Gaps is a lot closer to the action than a Phantom in a QRA shed back at Leuchars, some 500 or 600 miles to the south. In an operational environment, where readiness levels and reaction times are absolutely crucial, this was a burden worthy of Pilgrim. The trick was to identify ways of minimising it within reasonable resource levels.

Air Defence operations in support of maritime forces had begun in the mid-1960s and involved, in the first instance, Lightning F3s without the benefit of air-to-air refuelling support. The very short legs of this otherwise capable aircraft meant that these missions took place very close to land. However, valuable experience was gained and the concept really took off when the benefits of AEW were added to the equation. Joint exercises took place in UK and the Far East and the greater range of the Lightning F6 had a profound impact on our overall capability, although few, if any, exercises got close to the ADR boundary.

The tempo of AD TASMO increased significantly with the appearance of the fifteen Phantom FG1s of the SACLANT-assigned No 43 Sqn. Although there was initially great suspicion within RN circles about the sincerity of the RAF and the likelihood of this unit actually pitching up on the day, the relationships which slowly developed with naval units and staff bore fruit and during my time in command we hosted more visits from dark blue Ops teams and centres of learning than from their RAF counterparts. Perhaps we were



One of No 43 Sqn's Phantom FG 1s shadowing a Bear

deluding ourselves, but we really did feel that we were part of the maritime scene.

The majority of our TASMO flying took place in the Shetland/Faeroes Gap, with occasional forays to the more balmy South West Approaches (SWApps). When No 29 Sqn joined the SACLANT team they assumed responsibility for the SWApps, permitting No 43 Sqn to concentrate on the northern sector, which was also our normal operating area in the context of the routine peacetime Northern QRA commitment. The advent of the Phantom, with its greater range, endurance and radar performance, brought a marked improvement in TASMO capability and a much better alignment of fighter footprint and task area boundary.

The final step was the entry into service of the AEW Shackleton without which our TASMO capability, and credibility, would have been seriously undermined. More on this later.

Factors Affecting Operational Posture

The nature and, more critically, the location of the task would determine the posture adopted. A defensive task midway between UK and Jutland could probably have been based upon a response from ground alert, whereas anything north of (say) the Orkneys would

(without a Forward Operating Base in the Moray Firth or the Hebrides) probably have tipped the scales in favour of a standing Combat Air Patrol (CAP). Sorties would almost inevitably be of long duration with on-task productivity significantly improved if air-to-air refuelling was available. By that I mean that the ratio of time on CAP would increase as a proportion of total mission duration. If the shooting had ever started it is likely that CAP fighters, despite the impressive arsenal carried by the Phantom and Tornado, would have expended all their weapons before replacement fighters reached the area. Long range early warning and gutsy decisions by battle managers might have minimised this problem but the further the CAP was from its support base the more pronounced the CAP replenishment problem would have been.

Operations in a distant maritime area introduced other significant Command and Control challenges to all players. The fighters would take off from a base and transit airspace where SACEUR Alert States and Rules of Engagement (ROE) prevailed before entering SACLANT's domain where it was all likely to be very different. Not only did the crews have to keep an eye on how Alert Measures and associated ROE constrained or empowered them but they also had to work out *where* they changed. Subtle variations between permitted responses invariably featured in peacetime exercises and would have been a nightmare in a shooting war when fast rewind and/or a grovelling apology would not be available options. Some assets (AEW and tankers for example) were chopped in mid-mission between Subordinate Commanders, sometimes supporting both simultaneously. Achievable in a multi-crew environment but too schizophrenic for your average fighter crew in a fully blown exercise. That said, QRA crews were frequently passed from SACEUR units to naval forces during a complex scenario but did so without the complicating factor of wartime ROE. Peacetime operations also created some interesting examples of maritime forces either being required to perform unexpected tasks, or encountering circumstances where they had no option but to cross picket lines. A classic, but far from unique, example was the case of a Nimrod shadowing a Bear Foxtrot, rather than the usual SSN. There are also examples of fighters being tasked on a Form Green for surface search missions and also, amazingly, to

locate submarines on the surface near Rockall! I suppose that this all serves to underscore the inherent 'flexibility of air power'.

The Tools Of The Trade

The first UK SACLANT-assigned squadron was equipped with the FG1 variant of the Phantom which had originally been destined for HMS *Eagle*. The major operational differences between the FG1 and the RAF-specified FGR2 was the lack of an HF radio and an inertial navigation system. The former was a major drawback when operating at extreme range because, as we all know, V/UHF is horizon-limited and one could argue that a decent navigation kit was an essential tool of the trade. These two deficiencies were not only a constant source of embarrassment to us; they also created circumstances in which our situational awareness was seriously undermined and bordered on a flight safety issue. I only heard of one crew which got into dire straits because they did not know where they were (or more correctly, were not) until their fuel situation had become critical, but I am prepared to bet that there were plenty more. The miracle is that, to the best of my knowledge, throughout the life of the Phantom FG1 we lost only one set of fuel tanks on TASMO. The second squadron was equipped with the FGR2 in which these deficiencies were rectified. Both variants were well matched to the task in terms of performance, range and endurance, and, despite being handicapped by very poor V/UHF communications, could have given a good account of themselves in a shooting scenario if tanker support was available.

No description of AD TASMO in the 1970s and '80s would be complete without mention of the mighty Shackleton. Introduced as a stopgap measure, pending the arrival of the Nimrod Mk 3 or similar, this aircraft was equipped with radars recovered from the Gannet force as it was paid off, and manned by AEW operators who had gained operational experience with No 849 NAS during its final years. The ubiquitous and much-loved 'Shack' rapidly became a key element of the UK AD team, supporting SACEUR as well as SACLANT tasks. The achievements of the Shackleton, or more properly its crews, were legendary and, despite its crippling lack of speed, it always seemed to show up in the right place at nearly the right time. Its radar, which by any standard should have been in a museum, was nursed, tweaked and cajoled into producing information critical to the performance of the

No 8 Sqn's venerable Shackleton AEW 2s provided a crucial link in the maritime AD chain 1972-91. (MAP)

task in hand. There are few who operated up there at the time who would gainsay the fact that No 8 Sqn set the standard in the Gaps, kept us all on our toes, got the job done and provided the UK with a solid basis of knowledge and experience for the next-generation platform. The 'Anyface' callsign was usually the harbinger of good news when it hove onto the scene. It meant that things were likely to get better. A good feeling.

Staying with AEW for a little longer, we can, I think, agree that the Nimrod 3 went into history as a failure. However, in fairness, and in its death throes, it did make a very useful contribution to AD TASMO. Because the axe fell on it at a relatively late stage in its gestation, a significant number of crews had already been prepared for its introduction into service. This gave us a large pool of personnel that we could offer up to the embryonic NATO AEW Force to gain experience, to add realism and balance to the rather academic and stilted US input, and to supply the quality which was not a feature of the delegations from some of the other Alliance partners. Not only did this add lustre to our contribution but also it gave us a steadily expanding pool of expertise for the second coming of No 8 Sqn as an AEW unit. All of a sudden the UK had gone from 'also rans' to the

Without the service provided by Marham's Victor tankers the RAF could not have met its maritime AD obligations.

front rank of the Airborne Early Warning and Control league. There is little doubt that the early days of TASMO stimulated the growth of UK AEW which, in turn, gave us an excellent springboard for the E-3D era in which this platform now plays a key role in a wide range of RAF activities.

Another field in which a TASMO element grew to be indispensable, and then went on to become a major player in the broader scheme of things, is air-to-air refuelling (AAR). In the beginning, as it were, AAR made our contribution to TASMO credible, conferring on relatively short range AD platforms the ability to conduct operations at or beyond the ADR boundary. Not only did it provide reach, however; AAR also gave us persistence on task and thus an acceptable level of CAP productivity. No longer did we have to return to base just as the enemy broke radar cover and there was also a reasonable prospect of carrying enough fuel to the fight to make weapon expenditure a more likely outcome than fuel exhaustion. The Victor era saw the beginnings of flexible AAR operations which led to tactical tanking being tried and then adopted generally. In this endeavour the crews in the area decided on the pattern of usage rather

Starting in 1966, No 360 Sqn's Canberra T.17s provided the RAF with ECM training until 1994 when the task was contracted out to FR Aviation.

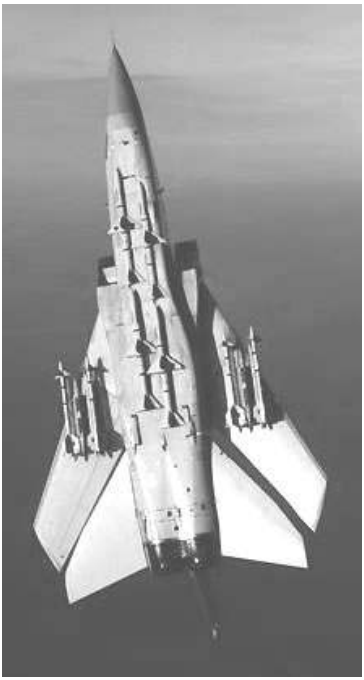
than a distant headquarters. Not exactly Earth-shattering stuff, but a big break from the past. The Vulcan made a brief late appearance in the AAR role, having been employed on many other tasks, including Maritime Radar Reconnaissance (MRR) in which I believe that it was also SACLANT-assigned. The multi-role, multi-theatre Hercules also did sterling work in the South Atlantic providing tactical tanker and MRR facilities and acting as general factotum in an area in which TASMO, in one form or another, was employed on an almost a daily basis.

Another element of the TASMO package which played a crucial role in force enhancement and the development of both doctrine and tactics was the training support that we received. Our potential threat during this era was considered to have a very powerful Electronic Warfare potential across the band of the spectrum in which we worked. It would have been easy to ignore this disruptive threat and achieve excellent results during all pre-hostility activities. However, we were fortunate to receive a very significant proportion of the training output of No 360 Sqn, operating specially equipped Canberra T17s and, later, by FR Aviation whose contract required them to produce a similar service using civilian aircraft. Both units were manned by crews with extensive experience of the EW and AD roles and they were thus intelligent suppliers of graduated training, the tempo and intensity of which was geared to either our individual training needs or the preordained collective objectives of the exercise in which they were involved. These aircraft performed an extraordinarily useful role in that they could be used to trigger procedural actions; they could blur an air picture such that air defence executives and operators had to rake through the noise to establish

what was going on or, alternatively, they could partially or totally blind the Air Defence Commander. Communications during such events were crucial and these crews could control the flow of information, throttle it completely and/or even substitute their own C3 patter. The effects ranged from delay to utter chaos, the outcome being dependant on exercise and training directives rather than any sadistic pleasure gained by their crews. One of their most useful contributions was in the exercise of ROE during which they took us up through the various levels and often ended with an attempt, often under jamming conditions, to force us into a blue-on-blue engagement. If we were following identification procedures correctly we were usually, but far from invariably, able to resist an inopportune shot. These training assets made us bleed in peacetime and were an invaluable part of our war-fighting preparation.

Prior to each sortie, all of these factors had to be co-ordinated and the information presented to the crews in a comprehensive, but comprehensible, format so we needed a robust but simple tasking procedure to support the three types of mission which we undertook: pre-planned, immediate or, if operating as part of a Coalition, rather than a NATO, package, in response to an ATO (an Air Tasking Order – the US-sponsored tasking mechanism). Ideally this would tell us who was calling the shots, where he wanted us to operate and in support of whom, and where he wanted the CAP and with what orientation. It would then need to specify the handover and joining mechanism, followed by the identification procedures, of which there were six basic types with an almost infinite number of variations. It was also a considerable advantage if, at this stage, the tasker could also provide details of other players in the area, their roles and their operating patterns.

Our next most pressing need would be for reliable ECM-resistant communications to allow free passage of re-tasking or re-assignment messages, the promulgation of changes in Alert State and/or ROE, together with the transfer of battle management and threat warning information. Without ECM-resistant communications we were at the mercy of No 360 Sqn, FR Aviation or a real enemy who might have moved us around the area at will, were it not for complicated and unreliable workarounds. The next item on the F-4 operator's shopping list was a good navigation suite for reasons that I have already



The operational handicaps of the Phantoms of the 1970s and '80s were overcome in the 1990s by the sophistication of the Tornado F.3 and its associated operational infrastructure.

covered. The final and probably most important requirement of all was a reliable and unambiguous identification system. IFF-based systems are insecure and jammable. Furthermore, they flag up *only* those contacts carrying the correct friendly squawk, which means that it is not safe to assume that a non-squawking target will automatically be hostile. It could be a friendly aircraft carrying the wrong squawk, or its equipment might be unserviceable, or it might be a neutral aeroplane or commercial traffic.

Based upon an IFF-only environment, without any other collaborating form of identification or a clear breach of ROE, we would be obliged to carry out a visual identification to avoid a blue-on-blue outcome. This was a huge operational penalty, particularly as our weapon suite was optimised for long-range front hemisphere engagements. It added time, which translated into target penetration; it

denied us our best shots and it made life extremely difficult if visual sightings were frustrated by darkness or cloud. Rudimentary solutions based upon rifle sights helped a bit but not a lot. The good news is that long overdue modern systems have largely overcome these difficulties.

As we always expected, and hoped, technology would remove most of the impediments to a truly effective TASMO posture. In our case this took the shape of a combination of the E-3D Sentry, Tornado F3 and JTIDS (or Link 16) which heralded an era in which most of our handicaps had been overcome, almost simultaneously. Tactical data could now be passed around the force in real time on secure and ECM-resistant bearers. All major players had access to the link and could therefore share information providing everyone involved with a graphical depiction of the battle space. The Missile Engagement Zones around ships could, for the first time, be seen and avoided in a measured, rather than a reactive, fashion, and all tracks carried an identity tag which clearly showed their status. In short, the AD team now has a clear and robust air picture which supports strategic needs and tactical requirements. Those who use it describe it as a real match-winner which has finally achieved our long-term goal of interoperability.

Marks Out Of Ten?

Unlike today's Tornado F3, with its sophisticated nav kit and JTIDS, the Phantom's avionic fit was never really up to the job. Furthermore, geography meant that our reaction times were always going to be long and, other than the stationing of watchmen, there were no practical solutions which could do much to alleviate this situation. Unfortunately, the Laws of Physics are simply not amenable to change so, in the environment within which we were obliged to operate, the tasking cycle was bound to be sluggish and unresponsive to changes in operational tempo, and our CAP-posture almost inevitably resulted in poor aircraft productivity. However, we must acknowledge that we had no other options. We had to do the best we could with what we had, and, by and large, we did. We achieved commendably high kill rates during exercises, and these were usually (but not invariably) on 'Orange', or exercise, targets! In all of this I believe that it should be placed on record that our tanker and AEW

elements, and our EW trainers, would have to feature on any TASMO Roll of Honour. They got us there; kept us there; gave us the best air picture available and ensured that we were all well trained and exercised in the difficult aspects of the task, of which there were many.

A postscript.

Many years after I had left No 43 Sqn and the TASMO scene, and not long after the Berlin Wall had come down, I was at a reception in the Italian Embassy in London. An RAF acquaintance took me over to a group saying that there was somebody I should meet. It transpired that he was the newly arrived Soviet Assistant Air Attaché, not someone that we would have been encouraged to meet in the past. His English was poor, but significantly better than my Russian, and we were able to carry out a reasonable conversation with the occasional reversion to French. Inevitably I asked if he was a pilot and, upon learning that he was, I asked, 'What type?' He replied, 'Tupolev 95' and, upon seeing a blank look cross my face, informed me that the NATO name of his steed was the Bear Foxtrot which he had flown during the period that I had been driving Phantoms around the Gaps. In for a penny, I thought, and asked him whether he had ever operated in the North East Atlantic. 'Oh yes', he said, 'and we often encountered your aircraft during our patrols.' Before I could work out the next question he broke in to say that we had been very good and that they had had great respect for us and our capability. What could I say? AD TASMO had clearly looked effective to the eye of an important beholder and, in an era of deterrence, that was probably good enough.

AFTERNOON DISCUSSION

Gp Capt Jock Heron. Although it doesn't relate directly to any of this afternoon's papers, I do have a question that someone might be able to answer. I recall a mid-1950s project for a lightweight maritime patrol aircraft called the Seamew. I remember seeing them in 1958 parked at Lossiemouth, apparently awaiting scrapping. Can anyone shed any light on that project?

Jefford. The Seamew was a small Gannet – and even smaller Shackleton – that was ordered for both the FAA, who would have flown them from carriers, and the RAF, who would have operated them very much like the shore-based floatplane and DH 6 flights in WW I. I believe that the navy were planning to issue them to its RNVR squadrons and they might well have been suitable for the RAuxAF too, although contemporary air force plans envisaged the Seamews being operated by four regular units. But the whole thing fell foul of the major rethink in defence commitments that emerged as the 1957 White Paper, which may not have been a bad thing as the Seamew's handling characteristics were not entirely satisfactory. It is said that, following the type's first flight, the company test pilot's report began along the lines of, 'It is difficult to gain access to the cockpit of this aeroplane; it should be made impossible.'

Gp Capt Hugh Eccles. Perhaps I could offer a couple of observations. As the CO of three Met Flights, in the days before they were elevated to squadron status, I would like to put on record that the 'father' of long-range meteorological reconnaissance flying was Flt Lt Eric Kraus. He was a most remarkable person, a Czech meteorologist, who found his way to England early in the war. He was commissioned into the RAFVR as an air observer and in March 1941 he flew the very first operational Met sortie in a Blenheim, subsequently doing a great deal more flying from Bircham Newton and then St Eval. I would add that I was appointed to form and command a Met Flight at Reykjavik in November 1941, which is a bit earlier than the timeframe indicated in Bryn's paper. (*In point of fact, the first two Met Flights had been established before the end of 1940, although it was early 1941 before they became operational. Ed*)

My second point concerns the Nimrod. In 1963, I was a Deputy Director of Operational Requirements and one of my responsibilities was the replacement of the Shackleton. I inherited an Air Staff Target which envisaged an all-singing, all-dancing aircraft which was to have been built from scratch and would have cost an enormous amount of money at a time when, as Air Cdre Pitchfork indicated, there wasn't much of it about. We went through the routine of examining the available options, the Orion and Alantique, but I thought it might be better to use an existing jet airframe with an integrated avionic system. We borrowed the prototype VC10 and spent an afternoon flying it up to 25,000 ft, diving down to 500 ft off the Isle of Wight, climbing back up again and so on; we concluded that the concept was perfectly feasible and that the VC10 was absolutely the right aeroplane. In the meantime, Farnborough set up a Committee which was responsible for developing the specification for the avionic system. In the event we actually used the Comet airframe and, as the Nimrod, it was in service within five years, although the avionics that we had envisaged lagged behind, hence the need to upgrade from the Mk 1 to the Mk 2 several years later.

Mike Meech. This morning it was pointed out that by 1939 we had forgotten much of what we had learned during WW I. By contrast, this afternoon's papers indicated that we had remembered many of the lessons taught by WW II. On the other hand, the reports raised after the Falklands and, to some extent, the 1991 Gulf War, suggest that some of the lessons learned in those conflict were similar to those taught by the experience of 1939-45. Is it possible that, having remembered what we had been taught in WW II, we subsequently managed to forget it again?

Sir Michael Stear. There may be some truth in that but I think that we really have moved on and that this has been partly technology-driven. That said, the problem is that we, the defence community, have never really been able to do all that we wanted to do because the necessary resources have never been made available. The realities of bureaucracy and the procurement process mean that, whatever it is, it always takes too long and it always costs too much. Nevertheless, I believe that we have made positive progress.

CLOSING REMARKS

by Air Chief Marshal Sir Michael Stear

This morning I talked about The Maritime Air Trust's Project *Constant Endeavour*, the motto and Battle Honour of both Coastal Command and No 18 Gp. There is a marked tendency to think of air-sea warfare in WW II exclusively in the context of sinking U-boats but, as we have seen today, there were many other facets to maritime air operations. Some reference was made to the casualties sustained and I would like to place on record that, owing to a very generous bequest by the late Tony Spooner, a Book of Remembrance has been compiled which commemorates the names of 10,875 Allied and Commonwealth personnel who lost their lives flying on operations with Coastal Command.

Since today's seminar was specifically dedicated to maritime operations, we did not address another of Coastal Command's responsibilities, photographic reconnaissance. The Society has dealt with this on previous occasions, of course, but for the sake of completeness, I think that it ought to be mentioned before we disperse. Prior to WW I many members of the General Staff had considered that there would be no need for aircraft because reconnaissance would be conducted by the cavalry – as it always had been – and naval traditionalists expected to rely on cruisers for scouting – as they always had done. It did not take long for aviators to make their mark, however, and the aeroplane soon came to dominate the reconnaissance business both over land and at sea.

By WW II this was a given, as evidenced by General Werner von Fritsch of the German High Command who said in 1938: 'The military organisation with the best aerial reconnaissance will win the next war.' That he had been right was underlined by a captured German Divisional Order of 1944 which stated: 'Enemy aerial reconnaissance detects our every movement, every concentration, every weapon and immediately after detection, smashes every one of these objectives.' From our own point of view, of course, reconnaissance was vital. To cite just one example, the Fleet Air Arm's spectacular success at Taranto made a nonsense of Mussolini's boast that the Mediterranean was an Italian lake, their *Mare Nostrum*, but that operation had been planned and carried out on the basis of the

very high quality and precise intelligence derived from the photographic reconnaissance effort mounted by Malta-based units of the RAF.

Since then we have made much progress, of course, and the days of 'wet film snapshots' are almost over – but not quite, as every international crisis invariably seems to yield a demand for the invaluable Canberra to fill a crucial capability gap. Nevertheless, while there is still a place for photographic and visual reconnaissance we rely increasingly on satellites, radar and electronic monitoring as methods of deriving intelligence. Indeed airborne systems like, AWACS and JSTARS, permit commanders to see not just 'over the next hill' but the entire battlefield, and in real time. The advances in the speed and accuracy of intelligence gathering have enabled targets to be routinely identified, illuminated and struck with a precision that was no more than an aspiration a mere twenty years ago – and, even more remarkably, all of this can be done, if necessary, by a small single-seat aircraft. The only problem is, as always, the cost.

As airmen, we are always keen to promote the concept of the 'flexibility of air power' and we must not lose sight of that in our eagerness to acquire these enhanced, but very specialised, capabilities. In seeking to be able to hit targets with ever greater precision we must not forget that we also need to establish air superiority, at least to the degree necessary to permit the army and navy to do their jobs. And, as became apparent from some of the papers read today, air power can be instrumental in establishing control of the sea, and in ways which may not be those which occur immediately to sailors. It was, for instance, primarily air, rather than naval, power that interdicted German coastal convoys in the North Sea and interfered with the trans-Mediterranean shipping that was supposed to sustain Rommel's *Afrika Korps*. Then again, the fact that aerial surveillance can deny the enemy the ability to redeploy his surface units undetected makes a huge contribution to the maintenance of sea control.

The Nimrod provides an excellent example of the innovative use of air assets to provide that essential 'flexibility'. From being the dedicated submarine-hunter of the 1970s, the experience gained in the course of the Falklands conflict and the Gulf Wars has considerably expanded the capabilities of the maritime reconnaissance force. It has, for instance, acquired the ability to refuel in flight and added

Sidewinder and Harpoon to its weapons options. Equally important, however, has been the sophistication of the Searchwater radar that, to some extent, permits the Nimrod to offer an AWACS-like overview of the maritime battlespace in that it can detect, display and aid in the identification of all surface contacts likely to be of interest.

As we heard, the rapid deployment of Buccaneers to the Gulf in 1991 provides another excellent example of the flexibility, or at least the responsiveness, of air power. I was AOC 18 Gp and I well recall that most of one squadron was at St Mawgan at the time, while much of the other was in Gibraltar. The aircraft were promptly recalled to be repainted in desert colours and have a number of essential modifications incorporated. From a standing start, they were ready to go within 72 hours. It was a quite remarkable performance.

Going back to WW II, there is one other topic which we have not discussed and which I think really ought to be mentioned – air-sea rescue. Some 10,663 lives were saved by RAF aeroplanes and/or marine craft, of which 5,721 were allied aircrew.

To complete the picture, I think that it is also appropriate to make some mention of Bomber Command. In the past some critics have contended that Bomber Command did not do enough to help in the overall context of the war at sea. I do not agree. There may have been some reluctance to do what was needed exactly when it was asked for, but there were other imperatives and Bomber Command had its own priorities. The fact is that Harris did transfer several heavy bomber squadrons to maritime duties – and his aircraft carried out an intensive and incessant mine-laying campaign – and they sank the *Tirpitz* – and they bombed the U-boat pens (although it might have been better if they had done it *before* the concrete set!) – and they breached the Dortmund-Ems Canal, up which the components of Doenitz' super U-boats were being transported to be assembled in the Baltic ports; at that stage of the war the prospect of these super U-boats putting to sea was indeed chilling. All of that, and many other operations, represented a major contribution.

While this contribution may not have been apparent to everyone at the time, the threat was all too clear to the Prime Minister, the man in whose hands rested the fate of the nation. As Winston Churchill later wrote: 'The only thing that ever frightened me during the war was the U-boat peril.' Echoing this many years later, The Duke of Edinburgh,

the Patron of the Maritime War Air Trust, wrote: 'We may have prevented the German invasion of this country in World War Two, but we only just succeeded in defeating the U-boat campaign, which came close to cutting off vital food supplies for our population.' The struggle raged in what came to be known as the Battle of the Atlantic and 2003 marks one of the most important victories of the war. Hence that Service at Westminster Abbey and the creation of the new memorial in the South Cloister.

In closing, I will offer just one more quotation, again from Churchill, who, on 31 August 1944, wrote, via CAS, to Air Chief Marshal Douglas as AOCinC Coastal Command as follows:

> 'I send to you and to all your officers and men my congratulations on the splendid work of Coastal Command during the last three months. In spite of all the hazards of weather, and in the face of bitter opposition from the armament of enemy U-boats and escort vessels, your squadrons have played a vital part in making possible the great operations now going forward in France, working in close concord with the Allied Navies, they have protected so effectively the host of landing craft and merchant vessels that the enemy U-boat campaign against them has proved a complete and costly failure. Many U-boats have been sunk or badly crippled in these operations in which squadrons of the Royal Air Force, of the Fleet Air Arm, of the United States Navy, of the Air Forces of the Dominions and of our European Allies have all played their part. In addition, most effective attacks have been delivered against enemy shipping and very many hostile escort vessels and merchant ships have been sent to the bottom or heavily damaged. I know that the achievement of these fine results required that careful plans by Commanders and staff should be executed with the utmost skill and determination by the aircrews, who in their turn depend upon the tireless efforts of all who work for them on the ground. All have been united in carrying out a most successful summer's operations of which you and your men may feel justly proud.'

And on that note I will pull the plug on the Society's maritime seminar.

BOOK REVIEWS

British Secret Projects: Fighters and Bombers 1935-1950 by Tony Buttler. Midland; 2004. £29.99.

Completing a trilogy (the previous volumes dealt with post-war projects), this book examines the work done to meet the specifications that produced world-class British aeroplanes, like the Spitfire, Lancaster and Mosquito, also-rans, like the Lerwick, Botha and Warwick, and scores of concepts, ranging from the mundane to the bizarre, most of which never reached the hardware stage. The book is divided into twelve role-specific chapters, medium bombers, naval fighters, maritime patrol (embraced here within the broad term 'bombers') and so on, finishing up with the earliest jets. Each one deals with the solutions offered to the series of problems set by the air staff, or formalised by them to reflect proposals dreamt up by industry. Some of these ideas, turret fighters (an operational concept with which we persevered way beyond the Defiant), for instance, were eventually abandoned while the prospects of others, like 100-ton, eight-engined heavy bombers were cut short by the end of the war.

The narrative traces the evolution of the various designs submitted by industry, through the ministerial weeding-out procedure and progressive refinement to, in most cases, ultimate cancellation or the issue of an updated specification to reflect the latest iteration of the requirement, in which case the whole cycle began again. Whenever this resulted in something that flew, this is acknowledged, so the book provides a comprehensive account of the trials and tribulations that eventually led to the familiar Typhoon, Halifax, Firefly and Sunderland while doing the same for obscure one-offs like the Supermarine 322, the Vickers 432, Gloster's E.1/44 and Blackburn's B.20. There is at least one photograph of every type that managed to get airborne but the real interest lies in the ones that didn't and it is here that the book scores most heavily. Tony Buttler has unearthed, from the archives maintained by a small band of enthusiasts dedicated to the preservation of the heritage of the British aircraft industry, rough sketches, general arrangement drawings and photographs of models of many of the unrealised projects that he discusses.

These illustrations, more than 400 of them, are presented in what has become Midland's admirable house-style, that is to say in a 240-

page, A4 hardback printed on coated paper. It is a handsome and impressive volume which provides an excellent work of reference although, because of the nature of the material, it is a bit indigestible if you try to read it at a sitting. On the other hand – like the other two books in the series – it is almost irresistible to browse through; opened at virtually any page, one can all too easily be drawn into reading the whole chapter. If you do, you will find the occasional anomaly, for example: a Madson, for Madsen, cannon (p58); the RAF's Washingtons were B-29s, not B-50s (p120); Ralph Sorley, not Robert Saundby, was CRD in October 1943 (p130); 'course', for 'coarse', pitch (p133 – twice); and Wilfred, for Wilfrid, Freeman (p193). There are a few others but the author has such a firm grasp of his subject that I am confident that these will all have been mere slips of the pen. I cite them only to demonstrate that I really did read the book from cover to cover, rather than succumbing to the temptation simply to flick through the pages to savour the fascinating illustrations.

Excellent. The only drawback I can see is that if you buy any one of these books, you may well find yourself being seduced into buying the others.

CGJ

Men Behind The Medals – A New Selection by Graham Pitchfork. Sutton; 2003. £19.99.

Air Cdre Graham Pitchfork will be well known to many members of the RAF Historical Society and also to those who read specialist monthly aviation magazines, notably *Flypast*. To the general public, he is the author of the widely regarded book *Men Behind The Medals* and of articles about medals and their recipients, which appear from time to time.

As its name suggests, *Men Behind The Medals – A New Selection* adds a further twenty accounts of bravery to those featured in the original book. The awards covered in this book include DSOs, DFCs, DFMs and combinations of these but also extend to the DSC and DSM, awarded for gallantry at sea. The book also deals with a Military Medal gained by an RAF escaper, first captured in North Africa and then sent to Italy, from where he escaped several times before making a successful 'home run'. The personalities described are mainly RAF but include: a Fleet Air Arm observer who, besides

winning a DSC, also received the DFC; an Army Air Observation Post pilot; and an unusual award of the DSM to an RAF technician serving aboard an aircraft carrier.

The book begins with a short resumé of the medals covered in the text before launching into self-contained chapters dealing with each individual. The book is well illustrated with contemporary photographs appropriate to the chapter and there are eight pages of colour plates displaying the full range of gallantry and campaign medals awarded to those whose exploits are featured.

The accounts are written in a 'matter of fact' style and the book is very readable. It will appeal to anybody with an interest in personal accounts of actions during the war, since most theatres are covered. Those who have a more specialised interest in gallantry and campaign medals will also find the accounts of interest.

All in all a worthwhile investment of £19.99. It is to be hoped that Air Cdre Pitchfork will continue with the series and perhaps address awards made in the post-war era.

Wg Cdr Colin Cummings

100 Years of Air Power and Aviation by Robin Higham. Texas A & M University Press; 2003, £35.50.

There are quite a few air power gurus around nowadays, and no shortage of weighty air power tomes. But for old hands like me, the doyen of aviation historians is Robin Higham. A former RAFVR pilot, Robin took his aerial expertise across the pond where he gained a PhD from Harvard and then became professor emeritus at Kansas State University. I remember writing aviation history articles for Robin's journal a full 25 years ago, and he is widely and justly credited with having established aviation history as an academic discipline.

It will come as no surprise that Robin has joined the millennium bandwagon and produced his own overview of air power and aviation covering the past century. It has to be said from the outset that much of the material is not new, insofar as Robin builds on his *Air Power* published back in 1972. He has also set himself to fill a massive canvas. The book aims to present a critical history of British, US, Soviet, German, Italian, French, Chinese, Japanese and Israeli aviation while running chronologically over major wars and police actions in which aircraft have been employed from before 1914 to Afghanistan

in 2001. And if that wasn't enough, there is a chapter on Civil Aviation and a concluding chapter on Patterns, Philosophies and Lessons.

And of course it is all too much. In trying to cover everything, Robin ends up covering nothing in any great detail or depth. This book is excellent to dip into on historical highlights, but it is all rather superficial for an RAF Historical Society audience. Don't expect to find many meaningful new insights or lessons for today and tomorrow when it comes to validating modern air power doctrine and practice.

There are some dodgy captions and the index is both limited and rather bizarre in that you can look up F-84 and FE2b under 'F' but not Tornado under 'T' or Lancaster under 'L'. A more noteworthy feature of this book is Robin's concept of Efficiency Ratings (ER). In essence, these are technical measures that can be computed mathematically to illustrate the changing nature of both aviation and air power. Robin sees Efficiency Ratings as a simple formula designed to allow meaningful comparisons between aircraft from different eras. But the maths is a bit suspect and to compare the efficiency of a squadron of eighteen Lancasters (ER 1,206) with that of a squadron of twelve Tornado GR1s (ER 864) only goes to show that modern bomber 'output' is dependent on far more than maximum speed, weight and radius of action.

In sum, Robin Higham has produced a very authoritative and readable overview of aviation over the past hundred years. This is a big work which runs out to 453 pages and as an old air power hand, Robin is to be commended for not falling into the trap of embellishing air power history with too much pseudo intellectualism. But the photos are not glossy, the book does not come cheap and the content is very 'retro'. I fear this book is largely a rehash of something written thirty years ago, and it shows.

Andrew Brookes

Chinook Crash – The crash of RAF Chinook Helicopter ZD576 on the Mull of Kintyre by Steuart Campbell. Pen & Sword; 2004. £19.99.

On 2 June 1994, a Chinook Mk 2, operating from Aldergrove and en-route to Fort William, Inverness, crashed on the Mull of Kintyre and all twenty-nine people on board were killed. In terms of human

life it was the most serious RAF accident since the loss of a Hercules in November 1971 off Pisa, Italy and there had not been so serious a military aircraft accident in the UK since July 1965, when a Hastings crashed near Abingdon.

In reviewing the subsequent Board of Enquiry, AOC 1 Gp, AVM John Day, determined that the pilots had been guilty of 'gross negligence' and in this view he was supported by Air Chf Mshl Sir William Wratten, AOCinC Strike Command.

Most people with an interest in military aviation in the UK cannot be unaware of the accident and many will also know of the very strong emotions that the 'negligence' verdict has generated. Indeed, it is very possible that they will have formed an opinion one way or the other. With the passage of time, the strength of feeling and convictions of those who support the decision of the air marshals and of those who oppose that view have hardened and it seems impossible that these conflicting opinions can ever be reconciled.

It takes a brave man, therefore, to enter the fray but this is exactly what Steuart Campbell has done. His book, which runs to 256 pages, is a careful analysis and reporting of the evidence submitted over the years and begins with a short summary of the events leading to the crash and its immediate aftermath. He then examines the RAF Inquiry, the Scottish Fatal Accident Inquiry (FAI), an investigation by *Computer Weekly* and the various debates and enquiries launched or conducted by both Houses of Parliament.

As Campbell sets down the evidence presented, he questions and comments on what was offered and, importantly, what was not. He hints at the failings of various counsels in the FAI and exposes the obvious prejudices and entrenched views, particularly of the House of Lords Inquiry, which robbed it of all objectivity.

Campbell's account necessarily covers many technical points and the reader will need to keep their wits about them if they are to keep up with the plot but he writes clearly and unambiguously. It is a good idea to keep one's finger on any diagrams to which the author refers and to glance at these frequently. Campbell is not an aviator but he is obviously a logical thinker with a sound technical appreciation and an enquiring mind.

It would be inappropriate to discuss Campbell's conclusions in a review of this sort but he approaches these with the same matter of

fact and well reasoned approach with which he addresses everything else in the book.

In summary, a book which anybody who has read any of the previous accounts, watched related TV documentaries or been minded to form an opinion about the likely causes of this tragic loss would do well to read.

Wg Cdr Colin Cummings

Flying, Farming and Politics – a liberal life by George Mackie (Lord Mackie of Benshire). The Memoir Club (Stanhope Old Hall, Stanhope, Co Durham, DL13 2PF); 2004. £17.50.

This book has been written by a Scottish Liberal Peer, Lord Mackie of Benshie, and its title reflects the old computer acronym WYSIWYG (what you see is what you get) since roughly one third of the book is concerned with his time in the RAF. The author is an interesting case because, on joining the RAFVR in September 1939, he was persuaded by his recruiting officer to plump for the observer role and to forego his initial intention of becoming a pilot. That in itself is not particularly remarkable, because the Service needed its observers and they had to be men of the same quality as was looked for in its pilots. What is noteworthy about Mackie's career, however, is that, while fulfilling his specialist role as bomb-aimer, he flew as the designated captain in aircraft of Bomber Command. Even more unusually, for a wartime navigator, he filled a Flight Commander appointment on an operational squadron, which involved a promotion to squadron leader.

After completing his training Mackie flew Wellingtons, gaining his first operational experience over France and Germany with No 15 Sqn. He subsequently ferried a Wellington out to Egypt where he joined No 148 Sqn and saw further action, including operations in defence of Crete in 1941. He comments that, although operational flying in the Middle East was easier than he had experienced over Germany, losses were still high, not least because of adverse weather conditions. On returning to Britain he was rested as an instructor at No 21 OTU, this 'rest' including participation in all three of Harris' 1,000 Bomber Raids of 1942. Having undertaken a Bombing Leaders Course at Manby it was back to operations at Lakenheath with No 149 Sqn who were still operating the somewhat inadequate Stirling and it

was during this period that Mackie had his first experience of flying as captain. From there he went to Boscombe Down in the summer of 1943 for a short spell on bombing trials before a posting in October to No 115 Sqn at Little Snoring. It was during this tour, which was flown on the Hercules-engined Lancaster II, that he consolidated his claim to captaincy, his abilities being endorsed by his being given command of C Flight. In May 1944, by now wearing the ribbons of the DSO and DFC, he was posted to the Air Ministry's Bomber Ops staff. He was finally demobbed in January 1946 to return to his beloved farming.

That is the outline of his RAF career and the book provides a lot of material to fill it out, both in terms of discussion of particular operations and of the social life which characterised his time in the squadrons. He recalls such things as crashes on take-off, the horror of mid-air collision as the bomber stream turned for home and he does not shirk discussion of the moral implications of the area bombing he took part in. His account raises one matter which is worthy of specific comment, namely that of command. The RAF's assumption was that captaincy should be the exclusive preserve of the pilot, in contrast to that of the FAA who took a more liberal view. The logic underpinning this assumption became increasingly strained as the war progressed and cases of inexperienced first-tour pilots, commissioned or not, captaining aircraft which numbered second-tour navigators or air bombers in their crews increased. For example, as a very experienced navigator/bomb-aimer, Mackie captained a Lancaster flown by a sergeant pilot who was on his on his first tour. A number of senior officers, notably Slessor and Ludlow-Hewitt, began to draw attention to the command situation from as early as 1941 and a notional provision for non-pilots to fly as captains was introduced in the following year but it was 1944 before officialdom formally endorsed a policy which accepted that the captain of an aircraft could be any suitably qualified member of its crew. All of this is explored in far more detail in Jeff Jefford's *Observers and Navigators* (Airlife; 2001); the point of summarising the situation here is that Mackie represented the proof of the pudding or, depending on your point of view, the exception to the rule. Either way, it is clear from his account that it worked.

Now, what of the remaining two thirds of the book? Mackie was a member of a family which had farmed in Aberdeenshire for some 300

years and farming played a central role in his life, both before and after the war. There is plenty about it here. In 1961, prompted by Jo Grimond, he stood for Parliament becoming the Liberal MP for Caithness and Sutherland. During his time as an MP he took on the Chairmanship of Caithness Glass to add to his agricultural activities which continued until his retirement in 1985. In 1974 he entered the House of Lords, in which he remains active, and served as a member of the Council of Europe until 1998. He writes about his life in an entertaining manner and comes over as a genial extrovert, used to getting his own way, who put his back into everything he took on. I think the book is worth its asking price as an autobiography and, if your primary interest is in the RAF, because that part of the book, deals with a rare kind of command in the wartime Service, it is certainly worthy of a place on your shelves.

Dr Tony Mansell

Those Other Eagles by Christopher Shores. Grub Street; 2004. £50.00.

Way back in 1966 I invested in a copy of Christopher Shores' *Aces High*, which he wrote in collaboration with Clive Williams. That book, which was the first attempt to provide a brief biography of the 1,000 or so British and Commonwealth fighter pilots who, by shooting down five or more enemy aircraft, achieved 'ace' status during WW II, cost me £5.95. It is some indication of the rate of inflation, that when Grub Street published a totally revised edition in 1994 it set me back a cool forty-five quid; five years later I shelled out a further £19.99 for *Aces High, Vol 2*, another substantial book providing updated, corrected and additional information. *Those Other Eagles* provides yet more data on the same theme, this one dealing with about 1,800 pilots who claimed between two and four victories. Why not one? Because one could have been a fluke, whereas two or more suggests a definite degree of skill.

Just for once, I cannot claim to have read this book from cover to cover. Partly because it is 670 pages long – and printed in a smaller typeface than this Journal to boot – and partly because it is simply not that kind of book. This one is not for reading *per s*e; it is for reference. So does it work? Yes. The entries are listed alphabetically and you are provided with: full name; highest rank achieved during the war;

Service Number; a narrative summarising each individual's career and a tabulated list of his combat claims – date; type shot down; type flown and serial number (where known); location; and unit. The career summaries, which vary in length from a few lines to the best part of a page, are not confined to WW II so one is presented with convenient potted biographies of a number of men whose names are more commonly associated with their post-war achievements than their exploits as fighter pilots; Peter Twiss, Fred Rosier, Micky Martin and Neil Cameron to name just a few.

Another invaluable contribution to the recording of RAF history by Shores (who else would have done all this work?) and one for which we are also indebted to Grub Street (who else would have published a book as specialised as this?). There is a downside, of course, the price – although, in view of the sheer size of this doorstop of a book, £50 is not unreasonable. My only misgiving is that Chris has invited readers to contribute corrected and additional information so one probably needs to start saving the investment that will be required for the inevitable *Those Other Eagles, Vol 2*….

CGJ

The Forgotten Few by Adam Zamoyski. Pen & Sword; 2004. £19.99.

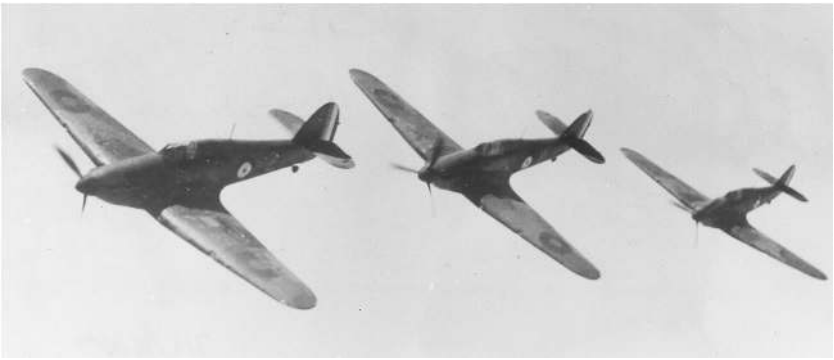
Sub-titled *The Polish Air Force in World War II*, this book originally appeared under another publisher's imprint in 1995. Although born in New York, the author's name betrays his Polish descent and he has written several other books on subjects relating to Poland. It is clear from this one that he understands his people and their culture. He admits to being less familiar with aviation, however, and in one or two places this does show. For instance, No 1586 Flt is identified as a squadron and there are several uncomfortable references to flying controls as 'the steering gear'.

In dealing with the nuts and bolts of an air force, one is almost bound to be drawn into citing statistics and some of those offered may not stand up to too close an examination. Zamoyski says in his Preface that he has 'taken scores and figures from printed sources considered to be authoritative.' Such data is almost bound to be contentious and before reprinting the text Pen & Sword might have been well-advised to have had it revised in the light of the latest published research, but the more recent works of such meticulous chroniclers as Shores,

Franks and Chorley are notably absent from the otherwise extensive bibliography. As a result, some of the 'facts' presented may raise the odd eyebrow. For instance, Gabreski was not 'America's top-scoring ace of the war' (p114) and the statement that when Harris took over Bomber Command in February 1942 25% of his strength was provided by the Polish Air Force is a long way wide of the mark (p137); Harris' initial ORBAT stood at fifty-eight squadrons, of which about fifty were operational but only four of these were manned by Poles. I think that I would also have to take issue with the contention that a fighter pilot's life expectancy in 1942 was a mere two weeks (p115).

Having made the point that I would hesitate to use this book as a statistical source, I have absolutely no hesitation in recommending it as an account of the trials and tribulations – more than that, it was a tragedy – of this extraordinary expatriate air force. Too small, too ill-equipped and too poorly organised to have been able to defend its homeland successfully, defeat was inevitable within a matter of days. Having first discussed the hectic events of September 1939, the author goes on to describe the, often prolonged and very uncomfortable, journeys made by the thousands of Polish airmen who found their way (some of them via service with the French Air Force), to the UK. On arrival here they were briefly enlisted into the RAFVR before being transferred to an independently constituted Polish Air Force in which some 17,000 men and women would eventually serve. Thereafter, having due regard to my reservations about some of the statistical content, the book provides a sound account of the actions fought by Polish air units throughout the war.

The bulk of the narrative features the usual tales of the exploits of individual fighter pilots and bomber crews, enlightened by numerous, and often amusing, anecdotes (one, to do with French nuns, is worthy of Chaucer, or perhaps *'Allo, 'Allo* – you will have to read the book) but that is not where its heart lies. Contrary to what this reviewer had previously understood, it is apparent that the refugee Poles were often very badly treated by the British; lionised when we needed them, they were vilified when we did not and the attitude of the trades unions, and much of Fleet Street, in the immediate aftermath of the war was shamefully ungrateful. To its credit, the Government did not repatriate the Poles, as Stalin had wished, and many stayed on to fly with the



Hurricanes of No 73 Sqn in 1939. Many squadrons were still employing close formation tactics during the Battle of Britain – a game which many Poles were disinclined to play; indeed it was well into 1941 before some British fighter units saw the light.

peacetime RAF (as late as the 1960s my own log book features names such as Radomski, Janczur and Murkowski). The most important contribution that Zamoyski makes is in interpreting and rationalising the behaviour of the various elements of this, desperately homesick, refugee community. Wherever they were permanently based, even at locations as close to the metropolis as Northolt, but even more so at isolated airfields in rural Lincolnshire, they tended to create Polish enclaves so insulated from the mainstream of British life, that the handful of RAF personnel involved sometimes felt like foreigners themselves.

The author also explodes a number of popular myths, notably that Polish fighter pilots were undisciplined and over-excitable, as was often reported by British pilots, particularly in 1940. Zamoyski argues, and very convincingly, that, whatever its other deficiencies, the pre-war Polish Air Force had trained its pilots well. Furthermore, many of these men, most of whom were several years older, and thus more experienced, than their British comrades, had seen action in Poland, some of them in France as well, and, as a result, many of them actually knew their trade far better than their RAF mentors. What may have appeared to be a lack of discipline to the exasperated CO of a British fighter squadron was more than likely to have been Polish reluctance to adhere to outmoded RAF tactics that involved flying in

close formation.

Well written, often entertaining, but all too often punctuated by sadness, I learned much from this book and commend it to others.

CGJ

Hurricanes Over Singapore by Brian Cull with Paul Sortehaug. Grub Street; 2004. £20.00.

Hurricanes over Singapore is a companion volume to 2003's *Buffaloes over Singapore* by the same authors. The story is continued in the same vein with the Royal Air Force, now reinforced with Hurricanes, striving to prevent the Japanese forces overrunning the Netherlands East Indies.

The scene is set by the striking dust jacket painting by Chris Thomas and the Foreword by Flt Lt B J 'Jerry' Parker DFC, a veteran of No 232 Sqn. The first Hurricanes, Mk IIBs, went into action in the skies over Singapore on 20 January 1942 alongside the obsolete Brewster Buffaloes being flown by RAF, RNZAF, RAAF and Dutch squadrons. However, the high expectations of the Buffalo pilots were soon dashed when the Hurricanes were found to have an inadequate rate of climb, a disappointing top speed and impaired manoeuvrability. The Vokes air filter under the nose and the Mk IIB's twelve machine guns had increased the overall weight by some half a ton which, together with the tropical conditions, accounted for the deficiencies in performance. Pitted against the lightweight and highly manoeuvrable Japanese Zero, probably the fastest fighter in combat at the time, the heroic efforts of the Allied pilots and ground crews were all in vain. This, together with the lack of adequate radar cover and observer facilities, resulted in a hurried withdrawal to Sumatra. The resistance in Singapore officially ceased on 15 February with 138,000 British and Empire troops surrendering to a considerably smaller Japanese force. During the last week the Japanese had gained complete mastery of the skies.

The air battle continued from Palembang with inevitably similar results, the Japanese invading and the Allied air resistance moving to Java for a last stand. The initial Japanese landings in north western Java began on 1 March 1942 and by the 7th all effective resistance in the air had ceased; the unconditional surrender of the Dutch forces to the Japanese followed the next day.

Many air force personnel paid the ultimate price; a few escaped to Australia but the majority of survivors became prisoners of the Japanese. The final chapter of the book relates the experiences of, and the harsh treatment suffered by, some of these POWs.

Hurricanes over Singapore is a well-researched, well-written and very detailed book with a large number of the kind of interesting first hand accounts which, to my mind, enhance the authenticity of any operational history. The book is illustrated with some photographs which are to be found together in the centre; chapter footnotes and maps are at the end. My personal preference is for photographs, maps and footnotes to appear in the relevant chapters to facilitate continuity of reading – perhaps not always possible, for technical reasons. This, however, does not detract from the book's being an excellent read and a reference work which will sit nicely on my bookshelf alongside my copy of *Buffaloes over Singapore*. Recommended.

David G Bancroft

2nd Tactical Air Force, Vol 1 – Spartan to Normandy by Christopher Shores and Chris Thomas. Classic Publications; 2004. £29.99.

The co-authors' first attempt at chronicling the activities of the RAF's 2nd Tactical Air Force was published in 1970. At the time it cost all of £4. Long regarded as a classic, and equally long out of print, current prices for second-hand copies start at £70 but you may have to pay twice that. Once they had given up their day jobs, Shores and Thomas set about producing a totally revised edition and this is it, or at least one third of it; Vols 2 and 3 are scheduled to appear in 2005. It is a splendid effort.

Classic Publications is a sub-division of the Ian Allan/Midland Counties complex and this book compounds the latter's reputation for high production values. It is a 192-page A4 hardback printed on coated paper and lavishly illustrated; there are thirty-two excellent profile paintings (by Chris Thomas) of specific aeroplanes, mostly Spitfires, Typhoons and Mustangs but including the odd Mosquito, Mitchell and Boston, supported by more than 250 photographs, many drawn from private sources, others from the less well frequented recesses of the IWM's archives so most will be fresh to all but the most dedicated of 2nd TAF anoraks.

The layout is strictly chronological with the outcome of each day's conclusive events being recorded in tabulated form, the details provided comprising: the time that the incident occurred; unit; aircraft type and (usually) serial number; pilot/crew (with a note as to fate if lost); type of enemy aircraft claimed and whether destroyed, probable or damaged; and a remarks column, usually indicating where the event occurred and providing a shorthand note as to what happened. These profit and loss summaries are amplified by narrative accounts of each day's activities, which serve to highlight the contributions being made by individual pilots and to keep track of each unit's often frequent changes of location and CO. At appropriate points there are longer essays discussing evolutionary changes within the organisational structure and/or reflecting on the state of the campaign and the relative performance of the allied and enemy air forces; others expand on particularly notable incidents or operations.

The authors had clearly not been idle in the thirty-odd years since their first account appeared and their meticulous research has permitted them to correlate many of the individual combats to establish exactly who was shot down by whom. In the process, their ability to compare claims with actual losses has thrown up numerous anomalies such as an encounter between Mustangs of No 400 Sqn and three twin-engined German aircraft on 11 November 1943. The Canadians claimed one Me 210 destroyed, another as a probable and a third damaged; they were actually Ju 188s and all three had been shot down. The book is full of such revelatory vignettes.

Mistakes? With writers of this calibre, I doubt that there will be many. All that I could come up with was the fact that on D-Day the German *VII.Armee* was deployed between the Loire and the Seine (not the Scheldt – p134) and at the end of June 1944 No 660 Sqn was operating from Westenhanger (not Westenhangar – p189) – both of which were, I am quite sure, mere oversights.

Vol 1 includes a comprehensive index to units but not to people, although a consolidated index to personalities will be included in Vol 3, which will also feature a number of appendices relating to the whole series. Unless you are content to do without, and to draw the line only three weeks after the invasion, you are eventually going to have to buy all three books in the set. That will be a bit pricey but you are, of course, able to spread the cost over three instalments and the

total will still be less than you might have had to pay for a sound copy of the now redundant first edition (care to make me an offer for mine?) so it is still good value for money.

One hesitates to describe any book as 'definitive' but it is hard to see how this one could be bettered and, once it is complete, this Shores/Thomas trilogy will provide a worthy preamble to Bill Taylor's recent account of the RAF in Cold War Germany by the same publisher.

CGJ

Swift Justice by Nigel Walpole. Pen & Sword; 2004. £25.00.

Nigel Walpole is exceptionally well qualified to write *Swift Justice*, his authoritative book about an aircraft which, over fifty years ago, promised much but did not achieve success in its intended role as a second generation jet fighter. His wide experience in the cockpit includes tours on the Venom, Swift, RF-101C Voodoo, while on exchange duties with the USAF, and command of a Hunter squadron before he flew the Buccaneer and Jaguar.

Popular history dismisses the Swift as a failure by comparison with its counterpart, the well-respected Hunter. The author sets out to show that the Swift deserves a more perceptive assessment, hence the book's title. He has researched his subject exhaustively and, through his contacts with many of those who were involved in the development and employment of the aircraft, he has produced a very readable account of the events surrounding its short history which ended a mere ten years after the first flight of the prototype. In fifteen chapters, which are illustrated by a wide selection of photographs, many of them original, the author describes, via the proud history of the company and the efforts of the men who designed, built and tested it, the evolution of the Swift and the disappointing circumstances of its demise as a fighter. He then focuses on its resurrection and successful, albeit brief, career as a fighter reconnaissance aircraft and on the RAF's operational (and social) environment in the Germany of the late 1950s.

By the end of WW II Vickers Supermarine had produced over 22,000 Spitfires but the company failed to capitalise on its reputation as the aircraft industry moved into the jet age. In describing the genesis of the Swift, the author notes that Supermarine's first jet

aircraft, the E.10/44, which first flew in 1946 did not enter service with the Royal Navy, as the Attacker, until 1951. Despite its conservative design, its lengthy development timescale compares unfavourably with that of North American's much more advanced F-86 Sabre, which first flew more than a year after the prototype Attacker but entered service two years before it. In the light of his extensive research, it is perhaps surprising that the author has not criticised the apparent complacency of the relevant government departments and, to a lesser extent, both industry and the Service, in the face of the rapid advances in transonic research being made by both the Russians and the Americans. When substantial numbers of MiG-15s and Sabres were entering service in the USA and USSR the RAF was merely improving the Meteor by installing an ejection seat and modifying the shape of its fin!

Despite its work with experimental swept-wing aircraft, Supermarine's attempt to produce a transonic fighter to match the Sabre failed. Early trials revealed serious shortcomings with the Swift, including limited manoeuvrability and poor engine handling at high altitude. In his discussions with those who flew the early marks, the author explores the causes of these defects in some detail. He acknowledges the dedication, enterprise and commitment shown at all levels by the manufacturer in its, ultimately unsuccessful, attempts to solve the problems being experienced at Waterbeach whence the first Swifts operated for a short time in 1954/55. He also gives due credit to the staffs of the A&AEE and the CFE who had the courage to refuse to endorse the aircraft as a fighter and finally to the Air Ministry who recommended its abandonment as a high altitude aircraft.

However, it is the low-level Swift FR5 variant, or rather the culture and spirit which surrounded the two Germany-based squadrons, which is the focus of this excellent book whose subtitle could have been 'Tales from Swift Crewrooms'. For those who served in Germany in the 1950s these stories will refresh memories of historic RAF airfields and the rivalry, in and out of the cockpit, which existed among the many squadrons of the Second Allied Tactical Air Force.

Although there are a few typographic errors there are only two minor points of contention. The first is the reference on pages 60/61 about Hunter contracts being cut shortly after the Korean War. This is a surprising assertion because at that time the three Hunter production

lines in the UK were working to capacity. Some years later 130 Hunters from the fifth Mk 6 production batch were cancelled, but that was as a consequence of the infamous 1957 Sandys Defence White Paper, although these aircraft were subsequently completed and delivered to Iraq and India. The second observation is the inference that the 1954 choice of the Swift FR5 was merely as an interim aircraft, pending the introduction of the Hunter FR10 in 1961. This is inconsistent with the timing of the trials carried out in Aden in 1957 to compare the Hunter, Jet Provost and Gnat as the proposed replacement aircraft for the Venom in the ground attack role. The Swift FR5 was in service with both squadrons in RAF Germany at the time of this trial and it was only after its completion that the Hunter FGA9 was chosen and as a result the FR10 followed.

While the Swift may have lacked the graceful lines of both its illustrious predecessor, the Spitfire, and its equally elegant contemporary, the Hunter, it was, nevertheless, a purposeful, aggressive and handsome aircraft which engendered loyalty and pride in those who flew the fighter reconnaissance variant. It was the brief success of the FR5 and his fond memories of his time with No 79 Sqn which has prompted Nigel Walpole to produce such an interesting and balanced account of the life and times of the Swift and its people. In doing so he has indeed achieved Swift Justice.

Gp Capt Jock Heron

The Reconstruction of Warriors. Archibald Mclndoe, the Royal Air Force and the Guinea Pig Club by E R Mayhew. Greenhill Books; 2004. £18.99.

Members of the Society need no introduction to Archibald Mclndoe's work at East Grinstead or to the Guinea Pig Club so what will they gain from this book? Quite a lot in fact because, apart from discussing the medical achievements pioneered by Mclndoe and his disciples, it goes behind the scenes and explores many ancillary aspects of burns.

Although the author says that the RAF Medical Service had to improvise rapidly when the 'entirely unpredictable' (*sic*) burn casualties began to appear in 1940, the RAF was well aware of the dangers posed by fire in aerial combat. In fact she devotes a chapter to the RFC's experience of 'flamers' and the efforts of the British Air

Board in WW I and the Air Ministry during the 1930s to address the problem of self-sealing petrol tanks and their location in aircraft. It was a difficult problem and efforts to deal with it were not entirely successful. For example, Hurricane pilots suffered disproportionately more cases of severe burn injuries than their Spitfire colleagues due to a phenomenon known as 'Hurricane Fire'. Unlike the Spitfire the Hurricane had vulnerable wing-mounted petrol tanks which, by what I would describe as a catastrophic oversight by someone, were not sealed off from the fuselage by any fire-proof barrier. As a result, flames were able to travel via the wing roots into the cockpit. The lesson learned from this experience led to production-line Hurricanes being fitted with sealing inboard of the tanks but retrospective modification was claimed to be beyond the resources of service units and unmodified aircraft continued in use with the squadrons. Their pilots, eg Pat Wells of No 249 Sqn, who was British and not South African as stated here, paid the price.

Medical matters form an important element of the book and the author gives an account of them which is thorough and accessible to the lay reader. This covers: the move from tannic acid as a first stage treatment to gauze dressings, which avoided the often gross tissue damage caused by the former; the advanced treatment for the potentially fatal physiological shock resulting from fluid loss in severe burns; the skills of Mclndoe and his operating team; and the control of infection. In the pre-penicillin era Mclndoe had a limited range of pharmaceuticals at his disposal to deal with infection, his main armament being the sulpha-drugs pioneered by I G Farben in the 1930s. Due recognition is given to the very high standard of nursing care that was required, including the work of orderlies who moved patients in and out of saline baths, an arduous process and one requiring great sensitivity. Although he could be a domineering and intolerant man at times, Mclndoe went out of his way to establish relationships of trust with his patients and encouraged everything which could boost their self-esteem. He refused to allow ambulant cases to appear in the regulation convalescent blue dress and insisted that they should wear their RAF uniforms with pride instead. This brought him into conflict with the Air Ministry where some unnamed jobsworth declared that it was inappropriate for a civilian to interfere with regulations but Mclndoe prevailed.

The population of East Grinstead played an important role by their open-hearted acceptance of badly injured casualties, both in public places and in their homes. This contribution should not be underestimated and is fully acknowledged here. In 1941 the formation of the Guinea Pig Club for men of all nationalities who had been treated at East Grinstead was another important morale booster. Mclndoe commented that it could be described as the most exclusive Club in the world but with a membership fee that most men would not care to pay. Its original members were predominantly fighter pilots but by the end of the war some 80% were Bomber Command aircrew. In her summing-up stages of the book the author draws attention to the way in which she claims the image of the Guinea Pigs became conflated with the 'mythology' of the Battle of Britain so that they all became 'fighter pilots' – returning to an image of individual heroism in combat. She stresses that this is unfair to Bomber Command and notes with approval a growing recognition of the debt owed to that Command, to which I think this book makes a valuable contribution.

In an excellent chapter, 'The Bomber's War', we get a graphic account of what that debt could involve. The narrative is interwoven here, as elsewhere, with first-hand accounts taken from the records of the Guinea Pig Club and from its surviving members. These reveal the nature of the ordeals undergone in a crippled bomber making its long journey home through dangerous airspace with badly injured crew on board. There is no bravado in these accounts and they are all the more gripping for that. Until 1943 when a sulphanilamide cream became available for first aid application, the most that could be done in flight was to protect the burn surface and administer morphine. In a chilling aside, the author notes that in the early years of the Cold War, when, following a nuclear attack, widespread burn casualties were to be expected among the civilian population, this cream was not made available to the public, although it was issued to civil defence units in the 1950s.

For burned aircrew who became POWs the situation was grim. German treatments for shock were not as advanced as those in Britain and facilities in the military hospitals available either to German surgeons or to the medically qualified POWs who served their fellows in such places were not always of high standard. Although he was an ophthalmic surgeon, the POW Maj David Charters of the RAMC

whose story is told here became adept at plastic surgery and, via the International Red Cross, received sets of specialised equipment and dressings from Mclndoe.

The vexed issue of pension and invalidity arrangements was an area in which the RAF fought hard on behalf of its burn casualties. The original situation was that a casualty continued to receive full pay and allowances for 90 days after which he was invalided out if not fit to return to active duty. This was wholly inappropriate where burns were concerned since plastic surgery was often necessary for a much longer period. The RAF wanted unlimited sick pay to be granted in such circumstances – a proposal which horrified the Treasury and did not please the other Services. Portal proved adamant in his belief that his men had a right 'to remain in the Service as long as we had treatment to give them.' The Treasury reluctantly conceded ground, first to fourteen months, then to thirty but it was 1947 before the RAF finally won the concession of no time limit for plastic surgery on aircrew with attributable injuries.

This book is based on sound sources and illustrated with good quality photographs, cartoons and line drawings from the Guinea Pig Club archives. There are a few errors – the Spitfire of No 504 Sqn in one of the photographs is a Mk VC not Mk ZC, the Americans arrived in 1942 not 1944 and the Lancaster of the Battle of Britain Memorial Flight which overflew London at the Queen Mother's funeral in 2002 was not the first to have done so for 50 years – it had appeared in 1990 for the 50th anniversary of the Battle of Britain and again in 1995 for that of VJ Day, when it did a 'Poppy Drop' along The Mall. However, what we have here is a good book which will certainly interest members of the Society and deserves a place on their shelves.

Dr Tony Mansell

The Kid Glove Pilot: A personal account of flying Sunderlands in World War Two by Alan W Deller. Colourprint Books (Jubilee Business Park, 21 Jubilee Rd, Newtownards, Co Down, BT23 4YH; Tel 028 9182 0505); 2004. £9.99.

This 'personal account of flying Sunderlands in WW II' traces the experiences of the author from the time he first attempted to join the RAF to train as a pilot in September 1939 until demobilised in February 1946. Despite the title, and the description which appears on

the cover, the book is more than just an account of Alan Deller's Sunderland flying.

Divided into four 'Movements', the first three describe his experiences prior to commencing flying in the RAF. These included time in Romania under cover as a second lieutenant in the Royal Engineers. Following this period of intrigue and adventure he was expelled from Romania and commissioned into the RNVR in Egypt and operated as a member of the Special Operations Executive. During this period a Sunderland overflew his ship and he decided that that was the aircraft he wanted to fly.

The Fourth Movement covers the period from April 1941, when Deller reported to Heliopolis for aircrew duties. Flying training was in Rhodesia, followed by General Reconnaissance instruction in South Africa, and an eventual return to the UK when he achieved his ambition to fly the Sunderland with a posting to Lough Erne and No 201 Sqn in June 1942. Not having had any instruction on flying boats, the author describes in great detail the Sunderland and his 'on the job training', including operations, before attending a captain's course.

There follows, also in considerable detail, the record of Deller's life on, and experiences with, No 246 Sqn including operations in the Battle of the Atlantic until the squadron was, surprisingly, disbanded in May 1943 when he converted to the Catalina. He was not impressed with the 'Cat', describing the aircraft as 'an ugly duckling that was clumsy to handle in the air, and on the water, compared with the Sunderland.' He has many other uncomplimentary things to say about the Catalina which, coincidentally, I discussed with John Cruickshank VC who concurred with Deller's views, although he stilled judged it a splendid aircraft for anti-submarine warfare.

But the author never operated the Catalina. After leaving the OCU he and his crew were posted to Mombassa. After a very protracted journey it transpired that the Catalina squadron did not need crews, but the Sunderland-equipped No 230 Sqn did. Flying from, and living in, East Africa, operating in the transport role around the islands of the Indian Ocean provided very contrasting experiences to that of Coastal Command. A squadron move to Koggala, in Ceylon, brought a return to anti-submarine operations interspersed with more unusual tasks.

In early 1945 No 230 Sqn was directed to airlift the component parts of river craft from Bombay to the Chindwin River in northern

Burma in support of the 14th Army. In addition to the difficulties of the actual task the operation was further complicated by the convoluted C2 arrangements of the Far East Command. On completion of this particularly hazardous exercise Deller, now a squadron leader, and his crews returned to Koggala in March to learn that the squadron was on the move to Akyab, about half way down the west coast of Burma. Here they were to be engaged in anti-shipping operations. The squadron was to become a fully mobile unit (shades of today's expeditionary air force) based on the SS *Manela*, used by the an RAF as an accommodation ship, until the end of the war.

The Kid Glove Pilot is a well written account of the author's experiences on, and off, duty in the various parts of the world where he served. He goes into great, often light hearted, detail that will be informative to the reader with no Service background, but stir the memories of those with similar experiences to Alan Deller. It is a good read and well worth £9.99. Highly recommended.

AVM George Chesworth

ROYAL AIR FORCE HISTORICAL SOCIETY

The Royal Air Force has been in existence for over 80 years; the study of its history is deepening, and continues to be the subject of published works of consequence. Fresh attention is being given to the strategic assumptions under which military air power was first created and which largely determined policy and operations in both World Wars, the inter-war period, and in the era of Cold War tension. Material dealing with post-war history is now becoming available under the 30-year rule. These studies are important to academic historians and to the present and future members of the RAF.

The RAF Historical Society was formed in 1986 to provide a focus for interest in the history of the RAF. It does so by providing a setting for lectures and seminars in which those interested in the history of the Service have the opportunity to meet those who participated in the evolution and implementation of policy. The Society believes that these events make an important contribution to the permanent record.

The Society normally holds three lectures or seminars a year in London, with occasional events in other parts of the country. Transcripts of lectures and seminars are published in the Journal of the RAF Historical Society, which is distributed free of charge to members. Individual membership is open to all with an interest in RAF history, whether or not they were in the Service. Although the Society has the approval of the Air Force Board, it is entirely self-financing.

Membership of the Society costs £18 per annum and further details may be obtained from the Membership Secretary, Dr Jack Dunham, Silverhill House, Coombe, Wotton-under-Edge, Gloucestershire. GLI2 7ND. (Tel 01453 843362)

THE TWO AIR FORCES AWARD

In 1996 the Royal Air Force Historical Society established, in collaboration with its American sister organisation, the Air Force Historical Foundation, the *Two Air Forces Award*, which was to be presented annually on each side of the Atlantic in recognition of outstanding academic work by a serving officer or airman. The RAF winners have been:

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THE AIR LEAGUE GOLD MEDAL

On 11 February 1998 the Air League presented the Royal Air Force Historical Society with a Gold Medal in recognition of the Society's achievements in recording aspects of the evolution of British air power and thus realising one of the aims of the League. The Executive Committee decided that the medal should be awarded periodically to a nominal holder (it actually resides at the Royal Air Force Club, where it is on display) who was to be an individual who had made a particularly significant contribution to the conduct of the Society's affairs. Holders to date have been:

Air Marshal Sir Frederick Sowrey KCB CBE AFC
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Oxon
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Coombe
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Glos
GL12 7ND
Tel: 01453 843362

TREASURER
John Boyes TD CA
5 Queen's Close
Stansted
Essex
CM24 8EJ
Tel: 01279 814225

EDITOR and PUBLICATIONS MANAGER
Wg Cdr C G Jefford MBE BA
Walnuts
Lower Road
Postcombe
Thame
OX9 7DU
Tel: 01844 281449