

THE EFFECTIVENESS OF MERCHANT AIRCRAFT CARRIERS

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Statement by the External Examiners

The author of this incomplete thesis sadly died before his work was complete. Although this thesis was perhaps two years short of fully meeting the necessary criteria for a PhD, the Examiners nonetheless agreed to pass the thesis in its final unfinished state. In their unanimous view it demonstrates clear potential to reach the necessary standard and through the accumulation and organisation of a very great deal of original and significant material it makes a major contribution to our understanding of the topic it considers.

SYNOPSIS: EFFECTIVENESS OF MERCHANT AIRCRAFT CARRIERS

Merchant Aircraft Carriers entered service in mid 1943 to provide air cover for convoys over an area in mid Atlantic beyond the range of shore based aircraft. Their presence within the convoy considerably increased the effectiveness of the existing strategy.

These dual purpose vessels were unique, having the facility to operate aircraft from a carrier deck whilst carrying a full commercial cargo. Two types of merchant ship were selected for conversion; Grain ships fitted with a flight deck and hangar which could house four Swordfish aircraft, and Tankers fitted with a flight deck, but no hangar, and carrying three Swordfish aircraft. Grain ships were loaded with bulk grain whilst the tankers carried fuel oil.

The overall planning and design of the ships depended on co-operation between the shipbuilders and naval air staff, but considerable compromise had to be made before specifications were finalised and production commenced. Mac ship design put expediency before sophistication; it was simple and imaginative. The engineering skills and ingenuity exercised by the Admiralty Merchant Shipbuilding Department in production methods, coupled with the dedication and enthusiasm of the eleven yards selected for the work, resulted in nineteen MAC ships being completed and operational within eighteen months.

The defensive nature of MAC ships caused the Admiralty to confer a hybrid status upon them. It was decided that they would retain their identity as merchantmen by flying the Red Ensign and be commanded by a Merchant Navy Master. This unique situation caused misgivings amongst Royal Navy Officers as to whether a MN Captain was capable of operating an aircraft carrier without the necessary experience.

Flying operations were the responsibility of the air branch of the Royal Navy, each ship having an Air Staff Officer, aircrew and maintenance personnel, together with a Medical Officer. Aircraft were from 836 Squadron, reconstituted as the official MAC ship squadron, with HQ at RNAS Maydown resulting in an administrative and

organisational structure almost unparalleled in its complexity within British military organisations at that time. The aircraft were embarked on the ships as detached flights of the squadron, each designated a letter of the alphabet for identification purposes. At sea, duties consisted of flights and searches as requested by the Senior Officer Escort to give necessary support to surface escorts against U-boat attack.

The thesis concludes that the original concept of MAC ships, and the determination of the Admiralty to proceed with their construction and operation, was inspired by the realisation that the development of naval air support was of vital importance in perfecting different strategies for convoy protection. Before final instructions were given for the construction of MAC ships to proceed, the Admiralty had to overcome scepticism and misgiving amongst Naval Air Staff based on an old philosophy and a reluctance to co-operate with civilian departments normally outside the sphere of Admiralty activities. The project had a direct effect in changing Admiralty thought and concentrating minds on technical development which would lead eventually to more radical aircraft carrier design.

The real success of MAC ships was not only the tactical success at sea but also the radical change in Admiralty philosophy resulting in the development of a unique personal relationship between Royal Navy and Merchant Navy personnel. The professionalism exhibited by both services ensured the highest standards of seamanship and airmanship bringing about a spirit of co-operation and mutual respect. This provided a pride in both ship and squadron which compounded a situation so essential for the effective operation of MAC ships.

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1. FOREWORD

1.1 PERSONAL CIRCUMSTANCES

John Mably died on 17th February, 2002, just after he had produced the first almost complete rough draft thesis. It had always been John Mably's ambition to research in depth the many factors surrounding his wartime experience of flying Swordfish aircraft from MAC ships.

1.2 PROCESS AGREED BY THE UNIVERSITY OF BRIGHTON

Following consideration by the Research Degrees Committee, it was agreed that the draft thesis text could be reformatted for submission together with a foreword from the supervisory team emphasising the overall contribution of the thesis to the field.

1.3 FINALISING THE TEXT

The supervisory team:

- Reformatted the existing textual material into one consistent database file.
- Took care not to add any new material or delete existing material with the exception of obvious typographical errors or omissions.
- Retained John Mably's initial draft conclusions which are presented in two parts, the second part being a succinct summary of his work.
- Recognise that a number of largely presentational issues remain unattended – e.g. there are no suggestions for further work (Section 13); some references are incomplete; some abbreviations are unexplained; some drawings are of poor quality (John Mably appreciated this but failed to ascribe the sources); and so on.
- Confirm that the work herein is all John Mably's and has not been augmented following his death save for the production of this explanatory foreword.

1.4 APPROACH TO THE STUDY

John Mably served as a Navigator/Observer on Swordfish aircraft flying off MAC ships following their introduction into the Battle of the Atlantic. The thesis builds upon his personal experiences and understanding of the Convoy System to create uniquely intimate assessments, analyses and evaluations, specifically of the evolution of the MAC ship as a tactical weapon, and in general of a little-known, historically- marginalised, yet vital chapter in British naval history.

1.5 SUMMARY OF CONTRIBUTIONS TO KNOWLEDGE

John Mably has demonstrated:

- How the early cynicism of the Admiralty to the whole concept of ship-borne aircraft was overcome.

- The extensive liaison needed between many diverse British maritime agencies in order to bring about effective MAC ship production, in the face of very real conceptual and practical difficulties.
- The design of the MAC ships was very well conceived and executed, retaining as it did full cargo carrying capacity of the converted vessel.
- The effectiveness of the MAC ships in covering the Mid-Atlantic “blind spot”.
- That what started as an interim anti-submarine measure steadily evolved into a very real deterrent to enemy submarine operations.
- The extraordinary reliability and toughness of the Swordfish aircraft.
- The role of MAC ships in establishing the feasibility of flying and landing aircraft from a vessel underway, in poor weather and rough sea conditions in wartime.
- The exceptional skill levels attained by Merchant Navy Seamen and Royal Navy Aircrew of all ranks in the accomplishment of their duties.
- The role of MAC ships in proving the practicality of Merchant Navy Officers having command of Royal Navy Officers at sea – a fundamental reversal of command structures up to that point.
- The key importance of establishing the right inter-personal relationships between all the Royal Navy and Merchant Navy personnel involved, and its realization by example.
- The substantial scale of the Merchant Navy contribution to this aspect of the war effort.
- The importance of MAC ships as prototypes for the creation and refinement of subsequent anti-submarine tactics.
- The importance of the MAC ship experience as a turning point in the transformation of Royal Navy thinking, from purely offensive to a position of aggressive defence.

1.6 EPILOGUE

The supervisory team consider it to have been a *privilege* to have worked with John Mably and would offer this semi-complete thesis as a tribute to him, and to his many colleagues who provided the extensive evidence which enabled him to establish his conclusions.

Professor F.J. Maillardet
 Professor R.A. Johns
 Mr Julian Freeman

2. INTRODUCTION

2.1 FIRST WORLD WAR 1914-1918

In 1914 began the first maritime war for a century using a new weapon; the submarine. For the first time Britain faced a war in which the populace could not be fed from the resources of the island nation. A successful blockade of British shipping would mean starvation and surrender.

Recognising this fact Germany carried out a policy of unrestricted submarine warfare against merchant shipping and achieved a position by 1917 for negotiation, if not indeed, victory.

The war against the U-boat reached crisis point in April 1917 when 881,000 tons of shipping was sunk world-wide and the life expectancy of all ocean-going vessels declined to four return voyages, a monthly record which was unbeaten during the Second World War. ⁽¹⁾

In this month (APL1917) Lloyd George, supported by Sir Maurice Hankey, a farsighted strategist who favoured the convoy system, put pressure on the Admiralty to introduce an immediate anti-submarine strategy.

On April 27th 1917, Lloyd George introduced a six-point plan for defeating the U-boat as follows. ⁽²⁾

1. The convoy system to be implemented immediately.
2. All merchant ships to be armed.
3. Priority research in submarine detection and destruction methods.
4. More ships to be built in Britain and more ordered from the United States.
5. More efficient use of existing shipping.
6. The introduction of an import substitution campaign, especially in agriculture.

The introduction of the convoy system was no miracle cure mainly because it was inaugurated piecemeal and the admirals were still unco-operative regarding the number of escort vessels that could be allocated for convoy duty, a situation that existed to the end of the war. The real reasoning behind this attitude was that many senior naval officers still regarded convoy work as defensive in nature and opposed to the basic philosophy of find, fix and strike, a cornerstone of Admiralty policy. The most important aspect of Lloyd George's plan was not only the realisation that a new strategy was necessary to overcome the U-boat but also a fundamental change in attitude towards the war at sea. In wartime naval power should reflect the ability to protect trade against the attack of the enemy and strategy should use its power as a source of transportation and economic goods. By using imaginative and organised defence systems such as the convoy, the U-boat offensive was kept under control and Britain managed to survive.

The search for anti-submarine weaponry was not successful before the end of the war. Following an Allied Submarine Detection conference held in June 1917 priority was given to the development of an Allied Submarine Detection Investigation Committee (ASDIC) but this was not deployed until November 1918.

The most successful innovation against the submarine was the maritime aircraft of the Royal Naval Air Service in spite of ineffective weaponry in use at the time. Contemporary bombs were too small and inaccurate, whilst the depth charge had not yet been adapted for airborne use, not least because contemporary aircraft were too small. Nonetheless it was discovered that aircraft, by their mere presence, drove submarines to dive, drastically reducing their speed and endurance, thus making it more difficult to chase and attack a convoy.

It was the advent of the flying boat that was to prove most successful because they had a range that would allow them to patrol convoys in the coastal areas and rely on combined attacks with escorts when necessary. From July to September 1917 three U-boats were sunk by the method. Air support to convoys was supplemented by the use of airships which proved to be highly successful for reconnaissance purposes.

By the end of 1917 the Royal Naval Air Service had over 400 aircraft on anti-submarine duty; this number had increased to 657 aircraft by November 1918 including 285 seaplanes, 272 aeroplanes and 100 airships. ⁽³⁾

This increase in air power not only indicated a significant change in attitude regarding defensive measures essential in anti-submarine strategy but found the Royal Naval Air Service in a position of strength which should have provided a platform for future anti-submarine warfare. The progress made went unheeded throughout the next twenty years with both naval aviation and the use of the convoy system considered to be a low priority in the essential problem of trade protection.

2.2 INTER WAR YEARS 1918-1937

The philosophy emerging post 1918 reverted to the battle fleet and the big gun and disregarded the value of the aircraft and anti-submarine warfare. However, the deeper aspects of Royal Navy philosophy can be attributed to the uncompromising conservatism of senior ranks obsessed with the power of the battleship. Their resistance to change manifested itself in vested interest and an uncompromising attitude toward the possibility of a future war.

Setbacks and Complacency

War, or even the fear of war, always brings change, not necessarily by desire but through force of circumstances. The fact that naval philosophy was aggressive in character resulted in any tactics that were of a defensive nature being given a low priority for improved development. This applied, in particular, to anti-submarine warfare, where the Admiralty improved the success of aircraft in the First World War and preferred to rely on ASDIC which had first been used in 1918 but too late to be effective by the end of the war. Considerable progress was made in the development of the Allied Submarine Detection Information Committee (ASDIC) in the immediate post-war years so that by 1932 all destroyers were fitted with this equipment. So great was the faith placed in improved submarine detection by ASDIC that Naval Staff optimistically believed that surface vessels fitted with this equipment could overcome any problems presented by every submarine in the future.

Naval attitude was not the only reason for the decline of the Royal Naval Air Service. On 1st April 1918 an event occurred that set back by two decades any hope of a well equipped and efficient air branch appearing. The amalgamation of the Royal Naval Air Service and the Army's Royal Flying Corps into the Royal Air Force appeared to be a logical move at the time but was dangerously simplistic although politically acceptable because of the economic conditions that existed in the UK

Inevitably, the Royal Air Force became a rival for power and influence in Whitehall competing with other services for scarce resources. This resulted in bitter inter-service

rivalries over the control of maritime aviation which caused the Navy to fall behind the Americans and Japanese in the development of naval aviation.

Finally, the progress and standing of air power in the Royal Navy was much impeded by the effects on the economic climate and a period of reluctant rearmament based on the optimistic assumption that there would be peace for at least ten years. Connected with this notion of ten year's peace was the sequence of naval disarmament negotiations set in motion by the Washington Treaty of November 1921. It was impossible in such a situation to have a strategy of warfare to satisfy the requirements of all three services and enter any conflict with confidence.

The Royal Air Force, similar to the Admiralty, followed an aggressive policy with the use of offensive tactics; as early as December 1919 Air Vice Marshal Vyryan, Commander of shore-based areas regarded anti-submarine patrols and convoy escort support as purely defensive and was opposed to devoting more than a minimum of aircraft to this task. ⁽⁴⁾

In spite of the considerable success of the convoy in the latter years of the war, the entire system had been dismantled by 1919. In view of the extremely narrow margin by which Great Britain had avoided defeat at the hands of the U-boat in 1917 it seems incredible that no systematic examination or analysis of the U-boat was attempted. It was not until 1935 that the Admiralty made an attempt to recreate the convoy system under the supervision of Rear Admiral Sir Elden Manistry. ⁽⁵⁾

The plan was to develop new trade divisions and Naval Central Service for the possible use of convoys which included four main tasks:

- i) To plan the organisation of the Trade Division in the Admiralty and to select and train a skeleton staff for immediate service.
- ii) To create and use committees for co-operation with ship owners and managers, together with other interested parties, to prepare the arrangements outside the naval service for control of the nation's shipping.

- iii) To prepare, produce and stockpile the necessary minimum equipment for all merchant ships and shore facilities. ⁽⁶⁾
- iv) To devise and prepare the organisation overseas and make provision for moving it.

This was a huge logistical exercise but proved invaluable when it became necessary to officially reconstitute the Trade Division in May 1939.

When Lord Stanley stated in the House of Commons in March 1935 that the convoy system would not be used at the outbreak of War it provoked no discussion at all, being accepted without question. Even as late as 1937 the Chiefs of Staff agreed that the submarine should never again be able to present the problem faced in 1917. ⁽⁷⁾

1937 found the Admiralty in a state of confusion and contradiction regarding the convoy system, but this was finally settled when Admiral James stated that the Admiralty considered the convoy system to be the most effective form of protection against submarine or air attack and plans were to be introduced by the Admiralty to ensure its availability in war areas.

The inter service differences over naval aviation had a detrimental effect on improving the Naval Air Service in spite of the efforts of Rear Admiral Reginald Henderson who was able to streamline the service and make some improvements on carriers, but could not make any headway on the stifling restrictions placed by the Royal Air Force on naval aircraft development and supply.

2.3 FLEET AIR ARM 1937-1939

It was not until January 1937 that the Fleet Air Arm became the responsibility of the Royal Navy, although control of Coastal Command remained with the Royal Air Force. This can be considered one of the Navy's triumphs although it did not open the way to a revolution because time did not permit. ⁽⁸⁾ The Fleet Air Arm therefore entered the Second World War without any clear aim or objective, a shortage of carriers, outdated aircraft and insufficiently trained personnel.

As a result of peacetime training, certain principles governed the assignment of specific fleet duties to naval aircraft.

- i) The tactical advantage gained by sighting the enemy before he realised the position of our fleet.
- ii) The 'fixing' of an enemy and reducing his speed by air attack.
- iii) Assistance in the protection of the fleet against U-boat attack.
- iv) Protection of the fleet against air attack.
(There was no faith in navy fighters; the main defence against air attack was considered to be anti-aircraft fire.)
- v) Protection of Carriers – the function of naval aircraft. (There was an unreadiness to accept responsibility for highly vulnerable ships when detached from main body of fleet.)

These tactics illustrate the shortsighted view taken on the use of aircraft and illustrate the lack of imagination and innovative possibilities that existed at the time. Evidence shows that it was still considered that, whilst ships could always be relied upon to carry out their assigned duties, aircraft were by no means dependable. Aircraft were, in fact, more generally regarded as providing a means of supplementing the work of ships rather than providing a new means of achieving a naval tactical objective.

With the advent of war these views were forced to change, even if only gradually; a change which was to alter the importance and status of the aircraft for many offensive and defensive tactical functions regarding surface vessels.

Note 1

Number of Carriers September 1939 - 1940

HMS Argus	Fleet Carrier	Commissioned 1918	Re-commissioned 1938
HMS Ark Royal	Fleet Carrier	Commissioned 1938	
HMS Courageous	Fleet Carrier	Commissioned 1916	Re-commissioned 1928
HMS Eagle	Fleet Carrier	Commissioned 1924	Re-commissioned 1937
HMS Formidable	Fleet Carrier	Commissioned 1940	
HMS Glorious	Fleet Carrier	Commissioned 1916	Re-commissioned 1930
HMS Hermes	Fleet Carrier	Commissioned 1923	Re-commissioned 1939
HMS Illustrious	Fleet Carrier	Commissioned 1940	

Number of Squadrons: (First line)

800	Squadron	3 Roe 6 Skua
801	Squadron	9 Skua
802	Squadron	12 Gladiators
803	Squadron	9 Skua
810	Squadron	12 Swordfish
811	Squadron	12 Swordfish
812	Squadron	12 Swordfish
813	Squadron	9 Swordfish
814	Squadron	12 Swordfish
818	Squadron	9 Swordfish
820	Squadron	12 Swordfish
821	Squadron	9 Swordfish
822	Squadron	12 Swordfish
823	Squadron	12 Swordfish
824	Squadron	9 Swordfish
825	Squadron	12 Swordfish

Development of British Naval Aviation. ⁽⁸⁾

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3. U-BOAT WAR

3.1 NAVAL AVIATION AND COASTAL COMMAND 1939-41

The Royal Navy entered the Second World War ready and equipped for a fleet encounter whilst considering the U-boat threat to be a minor problem compared with the dangers related to surface raiders; an approach that appeared reasonable during the early months of the War because of the small number of operational U-boats at sea.

Nevertheless, the Admiralty had, during the inter-war years, almost completely disregarded the need for naval aviation as support for convoy defence because escort forces equipped with ASDIC and evasion tactics could be relied on to provide sufficient security for the trade routes.

To Britain the battle for sea transportation was to pose one of the greatest challenges of the war, a lesson that had been apparent during the First World War when the U-boat had almost won the war for Germany. This was to be repeated by the savage attack of U-boats in 1942/43. The years of neglect between the wars had almost proved fatal, the situation only being overcome by a rapid change in attitude by the Admiralty and the determination, imagination and innovation of personnel involved with anti-submarine warfare. ⁽¹⁾ The Historian, Correlli Barnett claimed that the most serious failure of judgement by the Admiralty during the interwar years was to neglect the setting up of a convoy defence system against U-boats through lack of organised, scientifically conducted operational research. ⁽²⁾

In addition, it has been observed that the Royal Navy lacked the structure and imagination to accommodate those officers who served in the First World War who might have provided it was a knowledge and understanding of anti-submarine warfare. Naval aviation, therefore, began the Second World War totally unprepared for anti-submarine warfare, having neither the aircraft carriers nor suitably equipped aircraft to overcome the U-boat menace. Squadrons were based on seven first line carriers trained to act offensively against an enemy fleet whilst air/sea reconnaissance was still

regarded as a defensive matter limited to visual search with only the inefficient 100lb bomb as weaponry which had little or no chance of killing a submarine.

It is difficult to understand the time that was taken to restore the convoy system because of the persistent belief that to send out flotilla vessels and aircraft to hunt for U-boats was to take the offensive against them whereas to use them to escort convoys was of a defensive nature. ⁽³⁾ In this way Fleet Carriers were used to hunt U-boats, a complete waste of assets that could have been better employed elsewhere. RAF Coastal Command had suffered neglect in the same way as naval aviation when as early as 1935 an Air Staff Memorandum on air protection of merchant shipping against surface and air attack, declared that the danger should not be met in a direct way but by offensive action against the source of the power concerned. Coastal Command, therefore, received only a low priority for available resources so that by 1939 it was in a weak situation to face the enormous problems presented by anti-submarine warfare.

During the early period of the war, German U-boats met with considerable success in the North Channel and coastal waters of the UK when ships were sailing individually prior to the introduction of the convoy system.

Supplying air cover in these areas was the task of Coastal Command but the problems faced were manifold including aircraft availability. The older aircraft such as the Anson was only of use in Coastal waters whilst the Sunderland with a range of some 3,000 miles was only available in small numbers. These aircraft were being supplemented by the Lockheed Hudson and the Catalina Flying Boat but it was a case at this stage of too few, too late. However, these aircraft as they grew in number were to play a vital part in the support given to convoys. ⁽⁴⁾ In addition, some Whitley and Wellington bombers were transferred from Bomber Command, the latter proving itself of great value from its first day on operations. Apart from these factors, Coastal Commands means of finding and killing U-boats remained feeble. Experimental radar had been fitted in February 1940 but it was not until January 1941 that the first reliable ASV had become available. Aircraft also lacked an effective bomb sight, and naval type depth charges had to be used meaning that the depth had to be set before take off rendering them useless against a submarine on the surface. It was also not possible to illuminate a U-boat at night until the Leigh light was introduced in early 1942. ⁽⁵⁾

The land bases in the UK meant that aircraft had to be able to fly long distances into the Atlantic, a distance of at least 600 miles. This situation was alleviated in May 1941; Iceland was occupied and Hudson aircraft were immediately dispatched to cover the northern part of the Atlantic. The immediate effect was that convoys could be routed nearer to Iceland so as to gain help whilst Doenitz and his U-boats were forced to make far longer journeys if they were to intercept the enemy.

In Command and Control the British had forged ahead with a policy that was to reap rich rewards in the future. In February 1941 Coastal Command was placed under the operational control of the Admiralty and a new joint HQ was set up in Liverpool to which all information was fed from Operational Intelligence.

In spite of the fact that things were beginning to improve in 1941 from a technical and operational point of view (Note 1) and the acquisition of bases in Iceland (Note 2), there remained at this stage a long gap in the middle of the Atlantic that could only be patrolled by very long range aircraft or escort carriers.

3.2 DEVELOPMENT OF SHIP BORNE ANTI AIRCRAFT AND ANTI U-BOAT WEAPONRY

It was at this early stage that the Admiralty was sounding out the possibility of producing aircraft carriers for escort work and other ingenious methods of defensive warfare.

After the fall of France the Germans had introduced a new aspect into the Battle of the Atlantic. ⁽⁶⁾ Twelve Focke Wulf Condor aircraft, four engined reconnaissance bombers, were able to take off from Bordeaux-Merignac, their range being some 2,000 miles so that they could reach out into the Atlantic well beyond any aircraft based in the British Isles. They carried heavy defence armament and four 550 pounder bombs and, although there was no bomb sight fitted, the bombs were dropped in a stick which was remarkably effective. In August and September 1940 they sank more than 90,000 tons of shipping.

The only way to counter these aircraft was to attack them with fighter aircraft, and in October 1941 the Director of Research and Development came up with the idea of CAM ships - Catapult Aircraft Merchant ships. These vessels would continue to carry naval cargo and fly the Red Ensign, have all Merchant Navy Crew and always remain part of the convoy.

The aircraft to be used was the Hurricane MK1, being successfully modified for catapult work.

The CAM ship was a one-off defence. Once launched there could be no recovery of the aircraft, the pilot having no option but to ditch into the sea.

Judged simply on the basis of actual launches, the operations of CAM ships were reasonably successful. 170 round voyages by a total of 35 ships, 8 operational launches resulting in seven kills and the loss of one pilot. ⁽⁷⁾ There is also no doubt that the very presence of a CAM ship prevented a number of bomb attacks being made on a convoy.

The CAM ship, therefore was the first vessel to enable the enemy to be successfully engaged by an aircraft launched from a ship. It was a turning point in research and development which brought in a new era in anti-submarine warfare. The fact that the aircraft could not land back on the ship was a weakness in practical application because the aircraft was lost, an extremely costly exercise, even if the pilot was rescued.

This, however, in no way detracts from the imagination and innovative skills of the personnel involved with its development and production because it undoubtedly gave impetus to those responsible for swift action in the production of Escort Carriers capable of flying and landing on aircraft on a ship capable of giving close support to convoys.

Note 1

Advance in Aircraft Tactics and Weaponry

1941 had seen a significant advance made through the efficient tactical use of aircraft and the development of weaponry.

- (i) The development of air support had been improved by the use of Wellington and Whitley aircraft transferred from Bomber Command.
- (ii) In January 1941 reliable ASV became available for aircraft.
- (iii) Iceland occupied in May 1941. Hudson and Blenheim aircraft used to great effect. Convoys could not be routed nearer to Iceland making larger journeys for U-boats to make contact.
- (iv) Leigh light introduced - improved efficiency for night operations by aircraft.
- (v) Mark VII Depth charge introduced - improved anti-submarine weaponry.

Note 2

Atlantic Convoy Systems and Air Cover

The following map (Reference 8) illustrates the vast area that had to be covered escorts and air cover.

The following factors were crucial.

- (i) The approximate limit for air cover by July 1941 was only about 600 miles from the UK bases.
- (ii) Air cover from Iceland was limited to the South because it intercepted the range of UK aircraft. This meant that aircraft in Iceland were more effective to the North and convoys could be routed in this direction.
- (iii) Cover from N America was also around 600 miles into the Atlantic to the North and East.

The result was that a 'large gap' was left in the middle of the Atlantic which could only be covered by very long range aircraft or escort carriers (Reference 8). At this time it was not possible to cover this gap, but the possibilities were being explored and the CAM ship was soon to appear.

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4. CONCEPTS

4.1 CONCEPT OF MERCHANT AIRCRAFT CARRIERS

The conversion of Merchant ships into Aircraft Carriers did not begin with the introduction of the MAC ship. The department of Naval Construction (Admiralty) had already converted a few well-known passenger liners and had acquired and converted a number of vessels of the cargo liner class. However, one such vessel which largely influenced naval interest in the smaller ships of tramp class was the conversion of the captured German merchant ship, Hanover, into an escort vessel (HMS Audacity) which played a short but effective life in the anti-submarine war and demonstrated the practical aspects of flying off aircraft from this type of ship. ⁽¹⁾

MAC ships were first officially considered at the beginning of 1942 but it was not until the middle of the year that their immediate need became both apparent and urgent. They were an entirely different breed to the Audacity which had gone to sea as a fighting ship under the white ensign, but MAC ships, being dual purpose vessels combining the cargo with the fighting of aircraft, retained their identity as Merchant ships whilst continuing to fly the red ensign and to be commanded by Merchant Ship Masters.

The Red Ensign became the symbol of co-operation between the Merchant Navy and the Royal Navy. ⁽²⁾ All that this implied led to a policy of personal contacts and co-operation between all interested parties and provided the enthusiasm and interest in the project as a whole. It gave a new understanding to the traditions and codes of practice of both services.

It is difficult to establish with certainty from whom came the idea of the Merchant Aircraft Carrier but credit can probably be given to Sir Douglas Thomson, the Parliamentary Private Secretary, Ministry of War Transport, who had been working on the idea with colleagues in the Ministry of War Transport. ⁽³⁾

The subsequent development and operation of Merchant Aircraft Carriers was one of the most closely guarded events of the war. When the decision was made to proceed

with the idea it was decided at first to convert bulk grain carriers and in consequence it became the responsibility of the Admiralty Shipbuilding Department to draw up specifications for the first two vessels, the layout of which had no precedent. ⁽⁴⁾ It was incumbent on the Department responsible to ensure that constructional details could be developed rapidly and production commence without delay.

This development was closely observed by Mr John Lamb, who worked in the technical division of the Anglo-Shell Petroleum Company and proposed that tankers were more suitable for conversion. ⁽⁵⁾ Like any revolutionary idea this initially received only a luke-warm reception because of the inherent dangers involved with tankers, but the ravages of U-boats continued and so acute did the situation in the Atlantic become that in September 1942 Mr Lamb was requested to submit plans in detail.

All the preliminary plans were prepared by him and his assistants. Very few modifications were approved by the Ministry of War Transport, who had the task of arranging for selected tankers to arrive at UK ports precisely when needed for conversion. The logistics of the situation were unprecedented and placed on the Admiralty the responsibility to develop a degree of co-operation and co-ordination which overcame vested interest and inter-departmental and inter-arm rivalries. The need for air support in Anti-Submarine Warfare was now an established fact and accepted as a central factor. This resulted in the FAA having strong representation within the Admiralty. ⁽⁶⁾ In this respect the legacy of the CAM ships played an important part in both the administrative organisation and development of MAC ships because of the role they had played as a fighting unit and also for the new and essential relationship that had been achieved with the Merchant Marine. The latter relationship had been introduced and developed by the Department of Trade (Admiralty) who had originally held responsibility for DEMS personnel on Merchant ships and had then acquired a CAM ship section at a later date.

The experience gained had enabled the Admiralty to establish a new and fruitful relationship between the RN and MN which not only involved a control system but also a social background of unprecedented importance which was to be vital in the future for the traditions and codes of practice of both services.

The first insight into the administrative structure was issued on 2nd December 1942 in a memorandum issued by the Director of Trade Division (DTD) with proposals covering the setting up of a special section within the Admiralty to deal with MAC ships. ⁽⁷⁾ It is essential to illustrate the part played by DTD at this stage.

The main proposals were sparse but explicit and concentrated on the importance of all Departments in the Admiralty being kept fully informed of MAC Ship Development where appropriate. This also included close liaison with the Ministry of War Department as representative of the association with the Merchant Navy and their involvement in the project. The other special relationships were with the Director of the Naval Air Division who would be concerned with the provision of Aircraft and Air Personnel both at home and abroad, and initiate training.

The progress made in inter-departmental co-operation was impressive and enabled nineteen MAC ships to be produced, equipped and ready for flying operations within a twelve-month period. Whilst this side of the equation was satisfactory the provision of aircraft was more complex. Following the memo of 2nd December from DTD a response was made by DNAD in a memo dated 14th December 1943 to ensure there was agreement on most of the proposals, but a problem existed over the provision of aircraft. ⁽⁸⁾ It was the view of DNAD that MAC ships were of vital importance but priority be given to 6 escort carriers due to be launched in the near future. In his view few, if any, aircraft would be available for MAC ships and the best that could be hoped for was that MAC ships would get temporary allocations from squadrons which were waiting for the completion of escort carriers. This critical appraisal was to be seen at a later date and have far reaching consequences.

It was not a decisive blow to DTD but a setback making planning of an operational date more difficult. In the long run it did not provide as great an obstacle as was at first expected.

In a memorandum dated 14 December 1943 the Chief Adviser for operational research submitted to the Assistant Chief of Naval Air Staff a summary of factors that could affect MAC ships. These were far reaching and indicated that serious thought was

being given to future planning and technical matters and that past philosophy was being replaced by the modern concept of air warfare.

Because many of the suggestions were of such a revolutionary nature it is possible that those working in operational research were not only enlightened and motivated researchers, but skilled in the art of airmanship and operational affairs, a refreshing thought considering the imponderables that were to face aircrew in the early days of MAC ships at sea especially the psychological aspects of flying in conditions involving new and virtually untried methods on small ships.

In practice only a few of the suggestions were transferred into reality but some were used to considerable advantage in emergency situations.⁽⁹⁾

The second implication was an acknowledgement that Merchant Navy personnel were now involved in both tactical and planning aspects whilst on operations. This, in itself, was recognition by the Royal Navy of the improved status and professional ability of their officers and crewmen.

Finally, it was suggested that because of the complexity of these issues a strong case existed for a standing committee to be formed to handle these problems. It is of note that DNAD, whilst concerned with all of the problems, reacted strongly against the forming of any further Staff Division or Standing Committee because there was adequate representation on all Committees regarding MAC ships. An effort appears to have been made to eliminate much of the bureaucracy by control of the large numbers of committees that had appeared to meet all aspects of anti-submarine warfare.⁽¹⁰⁾ In a reply to a letter from C in C WA covering administration of MAC ships, the Director of Trade Division advised that it would help to reduce the number of Authorities involved in control of MAC ships, so that Masters of Merchant Ships would periodically be brought into touch with an organisation they both knew and understood.

This would facilitate discussion of their experiences and help maintain a common doctrine between the two services.

The planning to bring MAC ships to operational status was well advanced by the beginning of 1943 but further action had to be taken before this became reality. These carriers would be involved in escort work as anti submarine units with convoys in the North Atlantic zone but the Admiralty had to make final

The question of ports to be used on both sides of the Atlantic was still under discussion but an Admiralty communication stated that the first MAC ship would complete trials normally carried out by Merchant Ships and then proceed to the Clyde area to embark an Air Unit. Aircraft trials would then take place for three weeks before sailing in convoy.

The use of the Clyde was understandable as facilities for the discharge of MAC ship cargoes were available, especially for the tankers, whilst the Firth of Clyde provided a safe and satisfactory area to carry out flying training. In addition, it was close to Oban, the normal assembly point for convoys on North Atlantic voyages.⁽¹¹⁾

The operational use of MAC ships was to provide increased air protection for Convoys against U-Boat attack and to fit certain merchant ships for operating a small number of Torpedo, Bomber, Reconnaissance (TBR) aircraft.⁽¹²⁾ Two types of merchant ships were selected.

- a) Grain Ships. These were new ships designed to carry bulk grain. They would be fitted with a flight deck, hangar and lift and would operate 4 Swordfish Aircraft.⁽¹³⁾
- b) Tankers. These would be a combination of new vessels designed specifically as MAC ships or existing tankers converted to Carriers. They would carry heavy oil (flash point 150 °F and above) and would be fitted with a flight deck but no hanger and would operate 3 Swordfish Aircraft.

The status of MAC ships was made clear by definition. All ships would fly the Red Ensign and would not be used for offensive operations.⁽¹⁴⁾ The new ships would all be Government owned and carry out their ordinary functions as carriers of grain or Admiralty oil whilst the tankers to be converted would operate under Charter conditions of the Ministry of War Transport.

In addition to their normal Merchant Navy crews and DEMS personnel, the ships would carry Naval personnel for the operation and maintenance of aircraft and special equipment. ⁽¹⁵⁾

Once operational and allocated to a convoy the MAC ship would be under the operational control of the Commander in Chief, Western Approaches. The Senior Officer Escort would be in general charge of the operation of MAC ship aircraft and would issue instructions as he thought fit, keeping the Commodore of the Convoy fully informed. The decision to operate aircraft was to be the responsibility of the Master of the MAC ship who would be advised by the Naval Air Staff Officer as to the current situation. ⁽¹⁶⁾

The Admiralty now only required final administrative and organisational procedures to be put into place.

An Admiralty letter directed that the Air Units would be allocated from TBR (Torpedo, Bomber, Reconnaissance) Squadrons formed for Escort Carriers as available for embarkation in MAC ships. ⁽¹⁷⁾ In addition a cadre of each Squadron affected would remain ashore and be appointed to an appropriate Naval Air Station.

It had originally been intended to base this MAC ship Unit at RNAS Macrihanish but this was found to be impracticable for a variety of reasons including geographical situation, weather and poor flying conditions. It was therefore decided that the HQ for the MAC ship unit should be based at the Royal Naval Air Station, Maydown in Northern Ireland with the disembarked portion of 836 Squadron already stationed there.

836 Squadron was therefore to become the largest Squadron in the Fleet Air Arm being associated with every flight that would eventually be embarked on all 19 MAC ships. ⁽¹⁸⁾ In addition to the HQ arrangements a small DEMS unit (operating under DTD) was based in Glasgow. It was now proposed that this unit be moved to Largs on the Clyde as an administrative Unit for MAC ships in the area. Also the Stores personnel attached to 836 Squadron be moved to Largs to join this Unit and work in

close co-operation with Flag Officer Carrier Training who would be responsible for the Training of MAC ships whilst they were working up with their Air Units on the Clyde.

Stores for the Air Units would be supplied direct to the ships and would not be removed or interchanged when Air Units were disembarked. However, the personnel based at Largs would visit each ship at the end of a voyage to clear up any outstanding matters connected with supplies and equipment.

In order to simplify further, flying crews would take on board their own personal kits with parachutes and 'K' type dinghies.

Close co-operation had been necessary between the Chief of Naval Air Stores and the Director of Aircraft Maintenance and Repairs on a suitable policy for maintenance of aircraft. ⁽¹⁹⁾ It was agreed that only the simplest maintenance would be carried out at sea in order to obtain flying capability using spares of a ready use variety. Major and minor inspections of aircraft would be carried out by Station personnel at airfields on both sides of the Atlantic.

In April details of the MAC ship programme were issued and seventeen ships were listed giving details of the type, building yard and estimated date of completion whilst a further secret document gave information regarding details and equipment of the ships. ⁽²⁰⁾

The first ship to be completed would be the Grain ship 'Empire MacAlpine' and she was scheduled to sail with Convoy ONS9 on 28th May 1943. This would be followed by the tanker 'Rapana' which was due for completion in June.

The scale of manning by Service personnel was prepared before the ships left the Builder's yard and gave requirements for aircrew and both specialist and technical personnel. ⁽²¹⁾ It was headed by an Air Staff Officer who would hold the rank of Lieutenant Commander and be a qualified Air Observer with operational experience. He would be the Senior Royal Navy Officer on board and would be responsible to the Commodore of the Convoy for flying requirements whilst maintaining a sound relationship with the Master of the ship. It was also intended that one pilot from each

flight would act as Deck Landing Control Officer (DCLO) and receive appropriate training before joining a ship. ⁽²²⁾

The final stages for the operation of MAC ships came in August when staff for the Headquarters at RNAS Maydown were appointed as follows:

Commanding Office 836 Squadron: Lt.Comdr R.O. Slater (P)

1 Lieutenant (P) as Senior Pilot

1 Lieutenant (O) as Staff Officer (Air)

1 Lieutenant as Squadron Maintenance Officer

1 S/Lieutenant as Squadron Air Radio Officer

1 3rd Officer W.R.N.S. as Squadron Staff Officer

1 3rd Officer W.R.N.S. as Stores Officer

This was followed by an Admiralty Message which put in place the allocation of aircraft to 836 Squadron and followed the line that had always been advocated by the Director, Naval Air Division that only sections of Squadrons waiting for new escort carriers would be available for MAC ships.

- a) Remnants of 833 and 834 Squadrons were to be attached to 836 Squadron and reformed as MAC Units together with Swordfish II aircraft
- b) 838 and 840 Squadrons were to be disbanded immediately and formed into MAC Ship units. It was agreed that 838 and 840 Squadrons would probably be reformed at a future date for service in Escort Carriers.

The re-organisation of these Squadrons would thus provide 836 Squadron with 27 Mark II Swordfish aircraft. At this time it was proposed that FONAS set up three flights for MAC ships of 3 aircraft each.

Additional pilots would also be appointed to 836 Squadron to enable one to be trained as Deck Landing Control Officer (DLCO) for each MAC Ship flight. It was intended

to increase 836 Squadron gradually to provide for 17 MAC Ships (later 19 ships) but the number of spare flights would depend on the resources available at the time.

From these allocations 833 Squadron was to become F Flight of 836 Squadron whilst those from 838 and 840 Squadrons would become L and M Flights and embark on the first MAC Ships to become available.

The aircrew forming the flights were all hardened and skilful flyers and would need minimum time for work-up on MAC Ships. All had experience of flying from Escort Carriers in appalling weather conditions in both the Arctic and North Atlantic and were familiar with anti-submarine warfare. Their morale was high and enthusiasm to make a success with a new and untried development was evident and would have a profound impact on aircrew joining the Squadron at a later date.

References

1. LANAGHAN, J Institute of Naval Architects, Article 1945.
2. Ibid p.96.
3. ADM 13087 Admiralty Conference, 7 May & 2 June, 1942.
4. Ibid
5. Shell International Library - records of MAC Ships.
6. ADM 14179 Memo, 2 Dec, 1942, paras 1-4.
7. Ibid paras 4-6.
8. ADM 14179 Memo, 2 Dec, 1943.
9. ADM 14179 Memo, 14 Dec, 1943. Control Air Operations Room (CAOR)
10. ADM 13087 SVA 2554/41.
11. ADM 1/13523 Admiralty Communications, M/TD Defensively Equipped Merchant Ship (DEMS).
12. ADM 113087 Message 02049/43.
13. ADM 13087 02049/43, para 2.
14. ADM 13087 02049/43, para 4.
15. Ibid.
16. ADM 1/13523 General.
17. ADM 13152 Admiralty Letter (Secret) NA0686/48, Apl, 1943. Map attached.
18. Ibid para 3(a).
19. ADM 13087 Meeting of Assistant Chief of Naval Staff (ACNS) and Director of Air Maintenance and Repair (DAMR), Feb, 1943, para 3.
20. ADM 1/13523 DAMR Letter.
21. ADM 1/13087 TD02260 Re-manning, appendix 3.
22. ADM Message FONAS 13.8.43 (Secret), Public Records Office, Kent.

4.2 ROYAL NAVAL AIR STATION, MAYDOWN, NORTHERN IRELAND

The decision to use RNAS Maydown as the official HQ of MAC ship operations was made by signal 301551/ADM1253 in July 1943 with the following conditions:

- a) HQ staff of the MAC ship unit, apart from the stores personnel, should be based at Maydown, together with the disembarked portion of 836 Squadron and 860 Squadron.
- b) Stores personnel on the HQ staff should be combined with the DEMS (Air) staff located at Largs to be close to the MAC ships that would be working up in the Clyde area. ⁽¹⁾
- c) The formation of MAC ship Headquarters at Maydown resulted in a Command Structure almost unparalleled in its complexity within British Military organisations at that time. Ashore it covered all aspects for the efficient administration of 836 Squadron; the largest ever found in the Fleet Air Arms with treaty for attached flights operating from nineteen MAC ships. At sea the structure covered the complex issues of convoy defence but also gave a clear indication of the special relationship between Royal Navy and Merchant Navy personnel which had to be developed if MAC ships were to achieve their objective.

Maydown had originally been an RAF station which had been expanded in the early years of the war. It contained administrative buildings, messes, warehouse and living quarters, in Nissen huts, which were adequate but extremely basic in design for personnel stationed there. ⁽²⁾

The airfield was sufficiently large and well equipped to take up to 100 aircraft when disembarked from any of the 19 operational MAC ship flights. These finally numbered 23. In addition Maydown was ideally situated with the town of Londonderry lying four miles to the south east. The terrain was flat and free from any

mountains that might have provided obstacles to aircraft taking off or landing. This meant that it was possible to operate most of the time in an area that could frequently experience poor weather conditions, including high and variable winds and poor visibility.⁽³⁾

Two runways were available to controllers. The main one on 068/248o was approximately 1600 yards in length. The second runway on 005/185o was 1300 yards in length. The main runway could take full advantage of the prevailing wind direction and as extreme cross winds were infrequent this allow good take off and 2.

Landing conditions. The geographical position of Maydown was ideal because the Clyde had been chosen as the area of embarkation for the ships and also as the work up and training zone for the MAC ship flights prior to joining a convoy.⁽⁴⁾

The Clyde was approximately 100 miles distant and a Swordfish flying at 75 knots would take about one hour to reach its destination. Dead reckoning was used to navigate to the area before tuning its radar to "home" onto the ship if visibility was poor. If unable to make a landing on the ship an emergency landing could be made at either Macrahanish or Ayr airfields.

It was entirely logical that Maydown was selected because of the presence of the Joint Services anti-submarine School situated adjacent to the Air Station. The objective of the School was to improve tactical knowledge of Fleet Air Arm and RAF personnel engaged on anti-submarine work and to emphasise the importance of co-operation between the two services.⁽⁵⁾

With the introduction of MAC ships into the convoy system Masters of the ships, probably on their own volition, and with ship owners encouragement, attended short courses in carrier operations and anti-submarine warfare to improve their own capacity for the effectiveness of their own ships. This illustrated the growing spirit of co-operation between the Royal Navy and the Merchant Navy which had to be developed if MAC ships were to achieve their objectives.⁽⁶⁾

References

1. ADM 13523.
2. ADM 13523, Ref. 071418A.
3. RAF Hendon Archives, Ref. MPC 77/1/1904.
4. S/Lt MABLY, J.R. RNVR, log book.
5. AIR 20/3126.
6. Lt CROSS, G. Instructor at AS School, personal notes.

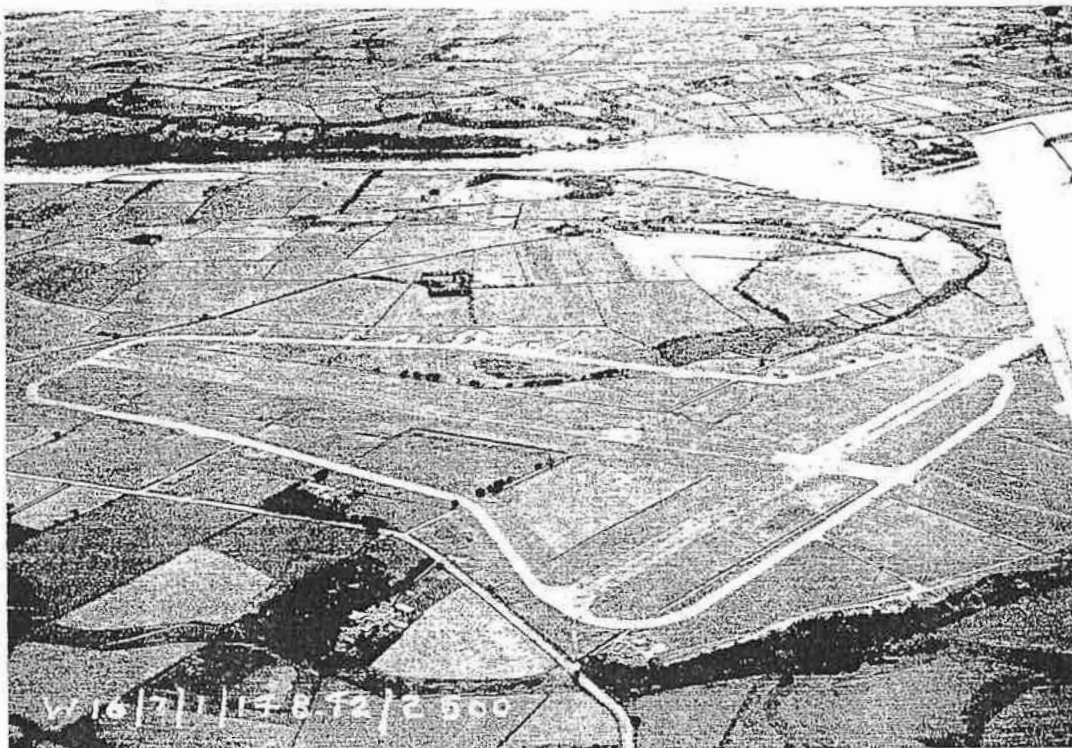
860 Squadron

In addition to the Royal Naval aircraft and aircrews joining 836 Squadron early in 1943 further developments took place which introduced a Dutch Squadron to Maydown to expand the number of aircraft available for MAC ships.

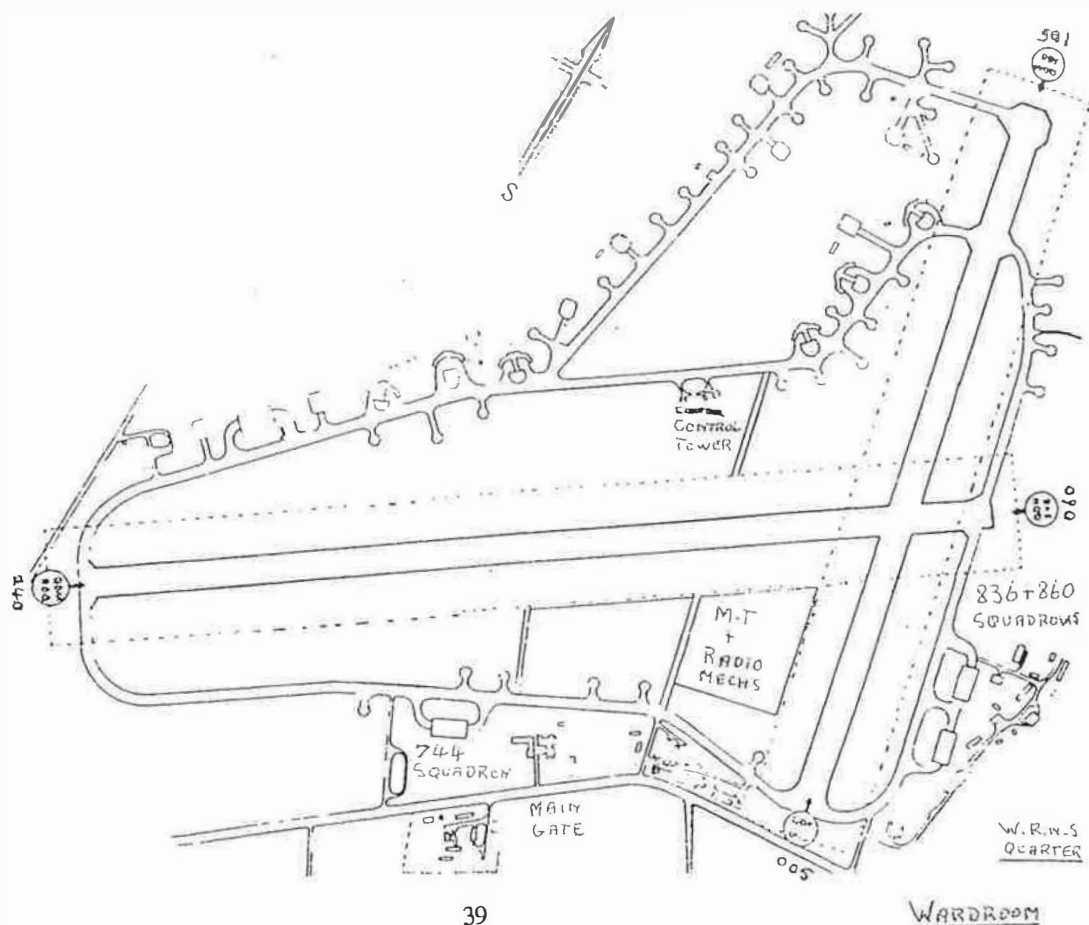
860 Squadron was formed at Royal Naval Air Station Donibristle in June 1943 with six Mark 1 Swordfish manned by aircrew of the Royal Netherlands Naval Air Service, commanded by Lieutenant J Van der Tooren RNN. An RAF Flight Sergeant and British ground crews were also appointed. These British servicemen were gradually replaced by their Dutch counterparts as they became available and aircraft strength was increased to 12 aircraft. The Squadron moved to Macrihanish for weapon training and were re-equipped with Swordfish MKII aircraft.

Following intensive training the Squadron moved to Maydown where it integrated with 836 Squadron and formed the new operational flights 'O', 'S' and 'T'. The first flight became operational in January 1944.

RNAS MAYDOWN - AERIAL PHOTOGRAPH ILLUSTRATING THE
SURROUNDING COUNTRYSIDE
LONDONDERRY LAY 4 MILES SOUTH EAST OF THE AIRFIELD WITH
LOCH FOYLE TO THE NORTH



PLAN OF ROYAL NAVAL AIR STATION MAYDOWN

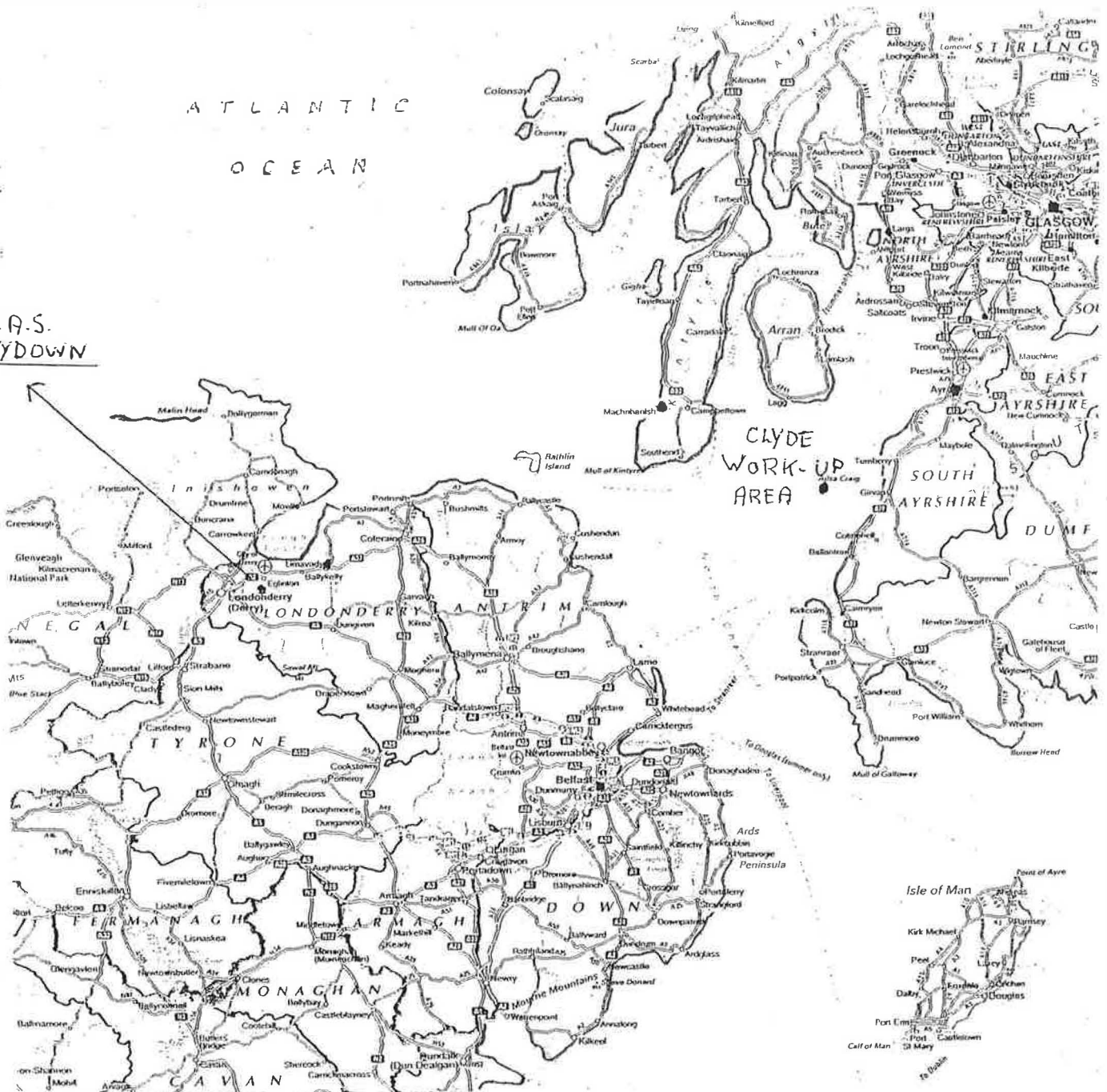


MAP SHOWING THE POSITION OF RNAS MAYDOWN AND THE MAC SHIP WORKING-UP AREA IN THE CLYDE

ATLANTIC
OCEAN

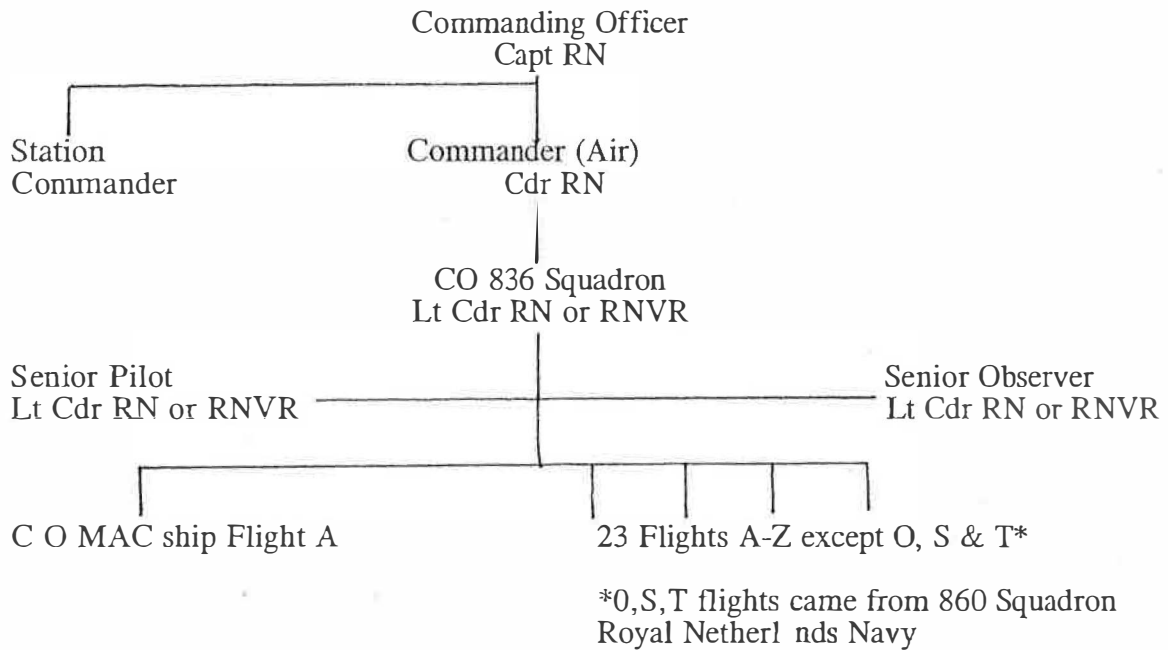
R.N.A.S.
MAYDOWN

CLYDE
WORK-UP
AREA

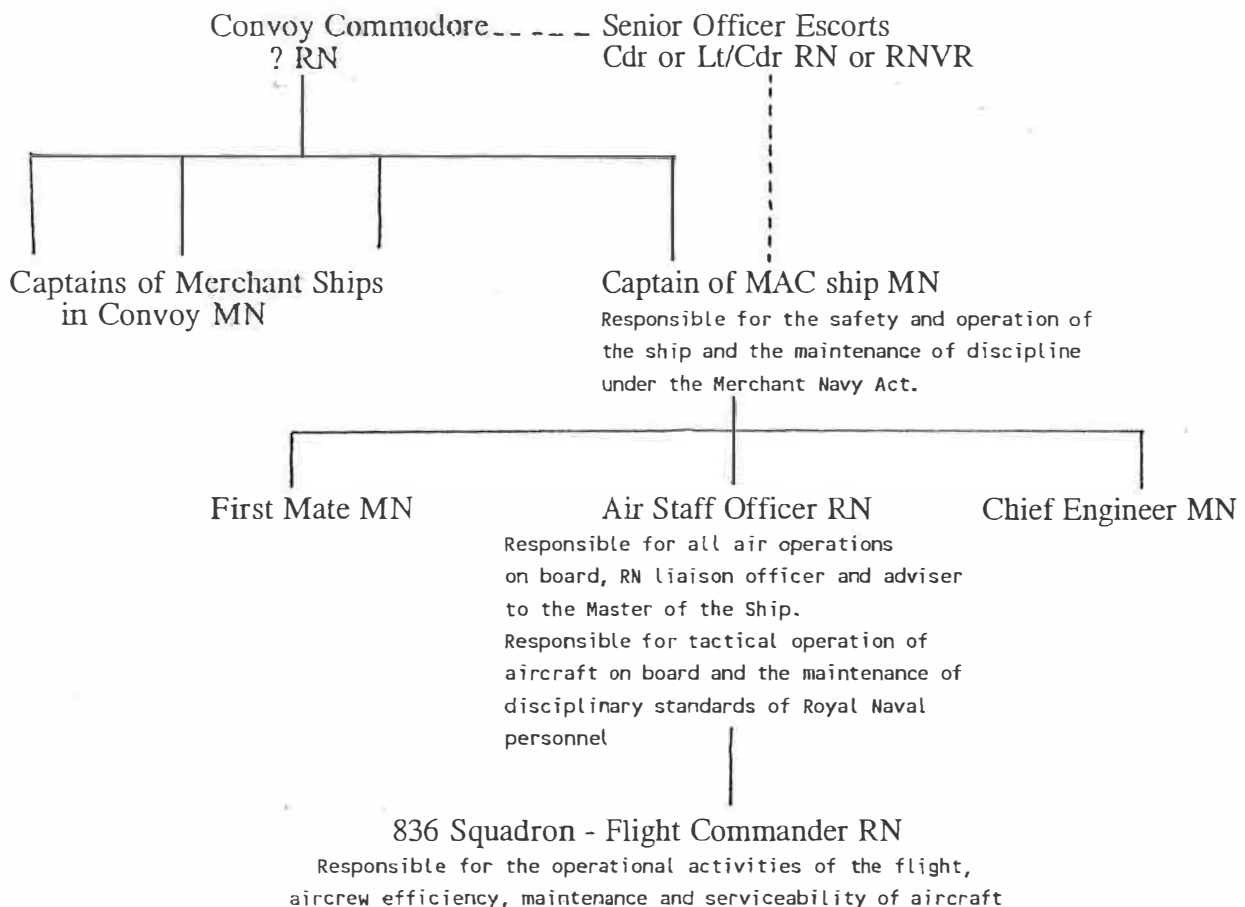


COMMAND STRUCTURE

ASHORE



AT SEA



4.3 TERMINAL PORTS

At the commencement of 1943 the first MAC Ship was nearing completion and it was estimated that it would be available for service early in May, the whole conversion having only taken a period of nine months. The speed at which this had been achieved had left many organisational and administrative issues unresolved so that swift action needed to be taken if the ship was to sail on time, resulting in the ACNS (Air) calling a meeting on January 20th 1943. The agenda was of considerable importance as all departments covered were requested to attend to discuss a wide and vital agenda which included the following items.

- a) Arrangements necessary to ensure close liaison between:
 - i) Ministry of War Transport Representatives.
 - ii) Naval Authorities responsible for the operation of MAC ships
 - iii) Naval Air Authority responsible for the provision of air units
 - iv) Naval Authorities responsible for the naval administration of MAC Ships (including Supply & Maintenance).

- b) General Arrangements required at Terminal ports to be used by MAC Ships including:
 - i) For the ships
 - Servicing of equipment
 - Replacement of stores

 - ii) For the Air Units
 - Accommodation, personnel, replacement of aircraft, equipment and stores and servicing facilities

 - iii) Training facilities ⁽¹⁾

Representatives at Meeting: ⁽²⁾

C in C Western Approaches

Rear Admiral Naval Air Stations

Director of Personnel

Ministry of War Transport

Director Naval Air Division

Director Trade Dept

DEMS (Air)

Director Air Maintenance

Director Air Maintenance & Repairs

The representatives at the meeting gave some indication of the large number of departments involved and the vast administrative organisation involved in the setting up of MAC ships. The fact that most of the difficulties encountered were overcome by the time the first ship sailed indicates the high degree of co-operation that took place together with a determination to put aside red tape and inter-departmental rivalries.

This Agenda contained many difficult and complex issues which could not be immediately resolved, but it introduced a sense of urgency to the representatives because of the time factor involved.

There was a realisation that an efficient liaison was required which required good communication and a decision making process that cut out red tape and bureaucracy if all administrative and organisational requirements were to be in place before the first MAC ship was due to sail.

The selection of Terminal Ports was crucial and had been under review for several months. This was not a simple matter as it required different facilities for tankers and grain ships.

The requirements were as follows:

1. The loading and discharge of cargo; both oil and grain with equipment that would guarantee a turnaround time of 3 days.
2. An area which would allow ships and aircraft to work up and train prior to joining a convoy.
3. An airfield in the vicinity which could be used by aircraft whilst the ship was in port.
4. Facilities for the loading of spares & equipment for aircraft.

Abroad

Two ports were considered; New York and Halifax, Nova Scotia but the latter was chosen for the following reasons: ⁽³⁾

- i) An oil pool was being established at Halifax and would be available to receive ships by the time that the first MAC was ready to sail in convoy.
- ii) Grain ships could load their cargo with the use of existing facilities at Halifax.
- iii) A Royal Canadian Air Force Station adjacent to the Port of Halifax could accommodate aircraft from the carriers and provide maintenance backing as necessary whilst the ship was taking on cargo.

It was possible to guarantee a turnaround time of three days, an essential factor if convoys were to include a MAC Ship for the return journey.

Home Waters

The port to be used in home waters was not solved without difficulty. The Clyde was suggested as the most satisfactory place because it provided most of the facilities required including discharge of cargoes for both grain ships and tankers. However, letter PT979 noted that discharge of Grain Ships could only be carried out at Meadowside Granary, Glasgow and could not be undertaken in less than 7 days and then only if certain modifications were made to the longitudinal bulkheads of the ships. It was therefore suggested that for grain ships the Mersey was much more favourable because a complete discharge could be effected in the Alexandra Dock in 36 hours. ⁽⁴⁾

The Clyde was ideal for Tankers as a discharge point was available in Lough Long free from the congested area of the port and enemy bombing raids.

Message 271251/B/May was sent to the C in C Western Approaches confirming that the Empire MacAlpine would sail with Convoy ON59 and load grain at Halifax, Nova Scotia whilst the return journey would be with Convoy SC135 with the cargo being discharged at Alexandra Dock in the Mersey.

The fact that this message came so close to the sailing date of ON59 illustrated the difficulties that had been experienced by all relevant Departments to meet the deadline. It would be several weeks before all administrative matters were to be finalised and promulgated in official terms. ⁽⁵⁾

Supply maintenance

The representatives at the meeting held on January 20th had been under no illusions regarding the urgency of the matter and all had left with action plans to be put into immediate effect. The responsibility placed on both the Director of Supply and the Director of Air Maintenance was considerable as they were entrusted with the task of organising the initial supply of stores and spares to the MAC ships and to make arrangements for replacement of equipment.

By early April considerable progress had been made and store facilities were being made available for the air units, thus providing facilities for the replacement and repair of aircraft and the replenishment of air stores at Air Stations in the vicinity of loading and discharge parts used by the MAC Ships.

In addition the inspection, repair and maintenance of special equipment fitted in MAC Ships became the responsibility of the Base Maintenance authorities on request of the DEMS Staff Officer. This was of particular importance because it affected the vital

radio and radar equipment which was to prove vital to MAC ships in convoy experiencing extreme weather conditions.

The Director of Air Maintenance had a problem covering both stores and personnel on the ships. Accommodation and space was severely restricted. A scale of both personnel and stores was drawn up on the basis of 4 (or 3) aircraft requiring supplies for a 30 day period (based on a return trip from the Clyde to Halifax and return).

The result was that no Squadron mobile equipment was to accompany the air units with the exception of special maintenance equipment for the mechanics and parachutes and 'K' type dinghies for aircrew. At the same time arrangements were drawn up for an organisation to be set up in the Clyde area (at Largs) able to supply ships with the essential heavy equipment required whilst at sea including both aircraft parts and offensive weaponry. Apart from stores and supply the Director of Air Maintenance prepared for the testing of equipment on the ships whilst undergoing sea trials with particular reference being given to the arrester gear and the safety factors concerned with the storage of high octave petroleum and explosives (bombs & depth charges).

The final arrangements for the operation of MAC Ships were issued by Admiralty letter in April 1943.

Supply of equipment ADM1/13087 Director of Air Material Jan 22 1943

- (a) Headquarters Squadron
Squadron mobile equipment in accordance with BR378 and 378A column 10, Publications AP (N)1, Column 5.
- (b) M.A.Cs
Squadron mobile equipment in accordance with BR378 and 378A column 9 (less parachute and 'K' dinghy equipment). These items to be permanently retained on board and treated as articles in use. Publications AP (N) 1, column 5.

In addition to the above equipment Director of Air Maintenance and Repair (DAMR) is requested to prepare a small range of essential spares for aircraft and engines and to forward these to DAM. who will add the necessary W/T and armament (vote 8) items for supply by D of S. Separate action will be taken by DAM with DAS for the provision of Vote items.

Administration

Admiralty letter NA/0686/43 tabbed 'Z' reported in Letter A 0686/43 Head of Air Branch.

The following arrangements were laid down.

1. Naval Administrative arrangements for MAC Ships would be the responsibility of the Defensively Equipped Merchant Ships (DEMS) organisation (operating under DTD) with duties set out in DEMS (Air) temporary memorandum Home 580.

The organisation would be stationed at Largs on the Clyde.

2. 826 Squadron would be the appointed Squadron for the Air Units of all MAC Ships (apart from Units provided by the Royal Netherlands Air Squadron). 836 Squadron to be based at RNAS Maydown in Northern Ireland.
3. Stores personnel to be based at Largs with the DEMS unit.
4. DEMS and Stores personnel should work in close co-operation with Flag Officer Carrier Training for the training and working up of Air Flights in the Clyde area.
5. Stores personnel should visit MAC Ships between trans-Atlantic crossings to discuss the position regarding the replenishment of equipment.

PT979 Secretary Admiralty Basil Sanderson

Quote: "It is understood that a ship is required to turn round in a maximum of seven days and in that time be in a state of readiness to sail 48 hours before time to join a convoy."

ADM/1 13087 Message 271230B:

Confirmed all MAC Ships to use Halifax.

Letter H.02870/43 Director of War Transport:

Confirmation that Grain Ships discharge in Mersey.

Confirmed Ref. TD/DEMS 1200/1/5:

All Tanker MAC Ships to discharge in Clyde.

References

1. ADM 1/13087 p.13.
2. ADM 1/13087 ACNS(A) Meeting, 20th Jan, 1943.
3. ADM 1/13087 p.22.
4. ADM 1/13087 Letter PT979.
5. ADM 1/13527 Message 271251/B/May.

5. SHIP CONVERSION

5.1 GRAIN SHIPS

MAC ships were first officially considered at the beginning of 1942, but it was not until the middle of the year that their immediate need became apparent and urgent. Once accepted, development of proposals proceeded very rapidly and the necessary instructions were issued for the construction of two vessels to be put in hand ready for service in the Spring of 1943. ⁽¹⁾

The preliminary naval staff requirements specified that selected vessels should have a speed of 14-15 knots and dimensions capable of providing for a flight deck of not less than 490 ft. length and 62ft breadth, with a hanger space for housing at least six fighter aircraft. ⁽²⁾

However, the unlikely event of enemy air attack in mid Atlantic soon made the provision of further aircraft impractical. Those escort carriers, building or in service which could have satisfied the requirements were already allocated for other equally important duties. The design and production therefore became the responsibility of the Admiralty Merchant Shipping Department. The capacity for construction had to be found in yards under their control.

The majority of Merchant Navy yards, however, were unfamiliar with Royal Naval equipment and generally physically incapable of producing vessels having dimensions required. ⁽³⁾

**Initial Specification for Grain Ships showing the first six vessels and the
Yards appointed for construction**

Builder	Burntisland Shipbuilding Co.Ltd.	Wm. Denny Bros.Ltd.	Lithgows Ltd.
Name of Vessel	Empire Mac Alpine Empire MacKendrick	Empire MacAndrew Empire McDermott	Empire MacCrae Empire MacCallum
Length	412 ft 6 ins	425 ft 0 ins	425 ft 0 ins
Length (overall)	433 ft 9 ins	445 ft 8 ins	444 ft 7 ins
Length of Flight Deck	413 ft 9 ins	423 ft 1 in	424 ft 4 ins.
Breadth on water-line	56 ft 8 ins	56 ft 0 in	57 ft 9 ins
Breadth at Flight Deck	62 ft 0 ins	62 ft 0 ins	62 ft 0 ins
Main draught loaded	24 ft 6 ins	24 ft 8 ins	24 ft 6 ins
Freeboard to flight deck	28 ft 6 ins	28 ft 4 ins	30 ft 1 in
Total deadweight (tons)	7,930	8,630	7,990

From a survey of the berth capacity then available and having regard to the number of vessels required which had increased from two to six within a few weeks it became obvious that nothing of larger dimensions than the steel screw cargo vessel could be produced from the merchant ship yards. Modified proposals based on this consideration were submitted to the naval staff who not only acknowledged the difficulties placed before them but agreed to the modifications. ⁽⁴⁾

The requirements were recast to cover the provision of a flight deck of not less than 390 ft in length and 62 ft in breadth, a hangar for 4 Swordfish aircraft (Grain ships only) and a speed of not less than 11 knots in fair weather.

This was a bold move by naval staff because the shorter length of the flight deck and reduction in vessel speed would have a profound effect on the flying conditions for aircraft. ⁽⁵⁾ It did however illustrate that great confidence was to be placed on the veteran Swordfish Aircraft and the capability of aircrew working under difficult and untried conditions on small carriers.

These new requirements were intended to cover conversion proposals for both cargo ships and oil tankers but with the different problems in each type their application followed separate courses.

The general layout for the combined functions of these two types of vessel had no precedent and made it incumbent on the department responsible to ensure that all fundamentals affecting the designs were settled quickly so that production could proceed without delay.

From an outline project plan supplied to the shipbuilder, a preliminary arrangement plan was prepared. ⁽⁶⁾ This plan and its subsequent amendments were tabled at three Admiralty conferences held on 7th and 20th May and 2nd June 1942.

Points at issue between the departments concerned the operation of these vessels as aircraft carriers. The production departments and the shipbuilder of the first vessels were discussed and settled at these conferences. ⁽⁷⁾

From the date of the final meeting the design agreed for grain ships remained unaltered, apart from certain details, for all six ships throughout their construction. ⁽⁸⁾

Two vessels were ordered from each of three yards with the following particulars being of vital importance.

- a) Cargo loading and discharging arrangements which would not interfere with, or seriously encroach upon, the aircraft carrier requirements. ⁽⁹⁾
- b) Siting of the bridge structure without detriment to the navigability of the vessel and the limitation of the projection outboard beyond the moulded line so that the ship was not prevented from using commercial quayside berths.
- c) Improved watertight sub-divisions, and the maintenance of structural strength in way of the sunken hangar space.
- d) The accommodation for two crews, merchant and naval, totalling 107 persons.

- e) Life saving arrangements to merchant ship standards, including all additional wartime emergency measures.
- f) Mechanical and natural ventilation for crew, cargo and machinery spaces, in addition to the disposal of exhaust from main diesel engine and auxiliary boilers.
- g) Spaces for magazines for safe storage of bombs, depth charges, ammunition and pyrotechnics, together with sundry small store and locker spaces.
- h) Good steering and manoeuvrability qualities for convoy work and flying on and off aircraft.

These necessities were fundamental to the operation of the ship as a carrier and their incorporation would have been comparatively simple and straightforward but for the time factor. With both plans and construction proceeding concurrently and with the dimensions of the ships fixed to that of the selected yards prototype, little opportunity was given for ideal planning.

Floor space was at a premium and only sufficient to provide satisfactorily for a specification that ensured the efficient working of the vessels two functions.

Model experiments, however, were essential and guidance was sought from the National Physical Laboratory (NPL).⁽¹⁰⁾

MERCHANT AIRCRAFT CARRIER SHIPS ("MAC" SHIPS)

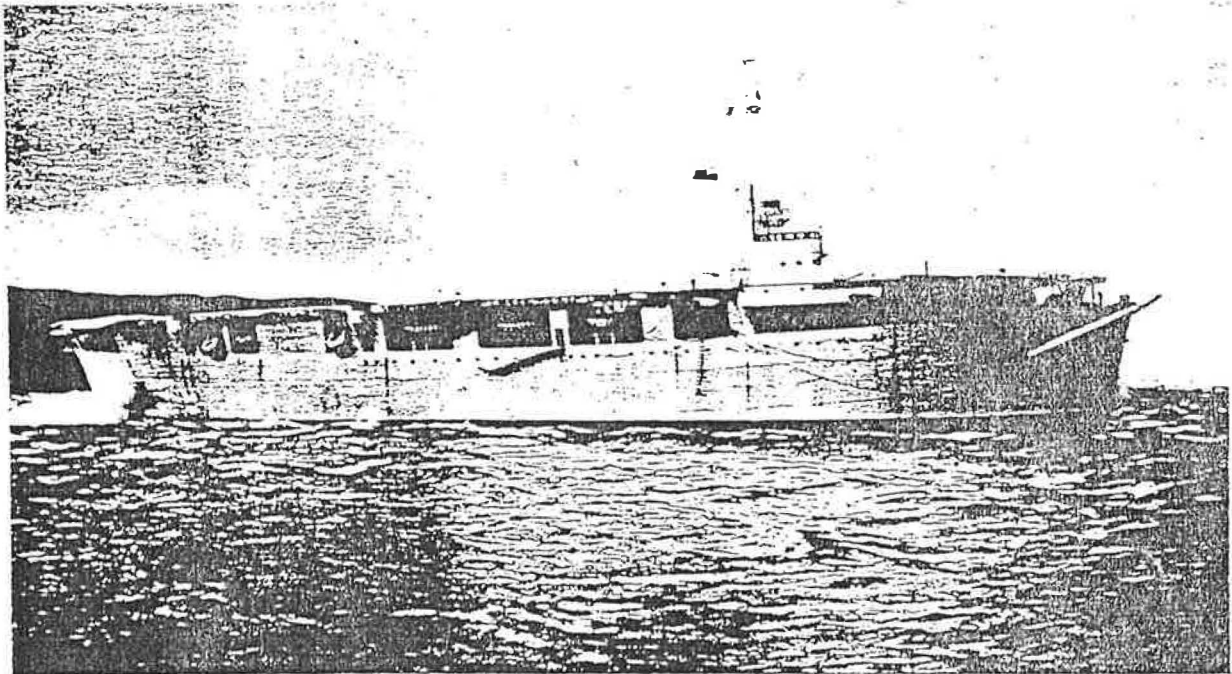


FIG. 1.—EMPIRE MACRAE—GRAIN "MAC" SHIP

Figure 1

Clearly shows the sheerstrake top and the openings cut in the plates to expose the lifeboats

MERCHANT AIRCRAFT CARRIER SHIPS ("MAC" SHIPS)

M.A.C. EMPIRE MACALPINE OUTLINE GENERAL ARRANGEMENT

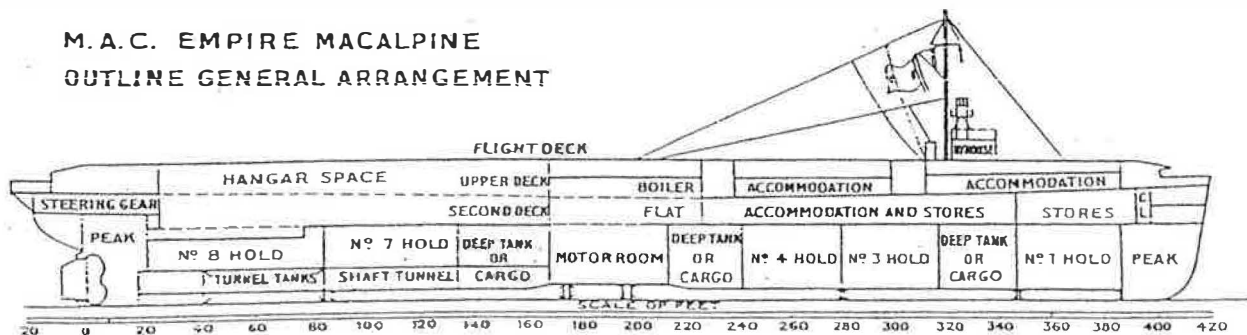


FIG. 2

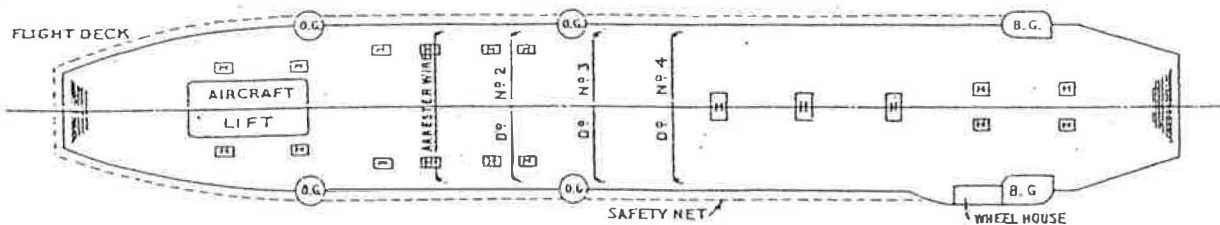


FIG. 3

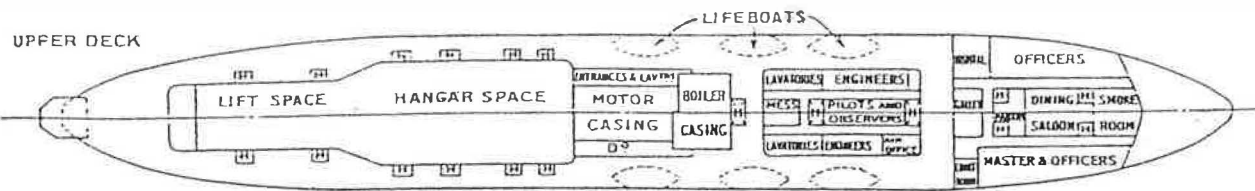


FIG. 4

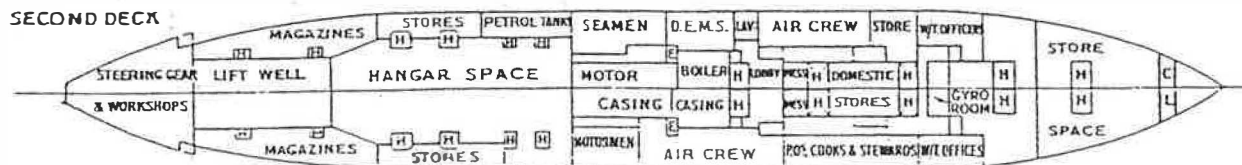


FIG. 5

The hull forms of all six vessels had already been tank tested and so no further tests were required. However, in view of the importance of the above water structure in aircraft carriers from the airflow point of view, advice was sought from the NPL.

The behaviour of short ships of this class when moving ahead at 12 knots in rough water was explored.⁽¹¹⁾ It was vital to obtain the maximum length of flat deck for the take-off and landing of aircraft and a profile was readily adopted. Each end of the flight deck was made similar because of the probability that landing over the bows might be desirable at some future date. The width of the deck at the ends was determined by the amount of overhang which could be supported by the sponson-shaped structure below the upper and flight decks.⁽¹²⁾

Solid plating in the sides between the sheerstrake top and the underside of the flight deck was impracticable having regard to the low freeboard and the liability of damage to their superstructure, particularly at the fore end when pitching in heavy seas. Openings in the side plating for lifeboats and rafts were limited in both size and number and had to be arranged so that the broadside surfaces balanced in a longitudinal direction about the centre of effort.

It was realised that the tendency to cut more and larger openings in the plating as construction proceeded may become essential. In order to offset any unbalancing effect due to this and lessen the angle of helm required to maintain a steady course with a side wind whose direction was nearly broadside on, the rudder area was increased by 15 per cent over normal requirements.

The construction of the flight deck was of vital importance. The hull of a ship flexes longitudinally in bad weather and this movement is doubled on a flight deck.⁽¹³⁾ If the flight deck was constructed in one piece cracking would occur in a very short time. In order to overcome this problem the deck was completed in three sections, one supported by the bow structure, one by the stern structure and one amidships which would have the strongest support. The points at which the sections met were covered by heavy steel plates.

Further experiments were conducted at the N.P.L. to ascertain the likely performance of the ships when operating in Atlantic weather conditions and running at 12 knots.⁽¹⁴⁾ It was believed that their short length might cause them to pitch and heave excessively. The experiments showed that at this speed the motion of the ship would not be excessive in wave lengths of less than 320 feet but that in regular trains of waves of approximately 400 ft both pitch and heave would be objectionable.⁽¹⁵⁾

It was felt, however, that the expertise of Deck Landing Officers was such that they could handle the landing of aircraft by taking advantage of phase variation when for a few pitches the movement of the ship is small and the period long enough to allow the aircraft to land.⁽¹⁶⁾

The grain ship aircraft carriers were the smallest of any produced before, or during, the war thus giving a pilot minimum space for landing.

Four arrester wires were stretched transversely across the deck at 30 ft intervals covering a 90 ft length of flat deck immediately abaft of amidships and with no crash or protective barrier fitted at the forward end (fig.3).⁽¹⁷⁾

The grain ships had one great advantage over the tankers because they were equipped with a hangar deck. The lifts fitted in these ships were available from the equipment ordered in anticipation of a considerable increase in the escort carrier programme and allowed for 4 Swordfish aircraft with folded wings to be easily accommodated. The hanger measured 142 ft in length, 38 ft in width and 24 ft in height which was served by a single platform lift 42 ft by 20 ft overall, electrically operated and capable of lifting a fully loaded plane of 5 tons from hangar floor to flight deck level in 50 seconds. Special ventilation, heating and lighting, fire appliances, including a sprinkler system were provided in this space.⁽¹⁸⁾

With normal naval practice, spaces for magazine, explosive stores and petrol compartments were away from the ships side and below the waterline. With these ships it was necessary to locate such spaces aft only at the side of the hanger between the second and upper decks.

The storage of aviation fuel with its high flashpoint required extra consideration. A special compartment, in which two pressure tested aviation fuel tanks were placed, were constructed so that it could be flooded and kept filled with fresh or sea water. Filling and filtering arrangements were controlled from a room placed under the flight deck and immediately over the tank compartment.

The propulsion machinery to these ships gave no problems. It was agreed that only diesel engines could be considered having regard to the removal of boiler smoke which because of dimensional limitations in the width of the flight deck had to be ejected horizontally from under the deck instead of vertically above the deck.

The standard ship of this type had machinery of 2,500 BHP capable of giving 11 knots. This was raised to 3,300 BHP and the additional 800 BHP gave an extra 1 1/2 knots. The auxiliary boiler outlet extended to both sides of the ship with a plate flap fitted to permit control of smoke to the lee side in order not to obscure flying operations on the flight deck.

Ships	Empire MacAlpine	Empires: MacAndrew; MacDermott; MacRae; MacCallum; MacKendrick
Propelling machinery	Doxford opposed piston four-cylinder	Kincaid-Harland B. & W., six-cylinder single acting 740 x 1,500 mm. Buchi supercharged
Type Dimensions	600 x 2,320 mm.	
Auxiliary boilers Type	Two Cylindrical multi-tubular, 12 ft. O in. dia. x 11 ft. 6 in. and Composite horizontal, 10 ft. 6 in. dia x 10 ft. 6 in.	Two Cylindrical multi-tubular 10 ft. 9in. dia x 10 ft. 6 in.
Working pressure	120 lb	150 lb.
Generators	3 at 65 kW, 220 volt, direct current	2 at 125 kW, 220 volt, direct current

The first vessel Empire MacAlpine, built by Burntisland Shipbuilding Co. was ordered in June 1942; the keel was laid on August 11th, 1942; the launch took place on December 23rd 1942 and the completed vessel, after inspection and trials at the shipyard, was handed over to the Managers appointed by the Ministry of War Transport on April 21st, 1943.

This period of only eight months was a creditable performance by Burntisland who worked in association with William Denny and Lithgows Ltd.

The total effort entailed in the production of the ships showed an increased cost as compared with a normal tramp ship of only 25% whilst the increased steel weight content amounted to nearly 20%.

A full grain cargo was carried on the maiden homeward passage of the Empire MacAlpine and no difficulties were experienced at either end of the voyage in berthing.

MAC ship Chronology

MAC-SHIP CHRONOLOGY	TYPE	DECK CODE	SHIPBUILDER - Launched	CONVERSION TO MACSHIP	DATE IN SERVICE	POSTWAR MERCANTILE SERVICE
EMPIRE MacALPINE	[G]	MH	Burntisland De 42	builders	14 Ap 43	1946 Derrynane 1970 broken up Hong Kong
EMPIRE MacANDREW	[G]	MK	W Denny Bros My 43	builders	Jy 43	1947 Derryheen 1970 sold for scrap
RAPANA	[A]	MV	Wilton-Fijenoord Ap 35	Smiths Dock North Shields	Au 43	1950 Rotula 1958 scrapped Osaka, Japa
EMPIRE MacRAE	[G]	MU	Lithgow Ju 43	builders	Sp 43	1947 Alpha Zambesi 1954 Tobon 1967 Despina
AMASTRA	[A]	MC	Lithgow De 34 [Kincaid]	Smiths Dock	Sp 43	1949 Idas 1955 BU at Spezia, Italy
ACAVUS	[A]	MA	Workman Clark No 34	Silley Cox Falmouth	08?0c 43	1952 Iacra 1963 broken up La Seyne
ANCYCUS	[A]	MF	Swan Hunter Oc 34 [Hawthorn-Leslie]	Palmer's Hebburn	Oc 43	1952 Imbricaria 1955 BU at Spezia, Italy
EMPIRE MacKAY	[B]	MM	Harland & Wolff Ju 43 [Govan]	builders	No 43	1946 British Swordfish 1959 scrapped Rotterdam
EMPIRE MacCOLL	[B]	ME	Cammell Laird Jy 43	builders	No 43	1946 British Pilot 1962 scrapped Gare Loch
EMPIRE MacMAHON	[A]	MJ	Swan Hunter Jy 43 [Hawthorn-Leslie]	builders	De 43	1946 Naninia 1960 scrapped Hong Kong
EMPIRE MacCABE	[B]	ML	Swan Hunter My 43 [Hawthorn-Leslie]	builders	14 De 43	1946 British Escort 1962 scrapped Hong Kong
EMPIRE MacCALLUM	[G]	MN	Lithgow Oc 43	builders	De 43	1946 Doris Clunies 1960 scrapped Osaka, Jap
EMPIRE MacKENDRICK	[G]	MO	Burntisland Sp 43	builders	16 De 43	1946 Granpond 1975 scrapped at Split
ALEXIA	[A]	MP	Bremer Vulkan De 34	Greenwells Sunderland	30 De 43	1951 Ianthina 1954 scrapped at Blyth
MIRALDA	[A]	MW	Nederlandse Dok Jy 36	Palmer's	Ja 44	1950 Marisa, scrapped 19
ADULA	[A]	MQ	Blytheswood Ja 37 [Kincaid]	Silley Cox Falmouth	08 Fe 44	Adula 1953 scrapped Briton Fer
GADILA	[A]	MR	Howaldtswerke De 34	Smiths Dock	16 Fe 44	?? Gadila? scrapped 19
EMPIRE MacDERMOTT	[G]	MS	W Denny Bros Ja 44	builders	Mr 44	1948 La Cumbre
MACOMA	[A]	MX	Nederlandse Dok De 35	Palmer's Hebburn	01 Ap 44	?? Macoma 1959 scrapped

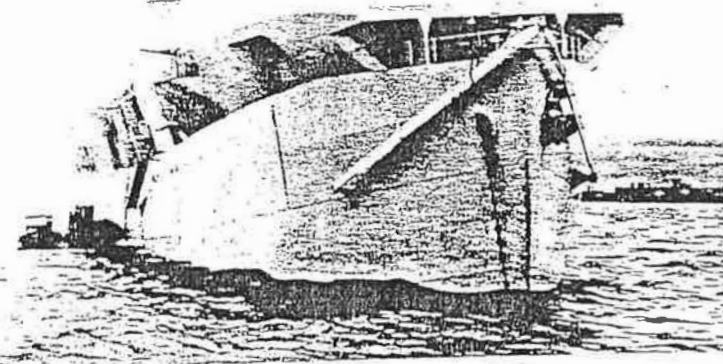
TYPE; A = Anglo-Saxon Tanker [Shell] B = British Tankers [BP] G = Grainship

[Dave Wellman, October 15]

GRAIN CARRIERS



MAC Grainship
Empire MacRae
Built and converted
by Lithgows
In service



Study - MAC ship.
This is the grainer
Empire MacAndrew,
converted by Denny
Brothers. She appears to be
fitted with a Type 272
surface/air search RDF set,
with its scanner cabinet on
the stump trellis mast on the
after part of the bridge
island.

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3. ADM 15361.
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5.2 TANKERS

Proposals for the conversion of tankers into MAC ships were under consideration concurrently with the Grain ship proposals, but little progress was made in the initial stages because of difficulties in procuring the release of suitable modern tankers.

Admiralty doubts were also raised because such vessels were engaged in the carriage of fuel cargoes of a low flash point considered to be dangerous under normal conditions, but much more so when combined with the operation of aircraft. ⁽¹⁾

However, John Lamb and a team of Anglo Saxon engineers submitted plans and managed to convince the Admiralty of the feasibility of using tankers as MAC ships and a Cabinet decision was made calling for a MAC ship programme for completion by the Winter of 1943 (see Note 1). ⁽²⁾ In order to comply with the programme nine tankers (see figures) were immediately withdrawn from the Anglo Saxons Petroleum Company's fleet for conversion and the full development and final detailed plans covering all these vessels was undertaken by Palmers of Hebburn, in association with Smiths Dock Co.Ltd., North Shields.

In addition, plans for four new ships were prepared by the Admiralty (see figs. 4-6) and these would eventually become part of the B.P. Company. ⁽³⁾ The work to be completed on the nine Anglo Saxon ships was helped by the expansion of the Shell Company prior to the War. In 1907 Shell had amalgamated with the Royal Dutch Oil Company and the Anglo Saxon Petroleum Company had been founded to handle transport and storage. ⁽⁴⁾ From that time all ships belonged to Anglo Saxon flying the British flag. Prior to the Second World War, Shell had embarked on an ambitious shipbuilding policy to enlarge their fleet of tankers. Included in this plan were three batches of new ships. A dozen ships nicknamed the 'Triple Twelves' which were all motor ships were delivered between 1935/37; a further sixteen were delivered between 1936/39 and a further 18 D. class were delivered between 1936/39. ⁽⁵⁾

The 'Triple Twelves' were so called not because there were twelve of them but because each had a capacity of 12,000 dwt, a service speed of 12 knots and a fuel consumption of twelve tons a day. They had long and low welldecks giving room for boats, rafts and arrester gear and were able to sail in loaded trim with either ballast or cargo.

The selection of so many similar vessels was of great advantage in planning, and considerably assisted the measure of standardisation in the actual conversion work. ⁽⁶⁾ These vessels appeared to be better balanced than the grain ships because of the open superstructure and a more elegant two-storied bridge erection.

The job was, however, not easy and many kinds of technical difficulties had to be overcome. The superstructure had to be removed and fitted with a sectional flight deck; upright funnels had to be replaced with horizontal ones; an island structure on the starboard side had to be installed, incorporating navigating bridge, aircraft control and signal top. ⁽⁷⁾ In addition, gun sponsons for two Bofors and six Oerlikens had to be mounted on the sides and lifeboat davits had to be relocated.

Allowance had to be made for approximately 63 more personnel on board and accommodation was built amidships for airmen, ground staff, doctors quarters and an Air Staff Officer with appropriate briefing room. ⁽⁸⁾ These alterations were helped by many of the larger sections being prefabricated away from the yard and included gun sponsons, cabin units and aviation spirit tanks together with sections for the flight deck. These were raised and fitted all in one piece, the total weight of the new structure being 1100 tons, most of which was the flight deck and its supports which were arranged on either side of the catwalk now under cover.

The propelling power of these vessels was considered satisfactory as all were considered capable of fulfilling the specified 11-knot speed and could develop 3,300 B.H.P. ⁽⁹⁾

Although the grain ships were better equipped on a power basis as they had a larger reserve of power above that required for the normal service speed.

The generator capacity in all the existing vessels was increased to cover for an additional electrical load. The main particulars of the machinery installed were as follows:

Merchant Aircraft Carrier Ships ("MAC" ships) Tankers (Propulsion)

Ship	<i>Empire MacCabe</i>	<i>Empire MacColl</i>	<i>Empire MacKay</i>	<i>Empire MacMahon</i>
Propelling machinery Type	Swan-Hunter-Doxford Opposed piston, reversible, two- stroke	← -- Harland-Burmeister & Wain -- → Four-cycle, single-acting		Hawthorn-Werkspeer Single-acting, four-stroke
Dimensions	4 cylinders 600 × 2,320 mm. 3,300 B.H.P.	6 cylinders, 740 × 1,500 mm., 3,300 B.H.P.		8 cylinders 650 × 1,400 mm. 3,300 B.H.P.
Auxiliary boilers Type	2 12' 6" dia. × 11' 0" oil-fired	2 Single-ended, cylindrical, multi-tubular 12' 6" dia. × 11' 6" oil-fired	2 12' 6" dia. × 11' 0" oil-fired	2 13' 0" dia. × 12' 3" oil-fired
Working pressure	150 lb.	150 lb.	150 lb.	180 lb.
Generators	← ----- 2 at 30 kW and 1 at 35 kW, 110 volt direct current ----- →			

The auxiliary boiler smoke and main engine exhaust gases were disposed of through discharge trunks carried under the flight deck and extended each side to the after end of the deck. ⁽¹⁰⁾

The primary difference between the two types of MAC ship was the absence of hanger in the tanker type. To have provided such a space in these vessels would have completely altered the oil cargo piping and associated arrangements and extend the time for conversion work. It was therefore agreed to make other arrangements for the parking and storage of aircraft. ⁽¹¹⁾

In some minds, however, it was felt that exposure of the aircraft to all conditions of weather would result in their damage and immobilise them when most urgently required. Actual performance of the vessels showed later that there was little justification for this doubt but it existed and led to a series of model experiments being carried out at the National Physical Laboratory (see Note 2).

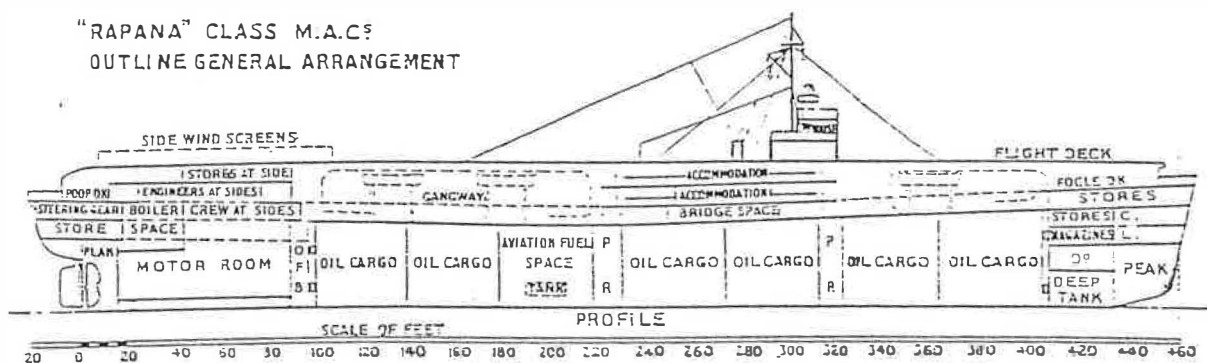
The flight deck was not a strength member and it was arranged in sections with an expansion joint between each, one joint placed immediately forward and aft of the midship erection with a further joint forward of the poop section and the joints were then covered with steel plates.⁽¹²⁾

This enabled the deck, together with its supports, to be designed for prefabrication.

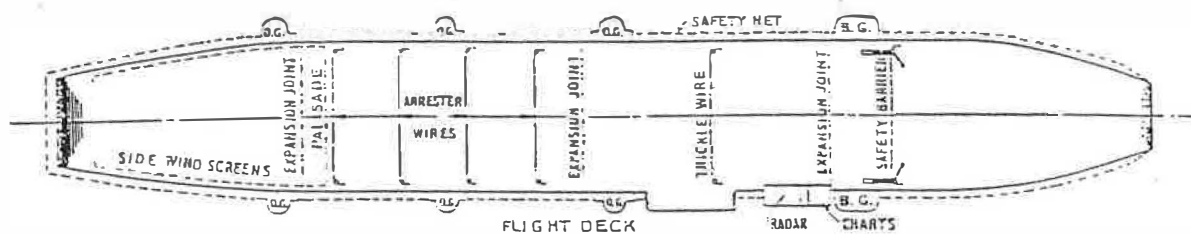
MERCHANT AIRCRAFT CARRIER SHIPS ("MAC" SHIPS)

Builder	Existing Vessels	Harland & Wolff (Govan)	Cammell Laird	Swan Hunter (Wallsend)	Swan Hunter (Newport)
Name of Vessel	Rapana Class	Empire MacKay	Empire MacGill	Empire MacManon	Empire MacCabe
Length (B.P. on L.W.L.) ..	460 ft. 0 in.	460 ft. 0 in.	463 ft. 0 in.	460 ft. 0 in.	463 ft. 0 in.
Length (overall)	482 ft. 9 in.	479 ft. 6 in.	481 ft. 7 in.	483 ft. 0 in.	485 ft. 9 in.
Length of flight deck	461 ft. 8 in.	460 ft. 0 in.	461 ft. 0 in.	461 ft. 6 in.	461 ft. 0 in.
Breadth on W.L.	59 ft. 0 in.	61 ft. 0 in.	61 ft. 9 in.	59 ft. 0 in.	61 ft. 9 in.
Breadth at flight deck	62 ft. 0 in.	62 ft. 0 in.	62 ft. 0 in.	62 ft. 0 in.	62 ft. 0 in.
Mean draught loaded	27 ft. 6 in.	27 ft. 2 1/2 in.	27 ft. 7 1/2 in.	27 ft. 6 in.	27 ft. 6 in.
Freeboard to flight deck ..	32 ft. 0 in.	31 ft. 6 in.	32 ft. 9 in.	32 ft. 6 in.	32 ft. 6 in.
Deadweight (tons)	11,009	11,246	11,508	11,000	11,450

"RAPANA" CLASS M.A.C.
OUTLINE GENERAL ARRANGEMENT



(Fig. 1)



(Fig. 2)

Dead weight, original vessel 12,240 tons
Dead weight, converted vessel 11,010 tons
Dead weight, decrease 1,230 tons

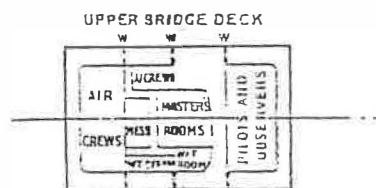
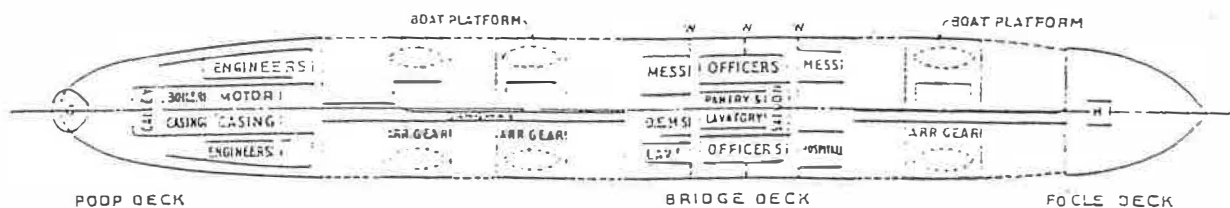


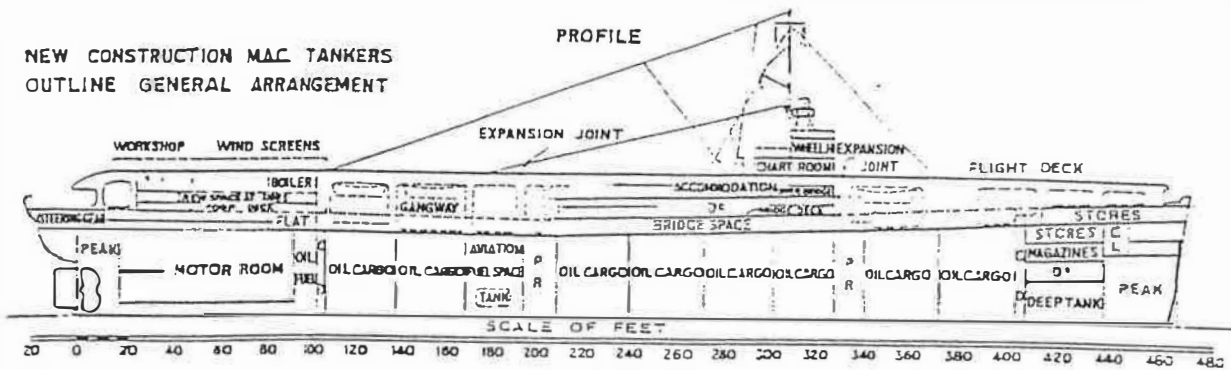
Fig. 3



(Fig. 3)

MERCHANT AIRCRAFT CARRIER SHIPS ("MAC" SHIPS)

NEW CONSTRUCTION MAC TANKERS OUTLINE GENERAL ARRANGEMENT



(FIG. 4)

Flight deck and other arrangements generally similar to existing tankers *Rapana* class

UPPER BRIDGE DECK



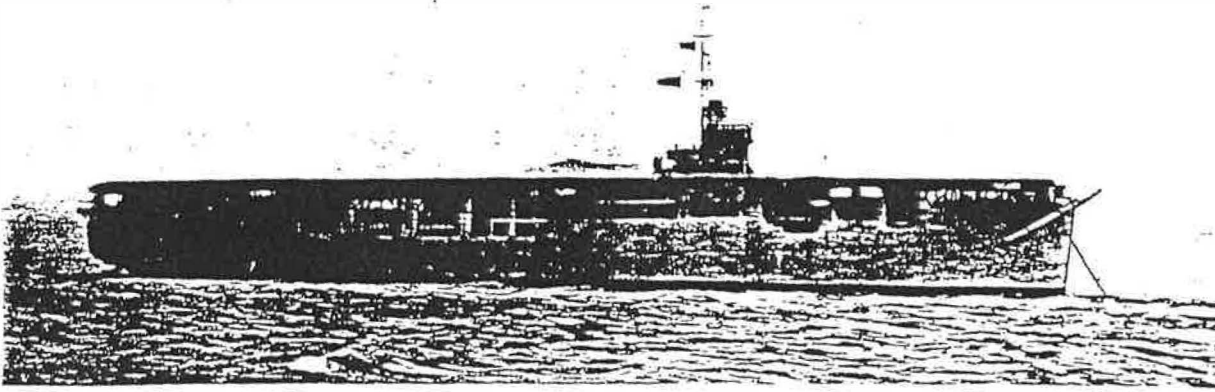
(FIG. 5)

BRIDGE DECK

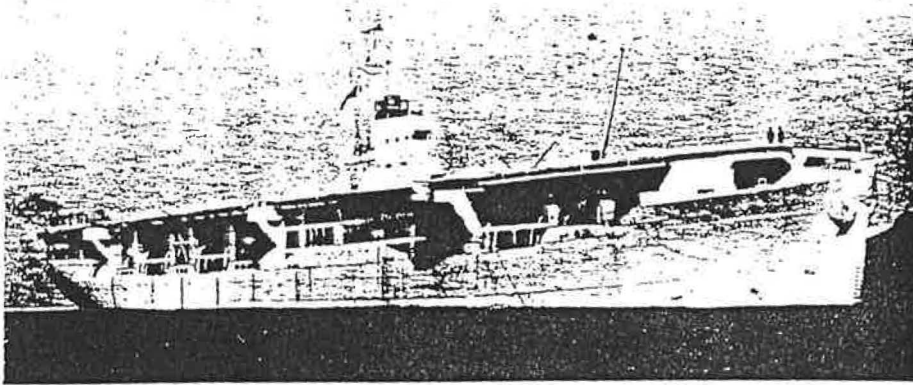


(FIG. 6)

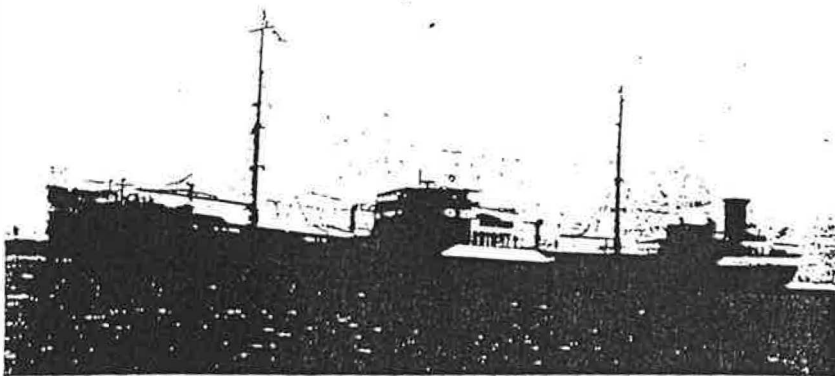
MERCHANT AIRCRAFT CARRIER SHIPS ("MAC" SHIPS)



(FIG. 13.) *EMPIRE MACKAY*—OIL TANKER "MAC" SHIP. NEW CONSTRUCTION TANKER



(FIG. 14.) OIL TANKER "MAC" "RAPANA" CLASS



(FIG. 15.) M.V. "RAPANA" BEFORE CONVERSION

The addition of a superstructure equal in weight to approximately 25 per cent of the weight of the vessel was achieved with minimum disturbance to the existing structure. The flight deck supports were electrically welded to doubling plates on the weather decks and were connected in a similar manner to the deck stringers and sheerstakes. In no case was the upper deck, or the poop, bridge or forecastle decks pierced with the main hull framing.

The storage or parking area for four Swordfish (see figure 1) aircraft was arranged at the after end of the flight deck. This space was closed in by an arrangement of hinged wind screens on each side of the deck and by a palisade of portable screens placed across the fore end of the space. Eyebolts screwed into deck sockets were made to take special lashings. A safety net was provided around the outside of the flight deck to within 12 feet from the fore end of the deck.

The arrester gear was identical to that found in the grain ships with an additional unit to operate the trickle wire and safety net. This barrier was placed across the deck at a distance of about 100 feet from the fore end which was supported by side stanchions raised and lowered hydraulically. ⁽¹²⁾

It was possible to use one of the main centre tanks for storage of aviation fuel which had joined the main pump room and was used as the control position for the fuelling system.

The electrical installation was less than in the grain ships and largely influenced the time taken in conversion of the existing tankers. The main differences in the specifications for the two types of ships were those concerned with the omission of fumes from the hangar and its special equipment. There was no need to provide mechanical ventilation to the cargo spaces.

The average time taken for the conversion work on the existing tankers was six months whilst the extra time taken to complete the new tankers was just under three months. ⁽¹³⁾

The names of the ships withdrawn from the Anglo-Saxon fleet for conversion and their repair establishments were as follows:

M.V. Rapana :	Smith Dock Co.Ltd.)
M.V. Amastra :	Smith Dock Co.Ltd.) North Shields
M.V. Gerdilla :	Smith Dock Co.Ltd.)
M.V. Aneylus :	Palmers Hebburn Co.)
M.V. Maralda :	Palmers Hebburn Co.) Hebburn-on-Tyne
M.V. Macona :	Palmers Hebburn Co.)
M.V. Acarus :	Silley Case & Co.Ltd.) Falmouth
M.V. Adula :	Silley Case & Co.Ltd.)
M.V. Alexia :	T.W. Greenwell & Co.Ltd.) Sunderland

British Petroleum Ships ⁽¹⁴⁾

Empire MacCabe :	Swan Hunter (Hawthorne Leslie)
Empire MacKey :	Harland & Wolff - Gevan
Empire MacColl :	Camel Laird - Birkenhead

The vessels Gerdilla and Macona at the time of their withdrawal were sailing the Dutch flag under the management of an associated firm in the Anglo-Saxon group. These vessels, when converted, continued in Dutch hands, and had the distinction of being the first aircraft carrier ships to sail under the Dutch flag.

Note 1

Use of Tankers

The fact that Admiralty prejudice against the use of tankers for conversion to MAC ships was eventually overcome was largely due to the intervention of John Lamb an engineer with Anglo-Saxon.

In 1927 the Company had taken delivery of ten diesel driven 10,000 dwt ships, their engines being entirely new and of untried design.

These engines turned out to be intensely unreliable and Lamb, as an Assistant Superintendent Engineer, soon became an expert in their repair with his services on constant call. There was always at least one of these ships broken down somewhere in need of attention and it was usually Lamb who was called upon to supervise the work.

By 1939 Lamb had enormous experience of the working and ability of tankers under difficult conditions and he headed a team of engineers devoted to improving safety.

His early research devised a system to help keeping tankers afloat after being mined or torpedoed by allowing compressed air to be fed into any part of a ship simultaneously forcing water out of a ruptured tank and providing buoyancy. The system was found to have many other uses: it could power sea water pumps for firefighting, shift cargo from a damaged tank and even steer the ship.

By mid 1941 the system was standard in all ships and Lamb and his team turned their attention to providing fireproof, covered lifeboats and equipment for keeping survivors of torpedoed ships alive whilst struggling in oil-covered waters.

A man of vision and ingenuity he was able to see immediately the potential of MAC ships and drew up plans which were submitted for consideration. It was his effort and enthusiasm combined with experience of safety matters that convinced the Admiralty that the dangers of aircraft landing on tankers was a risk worth taking in the existing circumstances.

Note 2

Model Experiments

The experiments carried out were for the purpose of investigating the effect of adding a hanger to tankers already provided with a flight deck and to ascertain the influence of the hanger on speed, wind resistance and steering in calm waters and in waves.

An analysis of the reports showed:

- i) The plating-in of the gaps below the flight deck for hanger purposes led not merely to lower wind resistance but also to greater manoeuvrability in high winds.
- ii) The presence of a hanger had no appreciable effect on the turning movements.

Early experiments had been carried out by Hughes (Research Scientist at NPL) in 1930 concerning steering problems on ships with and without a closed hanger. ⁽¹⁵⁾ The equipment used gave the turning moments on the ships hull for various rudder angles and torque at the rudder stock. From the set of data obtained the effectiveness of the rudder under different wind and sea conditions could be judged, an important consideration in landing aircraft on a moving platform.

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6. SQUADRON FORMATION AND ORGANISATION

6.1 836 SQUADRON BACKGROUND

836 Squadron assembled at Eastleigh on 1 February 1942 and was officially formed after passage to Jamaica at Palisadoes* on March 1st 1942 with 6 Swordfish MK1's for torpedo bomber reconnaissance work. The station was known as HMS Buzzard. The location served two purposes. It enabled the Royal Navy to train its aircrews on British Colonial territory and the squadron was on hand to embark as the new Escort Carriers which were being built in American shipyards to take their place in the war against the U-boats in the Atlantic. By April of 1942 Squadron personnel and aircraft were all in place and ready to operate as a front line unit. It was, however, to be a year before the squadron became the official unit for MAC Ship operations and the first deck landings were made on the Empire MacAlpine in 1943. ⁽¹⁾

It is a long and difficult process building up a squadron to an efficient and confident unit capable of having the necessary technical ability and with confidence to undertake operations against tough and capable enemy forces in adverse weather conditions. In the year available 836 grew into a respected and versatile squadron able to undertake a variety of specialised operations resulting in selection for the unique conditions required on MAC Ships. The first phase in Jamaica did not last long. On 13th May the Squadron moved northwards to join HMS Biter in New York and take passage for the U.K. However, the time spent in Jamaica was a valuable experience to aircrew. ⁽²⁾ The presence of U-boats in the Caribbean and the resulting tremendous toll of shipping resulted in the squadron making searches and patrols in the area, and the provision of escorts for ships leaving or approaching Jamaica. This proved to be a valuable experience. In New York the Squadron's officers were billeted in the Brabizon Plaza Hotel where the Royal Navy had taken a floor for the use of itinerant officers on passage or waiting for ships being built or prepared in American yards. ⁽³⁾

* Royal Naval Air Station in Jamaica

HMS Biter was almost ready and on 2nd July the Squadron flew on board and worked up in Long Island Sound doing deck landings and testing communications before going off to sea. Flying operations did not prove completely successful. Before getting into the Atlantic the ship had taken on board a batch of RNVR fighter pilots fresh from their final training at Pensacola* and the first deck landings saw the loss of two tail wheels and the total wrecking of two machines. The 836 Squadron aircrew heard the deck tannoy explain, for the information of spectators, that none of the pilots had landed on a carrier before. This did not exactly help the confidence of the 836 Swordfish pilots, some of whom were similarly lacking experience. ⁽⁴⁾

Out at sea the Squadron kept up flying anti-submarine patrols when the weather was suitable. This enabled the pilots to carry out the demanding flying requirements necessary for accurate navigation and also to gain more experience on deck landings. The Observers had the opportunity of testing their dead reckoning navigation from a moving base with searches over a 100 miles from the convoy. The Telegraphist Air Gunners could familiarise themselves with radio procedures and the preparation of coded messages and test the firing capability of the guns. Two aircraft had been wrecked before reaching harbour. In both cases dangerous situations were created, the first being caused by the collapse of a port oleo on landing resulting in the depth charges becoming dislodged and rolling around the deck whilst armed. The second accident was caused by pilot error when the aircraft hit the deck and slewed into the island. The engine fell off on impact nearly hitting an airman standing on the deck. The experience on HMS Biter was valuable and it was fortunate that there were no casualties. New relationships had been established amongst the aircrew which were to prove of great importance in the future.

* American Naval Air Base for pilot training

The Squadron arrived at HMS Daedalus, Lee-on-Solent in early July where it was joined by its new Commanding Officer, Lt. Commander Ransford Slater whose influence was to prove vital on the development of the unit into an effective force prepared for operational duties on MAC ships. By mid July new Swordfish MKII's had arrived and the Squadron was complete and crewed up as follows: ⁽⁵⁾

Pilots	Observers
Lt. Cmdr Slater	Lt. Turner
Lt. Fox	S/Lt Palmer
S/Lt Barrett	S/Lt Piercey
S/Lt Blakey	S/Lt Robertson
S/Lt Lisle	S/Lt Cartwright
S/Lt Johnstone	S/Lt Taylor
S/Lt Singleton	S/Lt Muir
S/Lt Aggleton	S/Lt Allen
Lt Blacaw	S/Lt MacVe

These pairings, seeming to be compatible, became more or less permanent. The squadron began to work as a team both in the air and the crew room as a working up period began. This meant refining and applying within the wider context of the Squadron the individual skills learnt under training. There was much tight formation flying at both low and high level, depth charge and bomb dropping on specified targets and practice work with special equipment (later called Anti-Surface vessel radar). In these exercises crews changed around frequently so that wider relationships could be established and cliques avoided to encourage a better team spirit. ⁽⁶⁾ Following the successful completion of training, morale was high due mainly to the encouragement of the CO and his senior lieutenants, a fact that was to be appreciated when the Squadron moved on to Machrihanish in early August 1942.

Machrihanish was disliked by all aircrew for a variety of reasons, the first being its

geographical location. The airfield itself was in a valley which cut the mountains of the Mull of Kintyre from east to west and was subject to appalling weather conditions. It was not only unpleasant to fly in this area but also dangerous. This was not helped by the fact that it was used for training in all weather night strikes. It should be pointed out, however, that these conditions in training were ideal preparation for Squadrons that were to embark on operations in the North Atlantic. There were days when flying was not possible but the time was not wasted. Observers did plotting exercises to keep their navigational skills sharp whilst the pilots made use of the link trainer to sharpen up their flying technique.

On 31st August an incident occurred which illustrated the problems which can be experienced in bad weather conditions. It was a day on which no one was expecting to fly because of low cloud with a damp, dense mist. In spite of this the Control Tower* said that flying was on so that the C.O, Lt.Cdr Ransford Slater, and three aircraft took off for an anti-submarine bombing exercise at Skipness. As the fifth aircraft prepared for take-off red very signals were fired and the flight abandoned. S/Lt. O Johnston, the pilot of this aircraft, was not alone in wondering how his colleagues would fare. Meanwhile, the first three aircraft flew in ever-thickening fog over Cambeltown**. The fourth aircraft had not yet joined the flight and was still climbing after leaving the airfield.

The CO ordered the three aircraft into line astern and as the pilots throttled back to execute the order Slater found himself flying into a hillside at the harbour and turned to starboard.

His colleagues, already reducing speed took evasive action and ditched into the harbour. The fifth aircraft had now arrived over Cambeltown and reported what was going on in the harbour and followed the coastline northwards to return to base. Still

* Air traffic Control Tower at Machrihanish

** Situated on the Mull of Kintyre

in thick fog and unsure of the gradient of the hills that barred his way westwards he decided to make a precautionary landing on the seashore halfway up the coast. The aircraft landed in the water and was written off, the only casualty being the Observer with a broken arm and a badly damaged eye. The fact that there were no fatalities in this incident was the only satisfactory factor to emerge.

The loss of three aircraft in one day indicated the need for constant pilot training in instrument flying in poor visibility, and for weather conditions to be good enough for Observers to navigate by dead reckoning and map reading especially where no radar was available. Specialised training requirements kept most F.A.A. aircrew constantly on the move as there was no single base which could adequately meet all requirements.

In November, the Squadron moved to HMS Jackdaw at Crail in Fife on the east coast of Scotland. The objective of the training at Jackdaw was to sharpen up aircrew ability to a peak where the Squadron would achieve operational efficiency. The training was hard and demanding. It included dive bombing, navigation, dummy anti-submarine exercises and torpedo attacks by day and night. Special emphasis was given to radar exercises designed to aid navigation, illustrating the importance being given to this new system now becoming available.

At this stage that the Squadron received new aircraft. These were Swordfish Mark II, all of which were painted black and thus acquired the name "Blackfish"*. The Squadron was to fly operationally in these aircraft after a final move to St. Merryn in Cornwall for air gunnery training. Much of the time at St. Merryn was spent on dive bombing and fighter evasion which pointed to the fact that the time was near when the Squadron could be in action against enemy fighter aircraft. ⁽⁷⁾

*A term not generally used by aircrew

The spirit within the squadron was one of confidence as the bonds which had been developed in Jamaica now enveloped all. The Observers were well aware of their good fortune in having capable pilots who, in their turn, could trust the Observer's navigation and competence in handling radar.

The standards of maintenance of aircraft and equipment was high and unserviceability in either rare. Relationships between aircrew and ground crew were excellent, helped by the group of Telegraphist Air Gunners who as non-commissioned officers had a foot in both camps and liaised well between officers and ratings. However, the main credit for this situation must go to the personality and qualities of Lt.

Commander Slater, who was proving to be an exceptional C.O. with that rare blend of reliability, authority and a readiness to set realistic standards. On 17th December the Squadron went on Christmas leave, an event that heralded not only the end of the year, but the end of training and the beginning of operational activity. ⁽⁸⁾ The new base was to be at Thorney Island, an RAF Station of Coastal Command. The station was already occupied by RCAF Squadrons flying Hudsons and Hampdens which were carrying out nightly radar sweeps to Le Havre and Cherbourg and it was to be the task of 836 Squadron Swordfish to attack any shipping that was sighted by these aircraft. The second task involved mine laying trips, probably laid on through intelligence sources in France, and usually concentrated on Cherbourg or Le Havre. This entailed flying across the Channel at a maximum altitude of 150 feet to avoid detection by radar and enemy fighters. The mines were dropped in a harbour or channel. These activities called for a very high degree of skill and determination from all aircrew. Pilots required incredible concentration flying on instruments for over three hours at very low altitude.

The imponderable was the barometric pressure which could, and did, vary on either side of the Channel. Thus an altimeter set at the correct barometric pressure on take off could read high or low over the target area and result in the aircraft flying lower than indicated, creating a highly dangerous situation. The observers had a particularly hard task, being expected to provide absolute navigational accuracy without which any sortie was pointless. Navigation was by dead reckoning. The wind Vector was calculated by taking back bearings on flame floats. This was particularly difficult in

windy weather conditions. ⁽⁹⁾ The final position was confirmed from landmarks on the French Coast and on approaching the target both the Observer and Air Gunner kept a constant look out to warn the pilot if he was flying too low. It was perhaps understandable that under these conditions two aircraft were lost whilst minelaying. One flew into the sea: the pilot and air gunner survived but the observer was drowned. The second aircraft was forced to ditch in the Channel and in this case the pilot was the only survivor. Whilst on Thorny Island the Squadron was augmented by additional aircrews to bring it up to its highest numerical strength since its formation.

The Squadron left Thorny Island in March 1943 and flew once again to Machrihanish where the black Swordfish were exchanged for new ones with sea camouflage. Anti-submarine training commenced in earnest once again. It was now evident that the immediate future of the Squadron was to be in the Battle of the Atlantic and a move to RAF Ballykelly in Northern Ireland, close to the MAC Ship base at RNAS Maydown seemed to support this view. ⁽¹⁰⁾

Shortly after arriving at Ballykelly the CO informed squadron personnel that they would be involved with an entirely new Carrier Escort Vessel known as Merchant Aircraft Carriers.

At this time the MAC Ship MacAlpine was nearing completion, came into service on the 14th April 1943. It immediately commenced speed and engine trials before being brought into Leith for final servicing and proceeding round to the Clyde for flying trials. The first landing ever made on a merchant ship was at 14.00 hours on 7 May 1943 by Lt Cdr Ransford Slater with his Observer, Lt. Jim Palmer and Telegraphist Air Gunner Petty Officer Robinson. ⁽¹¹⁾

Immediately after this landing the entire ship's company was addressed in the ship's hanger by Admiral Boyd, the Fifth Sea Lord, his words giving great encouragement to those concerned with the operation of the ship. Later in the day Admiral Boyd, together with Captain Pugh were flown off the ship by Ransford Slater and taken to

RNAS Machrihanish where the other squadron pilots were collected and returned to make solo landings and then carry out circuits and bumps. Throughout the day, Ransford Slater carried out nine deck landings, a remarkable feat of leadership which laid down the high standards expected from the remainder of the aircrew. On 8th May trials were delayed due to a howling gale, bad visibility and pouring rain but continued on the 9th when Slater landed in a 45 knot gale to indicate what was possible on a MAC Ship even in extreme conditions. His standard of flying reached ever greater levels when he landed his Swordfish on its brakes with two depth charges hung up and without a hook which had been ripped off by contact with the lift which had been left accidentally slightly open. The aircraft was brought to a stop by heavy use of the brakes.

For some observers and air gunners the MacAlpine gave the first experience of a deck landing to aircrew occupying the rear seats of the aircraft. To many it was a strange situation to be entirely in the hands of the pilot, powerless to adjust to the heaving, fast approaching deck knowing that the speed would drop from 50/60 knots to zero in the space of a few seconds. It did not take long for the Observers and TAGS to assess the capability and skill of their pilots. Fortunately, with few exceptions, respect and confidence grew resulting in an efficient team. Where there was an irreconcilable clash of personalities, changes were inevitable and quickly applied by the C.O. of the Squadron. ⁽¹²⁾

Whilst trials were in progress in the Clyde area the Squadron used Machrihanish as its shore base as a matter of convenience. It continued there until the first MAC ship was ready to join a convoy. ⁽¹³⁾

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6.2 MAC SHIP FLIGHTS

In May 1943 836 Squadron was officially reformed changing the whole character and organisation of the squadron to meet the unique requirements of the MAC ships entering service within a period of approximately 18 months. The official base for the squadron was RNAS Maydown in Northern Ireland.

Lt Cmdr R O Slater was re-appointed as CO of the reformed Squadron and he retained sufficient members of existing squadron aircrew to cover the flying trials to be carried out on the MacAlpine. ⁽¹⁾ As each MAC ship neared completion, a new flight was formed at Maydown; three or four Swordfish as appropriate with their aircrew and aircraft in the squadron. This made it far larger than any other in the Navy and unique. Instead of being a single cohesive unit that flew and fought together, its component flights became autonomous when at sea, under their own flight commanders though still very much a part of 836. ⁽²⁾

Each new flight formed was identified by a letter from 'A' Flight onwards and would be set up at Maydown for approximately four weeks before joining a parent vessel in the Firth of Clyde. In ADM 12523 AM101829B the Admiralty recognised the fact that there would be 19 MAC ships available in the near future and that immediate action was required if sufficient aircraft and aircrew were to be available as each ship reached completion.

In solving this problem a delicate balancing act was necessary. There was the need, not only to supply the MAC ships, but also 6 Escort Carriers which were nearing completion. The solution offered was as follows:

- i) 833 and 834 Squadrons were to be attached to 836 Squadron and to be referred to as MAC Ship units.
- ii) 838 and 840 Squadrons were disbanded forthwith and their personnel absorbed into 836 Squadron.

- iii) In addition, and of great importance, additional pilots would be appointed to 836 Squadron to enable one to be trained as Deck Landing Control Officer for each MAC Ship unit.
- iv) FONAS was requested to nominate lieutenants, if available, as Flight Commanders with names reported to Admiralty.
- v) It was the intention to introduce a number of spare flights to meet requirements in emergency conditions depending on the resources available at the time. ⁽³⁾

This re-organisation provided 836 Squadron with 27 Swordfish aircraft to be organised by F.O.N.A.S. into MAC ships units of 3 aircraft each.

The increase in aircrew in 836 Squadron was of particular importance. Many of them were experienced flyers who had served on escort carriers, but it was still necessary to draft in personnel from second line Squadrons and personnel who had recently qualified after training to make up the great number of pilots, observers and air gunners required. ⁽⁴⁾ The final addition to the group was 860 Squadron which was formed at RNAS Donibristle* in June 1943, and manned by aircrew of the Royal Netherlands Naval Air Service. It was commanded by Lieutenant J Van der Tooren RNN with an RAF Flight Sergeant as senior NCO. British ground crews were replaced by their Dutch counterparts as they became available.

860 Squadron moved to Hatson** where the strength was increased to twelve aircraft and vigorous anti-submarine training was completed before finally moving to RNAS Maydown to supplement 836 Squadron.

This Squadron never became fully amalgamated with 836 but retained their squadron number and independence whilst providing crew for Flight S and flight T on the Macona and Gadila. ⁽⁵⁾

* RNAS DONIBRISTLE Naval Air Station near Glasgow

** RNAS HATSON Naval Air Station in Hebrides

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**836 squadron flight allocations
with dates of start formation**

A Flt	MacColl	28 Nov 43
B Flt	MacAlpine	21 Jul 43
C Flt	MacRaw	1 Oct 43
D Flt	MacKay	11 Oct 43
E Flt	Amastra	13 Oct 43
F Flt	Acavus	23 Oct 43
G Flt	Ancylus	2 Nov 43
H Flt	MacAndrew	11 Nov 43
J Flt	MacMahon	24 Dec 43
K Flt	MacCallum	24 Jan 44
L Flt	Rapana	31 Aug 43
M Flt	MacAndrew	13 Aug 43
N Flt	MacCabe	21 May 44
P Flt	Adula	9 Mar 44
Q Flt	Miralda	10 Feb 44
R Flt	MacCallum	21 Mar 44
S Flt	Gadila	Feb 44
T Flt	MacCallum	26 Jun 44
U Flt	MacAlpine	Feb 44
V Flt	Acavus	17 Apr 44
W Flt	MacKay	16 Jul 44
Y Flt	MacCallum	23 Sep 44
Z Flt	MacKendrick	30 Sep 44
O Flt	Acavus	Feb 44
O Flt	Macoma	June 44 from Acavus

	Ship	In service
G	Empire MacAlpine	14 April 1943
G	Empire MacAndrew	July 1943
T	Rapana	August 1943
G	Empire MacRae	September 1943
T	Amastra	September 1943
T	Acavus	8 October 1943
T	Ancylus	October 1943
T	Empire MacKay	November 1943
T	Empire MacColl	November 1943
T	Empire MacMahon	December 1943
T	Empire MacCabe	14 December 1943
T	Empire MacCallus	December 1943
G	Empire MacKendrick	16 December 1943
T	Alexia	30 December 1943
T	Miralda	January 1944
T	Adula	8 February 1944
T	Galida	16 February 1944
G	Empire MacDermott	March 1944
T	Macoma	1 April 1944

Key

G Grain ship

T Tanker

6.3 AIRCRAFT TYPE

The introduction of the MAC ship in 1942 immediately concentrated the minds at the Admiralty on the flying aspects concerned and the aircraft that would be best suited to the unique conditions that would be presented to aircrew. Their capability to overcome new and difficult problems was vital. The status of MAC Ships was clearly defined in ADM13087 M/T. D(DEMS) dated 7th April 1943 paras 3-5.

MAC ships would fly the Red Ensign and would not be used for offensive operations, nor would they make ocean voyages independently. ⁽¹⁾ Upon satisfactory completion of trials normally carried out by Merchant Ships they would sail to the Clyde or other suitable area to embark an air unit. Aircraft trials and work up would then be carried out for a period of three weeks before sailing in convoy.

The aircraft selected for MAC ships would need to be of rugged construction, reliable and allow maintenance to take place under extremely difficult conditions. Working within the restricted area of a convoy a high degree of manoeuvrability would be essential to meet the time factor involved with the take-off and landing of the aircraft. In order to resolve this issue the Department of Air Research had contemplated the use of special aircraft, autogyros and helicopters but in all cases these had proved impracticable for a variety of reasons. ⁽²⁾ Greater success had been achieved however, in suggesting modifications to existing aircraft to improve overall performance and to make them more suitable for escort carriers and MAC Ships with their shorter decks and slower speed. (Note 1.)

In addition to the work being carried out by the Research Department a new Committee was set up in August 1942 to examine how existing aircraft could be used on new Auxiliary Carriers now under construction in the U.S.A. The pertinent factor to be considered was that the flight deck of these ships would be 540ft close to the specification of a MAC ship.

Taking into account the past performance of aircraft, their flying characteristics and the observations of experienced aircrewmen it became apparent that only 3 types of aircraft were capable of meeting the necessary requirements. The rate of production and the acquisition of spare parts also had to be considered if first line aircraft on operations were to be kept on a high degree of readiness. ⁽³⁾

The aircraft were as follows:

- i) Fairey Albacore Three seater torpedo dive bomber.
- ii) Fairey Barracuda Three seater torpedo bomber. ⁽⁴⁾
- iii) The Fairey Swordfish Three seater Reconnaissance, Anti-submarine.

In December 1942 the Committee agreed that for anti-submarine warfare, the Swordfish was the most suitable aircraft.

The Barracuda was discarded because it required too long a take-off for short deck carriers and major modifications would be necessary before this problem could be overcome and it would then become less effective than the Swordfish. This aircraft was very unpopular with pilots having several unpleasant vices including a tendency for a wing to flip causing a spin.

The Albacore, when it first appeared, seemed to have everything going for it. ⁽⁵⁾ Neat in appearance and with an enclosed cabin providing such luxuries as heating, a windscreen wiper and automatic emergency dinghy ejection, it nevertheless failed to come up to expectations. In its early days it was fitted with a Bristol Taurus II engine which had experienced development problems. Even after this engine was replaced by the Taurus XII it was never completely satisfactory and never experienced the same reliability as the Pegasus engine fitted to the Swordfish. In any case the Albacore had reached its zenith by 1942 and was being replaced by the Swordfish (Figs.1 and 2).

The Swordfish had a remarkable background. At the beginning of World War 2 the Fleet Air Arm had 13 Squadrons operational with this aircraft. Its initial operations

were concerned with torpedo attacks, the most successful being the attack on the Italian Fleet at Taranto which in a short space of one hour irrevocably changed the balance of naval power in the Mediterranean. ⁽⁶⁾

The last of the great Torpedo attacks made by these aircraft was made in a futile attempt to prevent the German battle cruisers Gneisnau and Scharnhorst from escaping eastwards in the English Channel. ⁽⁷⁾ Not a single aircraft survived. This experience gave confirmation of the fact that it was no longer a practical proposition to deploy Swordfish on torpedo attacks. This led to the redeployment of the aircraft into an anti-submarine warfare role (ASW). It was also used for mine laying and anti-E Boat operations in the Channel.

It was obvious that demand for new aircraft would be heavy both to equip the new carriers and to replace aircraft losses in existing Squadrons through enemy action and accidents. By December 1942, the Blackburn Aircraft Company at Brough had produced 271 Swordfish. ⁽⁸⁾ ★ The new Carriers were due in 1943 and time was an essential factor. It was now certain that Blackburn were the only company capable of meeting requirements. The Committee set a production target of 45 aircraft a month and to show confidence ordered another 250 Swordfish above existing contracts. These were to be the Mark II aircraft specifically designed for Anti-Submarine Warfare. ⁽⁹⁾

The final decision on aircraft to be used on MAC ships depended on the availability of aircraft together with trained and experienced aircrew. The Director of Naval Air Operations had always expressed the opinion that the Escort Carriers nearing completion in the US should take priority over any other requirements but on 13th August 1943 a message relating to the re-organisation of existing Squadrons provided

* The original Swordfish MK1 was produced and built by Fairey Aviation. By 1941 Fairey commitments were such that the growing contracts for Swordfish could not be met. Continued construction was passed into the capable hands of Blackburn Aircraft at Brough until the aircraft was withdrawn from service in 1945.

836 Squadron with 27 Swordfish. ⁽¹⁰⁾ These messages not only solved the problem of providing the first MAC Ships due for operations with both aircraft and aircrew but illustrated the intention of servicing seventeen MAC Ships in the future to bring the Squadron up to full operational strength. A further message from Flag Officer Naval Air Stations on 28 August appointed HQ Staff to 836 Squadron. ⁽¹¹⁾

The Squadron C.O. and other Officers appointed to flying positions were all veterans of operations flying in Swordfish aircraft when the first flights were found but later replacements were manned by aircrew with little or no operational experience.

The Swordfish was popular having proved itself over the years as an aircraft capable of performing efficiently under difficult circumstances and having excellent flying characteristics. The early Swordfish was of solid construction. The two-bay biplane wings were of all metal construction, fabric covered, with Ailerons on both upper and lower wings; the biplane configurations and its structural integrity maintained by robust interplane struts, flying and landing wires. For shipboard storage the wings could be folded about rear spar hinges. The tail unit was conventional with a strut braced tailplane and fin and rudder of metal construction with fabric covering. The fuselage with two open cockpits to accommodate the pilot forward and a crew of one or two aft was also of metal construction but covered by a combination of light alloy panels forward and fabric aft (Fig.3). ⁽¹²⁾

Landing gear was of fixed tailwheel type with each leg having an oleo shock absorber and the wheels having pneumatic brakes. There was a fundamental weakness in the strength of the undercarriage which could easily be damaged or collapse under a heavy landing. *

* The weak undercarriage compared unfavourably with the very strong system on the Barracuda and the rugged systems employed on contemporary American aircraft such as the Martlet and Avenger.

Early MK 2 Swordfish were powered by the 690 HP Bristol Pegasus III 9 cylinder radial air cooled engine. A Fairey Reed metal airscrew was fitted and the engine was encased in a Townsend ring cowling with a leading edge exhaust collector.

The later MK2 Swordfish was fitted with the more powerful Pegasus XXX rated at 750HP (Fig.4). There were two irritating problems that frustrated both mechanics and aircrew.⁽¹³⁾ Compared with other aircraft starting the Pegasus engine was slow, laborious and extremely hard work. The hand cranked inertia starter, being highly geared needed two men to get it up to speed before engaging it. If the engine failed to fire it caused severe annoyance and frustration as the whole procedure had to be carried out over again. It was a dangerous procedure especially when carried out on the pitching deck of a carrier.

The second problem was the fuelling of the aircraft.⁽¹⁴⁾ The main fuel tank held 155 gallons and was located just forward of the pilot's instrument panel. An overload tank of 69 gallons could be fitted under the fuselage but more often a 60 gallon tank was mounted on the upper longerons immediately behind the pilot in the rear cockpit. This meant that the observer was relegated to the rear cockpit and no air gunner was carried.

The fuel filter cap was situated on top of the front fuselage and if no fuel pipe was available the operation had to be carried out using 4 gallon cans of petrol, an extremely time-consuming business.

The Swordfish (called 'the Stringbag' by its crew) was highly respected by aircrew and preferred to many of the other FAA aircraft available at the time. It is difficult to understand this attitude when analysing the general arrangements for the three crew members. The pilot had little room for movement when in the cockpit. His parachute was secured to the base of the harness which fitted into the seat. The arrangement of instruments was simple but effective. The vital instruments such as the air speed indicator and altimeter were prominently displayed, an essential factor for deck landings whilst the throttle controls, twin wheel and arrester hook release were easily accessible. In all, the instruments were sensibly laid out for an aircraft employed

on carrier work (Fig. 5). The forward view of the pilot was adequate allowing reasonable vision when making an approach for a carrier landing whilst the Pegasus XXX engine was sufficiently responsible to inspire confidence in the event of errors of judgment. The Observer was not so fortunate. In order to prevent him from being thrown out of the aircraft in turbulent weather or when taking violent evasive action a 'g' string was clipped to the base of his parachute harness which considerably restricted freedom of movement. ⁽¹⁵⁾ His parachute was a chest type which, when not attached, was clipped to the side of the cockpit. A retractable seat was fitted and was always used for take-off and landing so that safety straps could be effective. The seat was of little use when navigating as it was too low for the compasses fitted port and starboard to be used so most observers navigated by using the chartboards whilst standing. It was made more difficult because no provision was made for storage of equipment such as calculators, pencils and dividers, etc. It nearly always fell to the ingenuity of the Observers to improvise in these circumstances and to fit equipment with the help of the mechanics that made life easier.

The remainder of the cockpit was taken up with ASVX and radio equipment whilst smoke floats were stored in the rear for use in wind finding. The Telegraphist Air Gunner occupied the rear cockpit and, like the Observer, movement was restricted by the 'g' string. Apart from being responsible for radio connection the Telegraphist Air Gunner was required to operate the Lewis gun on a Fairey high speed mounting. The Lewis gun was a relic from World War I and presented many problems; being liable to jam at any time and 'having a low rate of fire'. The greatest discomfort to all the crew was caused by the open cockpit. Mid-winter in the Northern Atlantic can be incredibly cold and temperatures as low as -18°C were reported on the thermometer carried on one of the starboard mainplane struts. One of every Swordfish crew's abiding memories is of the terrible penetrating cold in all three cockpits. It froze one to the marrow which could at times make both thought and action very difficult. ⁽¹⁶⁾ These difficulties made working efficiency difficult but with determination and personal organisation they could be overcome. The flying characteristics of the aircraft more than compensated for these factors because all aircrew had great respect and confidence based on the reliability of the machine.

The view of three experienced pilots who saw service on escort carriers and MAC ships give credence to the ability of the Swordfish. ⁽¹⁷⁾

The aircraft was almost totally foolproof and could be flown far beyond textbook capability. It was absolutely stable and even at the lowest speeds the controls were firm and positive. In a steep dive the speed would stay below 200 knots and a firm pull out would never result in a high speed stall. No pilot ever wrenched the wings of a Stringbag although on the deck the wings could be folded fore and aft.

If the speed was cut back, slots would come out on the leading edges of the mainplanes, decrease wing loading so that when stalling speed was neared at 58 knots and the stick pulled back the nose would drop sedately. The absurdly low landing speed made it possible to operate even when the birds were walking. The carrier could pitch all over the Atlantic but if the wind was 55 knots the Stringbag's forward speed relative to the deck would be a mere 5 knots.

S/Lt Beresford stresses that the Stringbag was easy and uncomplicated to fly because it had a minimum of controls and no nasty vices thus allowing the pilot to give most of his attention to the mission itself. ⁽¹⁸⁾ It was reliable in extreme conditions and had a good range and endurance and was easy to maintain. Pilot conversion and familiarisation were quick and painless and even sub-standard pilots could fly it.

S/Lt Cocklin also emphasises the general stability of the aircraft at low speeds and attributes this to the special fine pitch aircrew equivalent to the lower gear in a motor car which facilitated both take-off and landing. ⁽¹⁹⁾ There was no variable pitch propeller mechanism fitted to the Pegasus engine so a five pitch propeller was fitted to improve performance for take-off and landing on MAC ships.

The Swordfish MK2 was introduced in 1942 and available for MAC ship and ideal for anti-submarine warfare. The lower wing of the mainplane was strengthened and metal

skinned so that it could carry and launch light rocket projectiles. The alternative was to load 4 250lb depth charges as a more effective weapon against a submerged U-boat.

The short deck and low speed of MAC ships had always presented problems for taking-off with a full load of fuel and weapons when the wind speed over the deck was low. To overcome this difficulty RATOG (Rocket Assisted Take Off Gear) was introduced early in 1945 and proved to be highly successful by improving the tactical efficiency of the aircraft.

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Note 1

The advent of MAC ships in 1942 raised a number of technical, tactical and planning problems of a novel kind.

Both Grain ships and tankers presented new factors which exercised the minds of personnel within the Department of Operational Research; the most important being the selection of a suitable aircraft with a high operational capability.

Three main problems were presented:

- i) The Ships had a short flight deck.
- ii) Their top speed was approximately 10 knots.
- iii) Their degree of manoeuvrability when fully loaded with cargo was untried especially when working within the confines of a convoy.

ADM14179 issued in October 1942 was concerned with the setting up of MAC ships by the Admiralty Trade Division who immediately liaised with The Chief Adviser of Operational Research covering the use of aircraft on MAC ships and before any final decision was made, research was covered on three aspects regarding suitability:

1. Technical Aspects

- (i) Methods of improving aircraft take-off by propeller modifications.
- (ii) Rocket assisted take-off.
- (iii) The fitting of additional arrester wires.
- (iv) The development of simplified arrester gear.
- (v) Development of blind approach aids and improved night flying techniques.
- (vi) Roll and pitch measurements of carriers in different sea conditions and correlation with limiting flying conditions.
- (vii) Design and position of Island and possible movable flying position.
- (viii) The fitting of a tricycle undercarriage to the Swordfish.

2. Tactical Aspects

- (i) Investigation of wind speed limits for flying.
- (ii) Investigation of sea conditions for limits of flying.
- (iii) The best position for a ship within a convoy.
- (iv) Tactics of manoeuvre for carrier in relationship to a convoy with given wind and sea conditions and given escort.

3. Planning Aspects

- (i) Investigation of wind and sea conditions on alternative routes in Atlantic to help improve flying conditions at all times.

The importance of these considerations cannot be overestimated and show that research was at this stage being concentrated on fixed wing aircraft.

The Technical Aspects show a degree of ingenuity and foresight which was to have enormous impact in the future regarding short take-off and landing features but were actually to be associated with aircraft flying from MAC ships. In essence they recognised the fact that a revolutionary new stage was approaching which would completely change the conventional methods of flying from Aircraft Carriers.

The tactical aspects were even more significant as they represented a change in the philosophy of Naval Air Warfare which had held for approximately 50 years. This was best illustrated by the importance now being given to carriers working within a convoy system for which MAC ships were intended. To date, the system had been dominated by the use of surface vessels relying upon asdics as the main instrument for detection of submarines. Great advances had been made with tactics whilst technical improvements had made the system more effective. In spite of this, air cover was now being recognised as the most efficient defence method and the achievements of Coastal Command with aircraft capable of flying long distances had made this apparent

to the Admiralty. However, to provide constant cover for convoys was still a priority as the research being carried out proved.

That this was primarily concerned with fixed wing aircraft was understandable but there were those whose vision of the future went beyond this concept as ADM 13087 indicated in late 1942. The Admiralty had not only been supporting research at home but had approached the United States about aircraft of special application which were under trial or investigation.

a) **Autogyro**

Two prototypes were being built in the US to meet staff requirements and successful trials had been carried out from the platform of a merchant ship.

b) **Helicopter**

An aircraft had carried out successful trials on land in the US but was being primarily developed for American forces.

The result of these early trials however, was to set up a joint Anglo American board under the direction of Admiral E King USN which had members from the Royal Navy, Royal Air Force and the U S Coastguard to evaluate the helicopter as an anti-submarine vehicle. A preliminary test programme off the N E coast of America had shown that it was quite feasible to operate these early machines from a ship leading to a pair of Sikorsky XR4 being placed on a convoy escort.

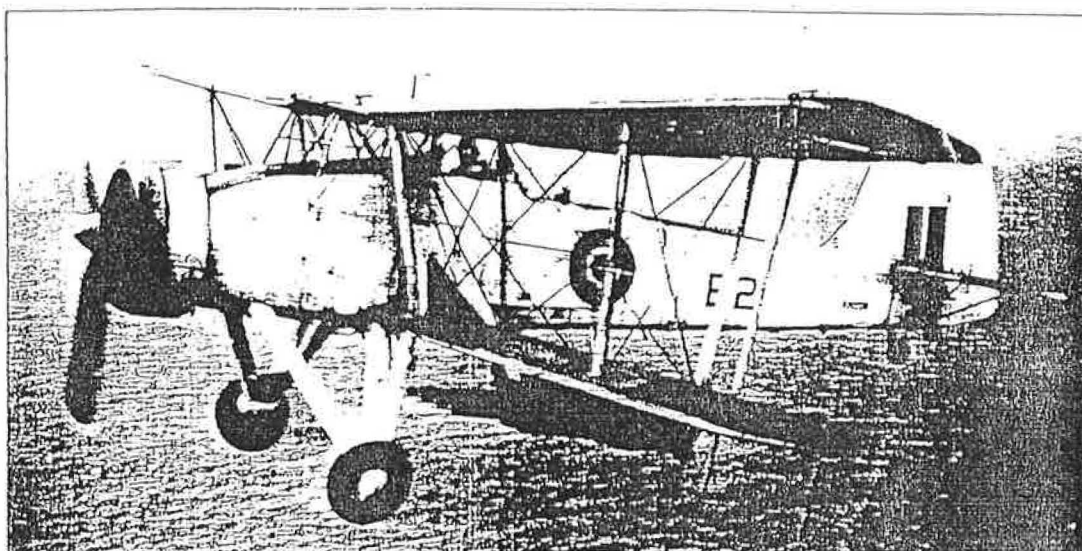
These particular machines were no threat to any U-boat because they were simply under trial at sea. The trial was a flop because the rough weather experienced during the crossing produced large rolling movements in the ship of up to 40 degrees and seriously hampered any attempt at flying.

The trial report came out with a finding that in its present form the helicopter was of no use for anti-submarine warfare.

Although this particular trial was a failure the Board's report did not abandon the helicopter altogether but recommended that development should continue. The Royal Navy had already purchased some XR4's but decided to cancel an order which had been placed for a later model the XR5.

The R4's owned by the Royal Navy were not wasted but used as targets for calibration of radar sets. Of greater importance was their use for training RN Pilots to fly new rotary wing aircraft.

Fig. 1 An aircraft from Adula showing typical flight markings



'Merchant Navy' proclaims the tail marking on Swordfish Mk II LS276. Piloted by Sub-Lieutenant H. Beckett, it served as 'E2' of 836 Squadron P Flight, which operated aboard the AIAC ships *MV Adula* and later *MV Alinda* from September 1941 to March 1945. The men of the Merchant Aircraft Carriers, which were cargo-carrying freighters or tankers with flight decks, regarded the embarked aircraft as part of *their* navy.

Fig. 2 Fairey Swordfish Mark I

Type: Two/three seat. Anti-submarine Warfare/Reconnaissance biplane

Powerplant: Single 750 HP Bristol Pegasus III radial piston engine.

Performance: Cruising speed: 110 knots ★(Manufacturers figure)

Service ceiling: 10,700 ft.

Dimensions: Span: 45ft 6"

Length: 35ft 8"

Height: 12ft 4"

Wing Area: 607 sq.ft.

Armament: One forward firing synchronised .303 in machine gun in forward fuselage and one Lewis gun on Fairey high speed mounting in aft cockpit.

Boónbs or depth charges up to 1,500 lbs. or 8 rocket projectiles on underwing racks.

★ The speed of the Mark II Swordfish on MAC ships fitted with a five pitch propeller had a cruising speed of approximately 75 knots.

[illegible]

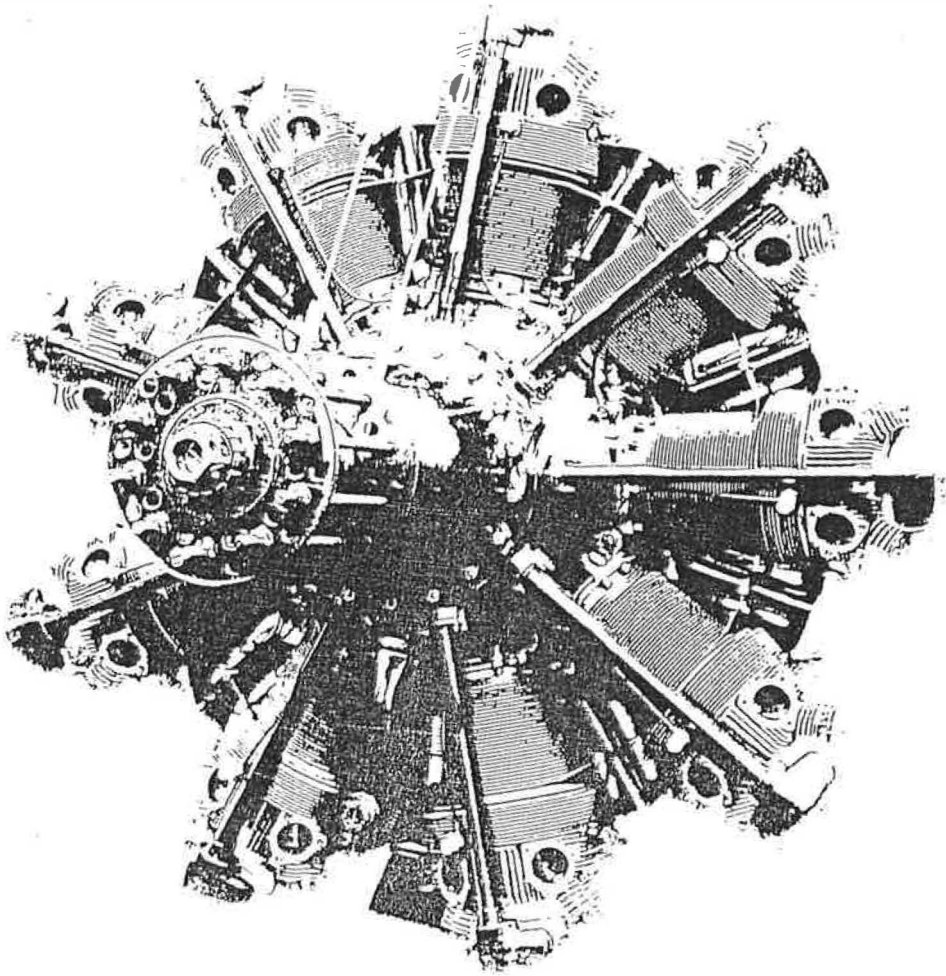


Fig-4. BRISTOL PEGASUS ENGINE
MK XXX
Fitted to Fairey Swordfish
MK II

The Fairey Swordfish cockpit

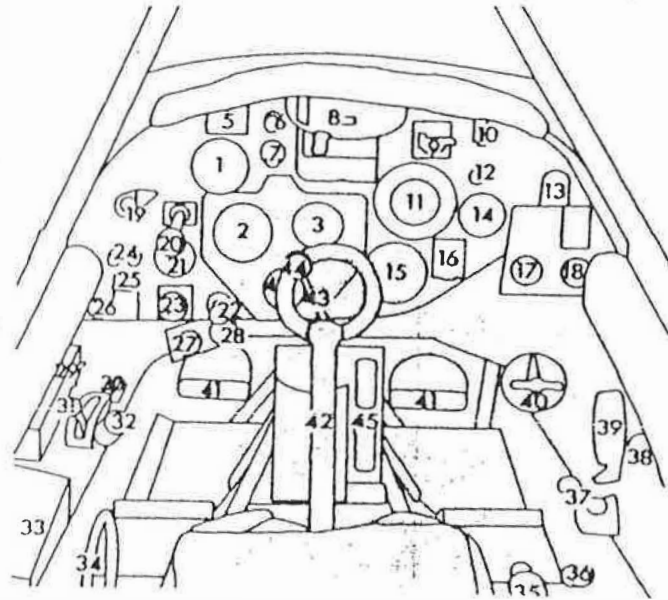
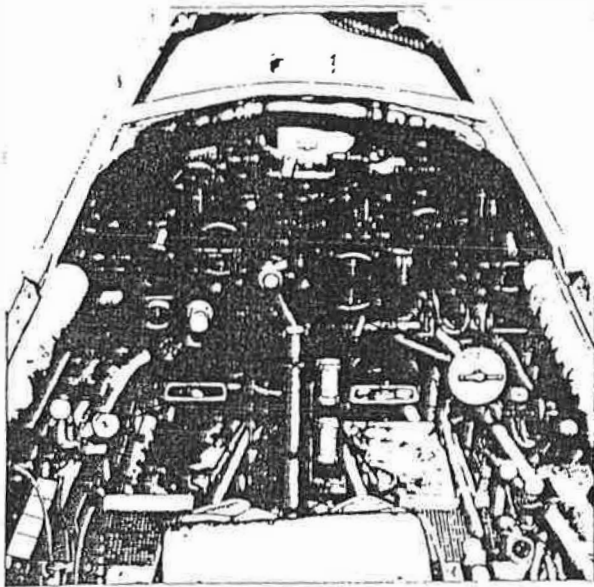


Fig. 5. The Fairey Swordfish cockpit

1: Airspeed indicator 2: Artificial horizon 3: Direction indicator 4: Altimeter 5: Compass correction card holder 6: Compass lamp dimmer switch 7: Compass lamp plug 8: Compass 9: Fire extinguisher button 10: Main starting switch 11: Engine speed indicator 12: Fuel pressure warning indicator 13: Engine priming pump 14: Oil temperature gauge 15: Turn and bank indicator 16: Oil pressure gauge 17: Cylinder head temperature gauge 18: Suction gauge 19: Power failure warning light 20: Landing light control 21: Brake pressure gauge position 22: Engine priming pump 23: Boost gauge

24: Starter lights 25: Starter switches 26: Engine cut-out 27: Oil by-pass valve control 28: Carburettor air intake shutter control 29: Lighting control box 30: Landing light on/off switch 31: Fuel mixture control 32: Throttle control (with press to transmit radio button) 33: VHF radio 34: Elevator trim wheel 35: Seat height adjustment lever 36: Rudder bias trim 37: Carburettor de-icing controls 38: Arrestor hook release control 39: Signalling switch 40: Fuel tank selector 41: Rudder pedals 42: Control column 43: Wheel brake lever 44: Weapons release button 45: Very pistol cartridges

6.4 SELECTION AND TRAINING

As each flight was formed there were two stages of training and development before joining a convoy on operational duties. The first three weeks, spent at Maydown, gave the crew the opportunity to become acquainted and to operate as a team both within the individual aircraft and the flight. It was also possible to build up a relationship with the mechanics allocated to the flight, so essential once the flight was at sea on operational duties. There is no doubt that mutual respect both on a human and professional basis was required if the necessary standard on maintenance was to be achieved to keep the aircraft serviceable and the aircrew confident of their reliability.

Training at Maydown was helped because the joint anti-U-boat School was based close to the airfield. ⁽¹⁾ The objective of the School was to ensure that all personnel conducting anti-U-boat warfare, whether on the sea or in the air, should have a thorough knowledge of the most appropriate methods and technology available at the time. It was during this period that all airmen became aware of the tactical methods in use and were given the opportunity to put them into practice in intensive training sessions. ⁽²⁾ Whilst many of the pilots had completed deck landings at sea, there were those who joined 836 Squadron with only a few landings gained on the HMS Argus at the end of the basic flying training. These pilots were required to land on the deck of a MAC Ship of 460ft in length and 60ft wide, an awesome task, especially on the first landing with the added responsibility of an observer and Air Gunner on board the aircraft. ⁽³⁾ To help overcome this problem much time was spent on ADDLS, both at Maydown, and at Eglington, an airfield a few miles away. Whilst unrealistic, compared with a ship at sea, it did give the pilot the opportunity to put the aircraft down accurately over a limited distance. Of greater importance, it gave the DLCO (Batsman) appointed to the flight the opportunity to co-operate with the pilots of the flight and to learn their flying capability and eccentricities. For observers and air gunners it gave the opportunity to familiarise themselves both with the aircraft and its specialist equipment.

The observers in particular were able to improvise and to introduce innovative ideas to help make their navigation equipment easier to handle and more effective, whilst

making full use of the limited space available in the cramped cockpit when using the radar. To make these alterations it was necessary to have the co-operation and help of the radar and radio mechanics whose knowledge was essential to the observers who only had the minimum of experience with radar and a background training in radio and radar theory.

The training received enabled the flight to work as a team and give an air of confidence, so necessary before joining a MAC Ship in the Clyde. ⁽⁴⁾ On leaving Maydown, the flight flew in formation and followed the Irish coast, skirting the Mull of Kintyre, climbing over Arran to the Firth of Clyde to rendezvous with the ship. Three weeks of intensive flying trials completed the second stage of training before the ship joined a convoy for the Atlantic crossing.

Whilst in the Clyde the ship would sail every morning from Gorrock for exercises off Arran. These involved both airmen and merchant navy crews in perfecting techniques that could become a matter of life or death later in Atlantic waters. The pilots carried out numerous deck landings gaining the necessary understanding of the skill required to overcome the problem of a short deck whilst the Master of the ship and the mates became skilled at turning precisely into wind for the take off and landing with minimum delay. The Deck Landing Control Officer attached to the flight had to take full advantage of the short time available to perfect a technique that would give pilots the maximum assistance in deck landings both during the day and at night. It required great skill to appreciate the height, angle of descent and speed of an aircraft approaching a carrier and even in calm water it was absolutely essential that the pilot had absolute confidence in the DLCO. The task was not made any easier because of idiosyncrasies of individual pilots which had to be learnt and allowance made whilst the aircraft was making its final approach and landing. ⁽⁵⁾

In order that all members of the crew could be involved, practice attacks with depth charges and RP's were made, navigation exercises carried out together with homing exercise and radio drill. On completion the flight would be operating as a "well oiled" team with a high degree of competence and respect for each other. It was in

this atmosphere that all aircrew welcomed the opportunity of joining part of an escort group on an outward bound convoy. ⁽⁵⁾

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6.5 AIRCRAFT MAINTENANCE ASHORE

The system for the maintenance of the aircraft on the nineteen MAC Ships and twenty four flights was organised after the final decision had been made on the terminal ports to be used and the facilities available at adjacent airfields to these ports. A letter from the Director of Air Maintenance to the Director of Air Material laid down a code of operation as follows:

- i) Maintenance personnel would be drawn from the parent Squadron for each individual MAC Ship whilst ensuring that sufficient personnel were left to handle remaining aircraft on the shore station.
- ii) Minor and major inspections would be carried out by Station personnel on either side of the Atlantic with other requirements met by small maintenance parties at the points of embarkation. ⁽¹⁾ RNAS Maydown in Northern Ireland thus became the Headquarters base for 836 Squadron and the main maintenance station for all aircraft allocated to MAC Ships. Sufficient personnel and equipment were held at Maydown to complete the scheduled inspections of all aircraft not embarked at sea and replacement aircraft for those damaged beyond repair. ⁽²⁾ A second base was located in Halifax Nova Scotia, a deep water port approached directly from the Atlantic and within 120 miles of the great circle route from Europe to North America. Halifax also had other advantages including excellent facilities for handling the cargoes of both tankers and grain ships both quickly and efficiently thus giving a short turn around time for ships to meet up with convoys leaving for Europe. In addition the Royal Canadian Airforce base, adjacent to the port provided an airfield for MAC ship aircraft to use whilst the ships took on cargo. This usually took about three days to complete the task.

The airfield at Dartmouth* thus became the second base to carry out inspections and a station flight was formed to meet requirements. This was on a smaller scale than that at Maydown because of the ships turnaround time which allowed flights only a short time ashore. The main task was to repair aircraft damaged at sea and to bring them to a state of serviceability ready for the return trip to the U.K. Regular inspections would only be carried out if the MAC ship had a longer period of time in dock.⁽³⁾

*Dartmouth situated adjacent to Halifax was a large airfield flying liberators for the Canadian Air Force generally in support of Atlantic convoys both entering and leaving the port. It provided excellent facilities for MAC Ship flights which used to fly off to the airfield prior to the ship entering port.

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7 METHODS OF WARFARE

7.1 SURFACE VESSELS

The role of Merchant Aircraft Carriers was laid down in Admiralty letter M/TD (DEMS) 02049/43. This stated that MAC ships would fly the Red Ensign and would not be used for offensive operations, nor make ocean passages independently. The new ships would be Government-owned and would carry out their ordinary functions as carriers of grain or commercial Admiralty oil and operate under charter conditions under the direction of the Ministry of War Production. In addition, the Admiralty, after consultation with the Ministry of War Production would allocate MAC Ships to outward bound convoys after due warning had been given to the Commodores of the Convoy concerned.

Strategically, these ships would be under the operational control of the Commodore in Chief Western Approaches whilst the Senior Officer Escort would be in general charge of the operation of MAC Ship aircraft whilst keeping the Commodore of the Convoy fully informed of his intentions.

Finally, and of high significance, the decision to fly off aircraft would be the responsibility of the Master of the MAC ship, advised by the Naval Air Staff Officer on board. This placed a high responsibility on Merchant Navy personnel with no experience of carrier operation.

The MAC Ship, therefore, was introduced into a defensive system which had been in effect since the commencement of the war and had seen little change in character except for the introduction of more advanced weaponry and the tactical procedures of escort vessels. This significant change at the end of 1942 had been brought about by the Admiralty realisation of the importance of air support. ⁽¹⁾

The gradual increase in the number of long distance aircraft operating from bases in the U.K., Iceland and Canada had met with great success particularly when these aircraft were fitted with radar, which made aircraft the greatest “predator” of the U-

boat and becoming the main cause for the German Command having to change its overall strategy and tactics.

However, there were still insufficient aircraft to cover the whole Atlantic route adequately. The box left in the middle of the Ocean was not covered adequately and remained an ideal hunting ground for the U-boat.

This gap was one of the main reasons for the introduction of the MAC Ship which could provide air cover for the whole of the Atlantic trade routes whilst providing a system of weaponry which in co-operation with the escorting vessels of a convoy could significantly improve the overall defensive system. ⁽²⁾

The MAC ships cannot be considered as a strategic weapon but rather a tactical addition; a response to a desperate need. Their importance was as much in the way they were conceived as in the way they were built and employed. The tactical operation of MAC Ships did raise many complex problems including the difficulty of flying from a carrier manoeuvring within the limited area of a convoy. ⁽³⁾ The operation of aircraft within a convoy had happened before but always in ships manned by Royal Navy personnel with carrier experience. In the case of the MAC ships they were commanded by Merchant Navy personnel, were heavily laden with a relatively low speed, short flight decks and limited manoeuvrability. The training that a Master received before joining a convoy was short and inadequate. A short course was devised. This commenced with an introduction to the origins and purpose of Merchant Aircraft Carriers followed by instruction covering the skills of handling such ships and lectures with pilots and observers to gain an understanding of the problems confronting aircrew flying from a MAC Ship. Finally, a few days were spent on the carrier *Angus*, a deck landing trainer operating in the Clyde area, gaining practical experience in the art of manoeuvring for the dispatch and landing of aircraft in a confined space. ⁽⁴⁾

Notwithstanding this instruction the Masters of the ships soon learnt that every aspect of their professional conduct and seamanship would be called upon to the full if they were to implement successfully the task with which they were faced.

All convoys had two separate but co-ordinating components, the merchantman flying the Red Ensign sailed by the civilian crews of the MN and their escorts under the White Ensign manned by Royal Naval personnel. The former were under the direct and sole command of the Commodore (Convoy), a senior officer in the R.N. or R.N.R whose ship, a merchantman, always had the same position in the convoy, the leading vessel in the control column from which he could order by flag, signals and changes in course or speed. The Aldis lamp was used extensively and, although by end of 1944 R/T communication was available, was rarely used.⁽⁵⁾ The escorts on the other hand, each under her own captain, came under the overall command of the senior officer amongst them, known as the SOE (Senior Officer Escort) who allocated their position in the protective screen around the merchantmen or dispatched them on special missions. The MAC ship with her hybrid status as a tanker or grain ship and also as an aircraft carrier was unique in coming under the direct command of both of these officers as appropriate; the Commodore in his role on a merchantman but the SOE on a Royal Navy ship.⁽⁶⁾

The SOE would be in direct contact with the Air Staff Officer in the MAC ship to decide on flying operations but the final decision as to whether the aircraft left the ship rested with the Master. The normal position of a MAC ship was in the rear of the central column. This allowed maximum manoeuvrability. If the prevailing wind was 15° or less off the bow, the aircraft could fly off without the ship having to alter course but if the wind was from abeam, or even worse from the stern the MAC had to drop astern clear of the convoy and either steer 90° from the convoy or in the opposite direction. At this time she was very vulnerable to U-boats. This made flying off a tense experience.

It was vital that lines of communication between the MAC and SOE were sound in order that flying on and off the carrier could be co-ordinated with the escort vessels.

In the event of the MAC ship having to drop astern to dispatch or receive aircraft it was essential that the necessary manoeuvres were carried out with maximum speed. This depended on co-operation between escorts and carrier and the skill of the Master to turn the ship into wind and hold the resulting course with accuracy. In favourable weather conditions with experienced deck handlers and aircrew, three Swordfish could be flown off in under one minute and land back on in approximately three minutes. This was a remarkable achievement and illustrated the high degree of professionalism that existed between the two services and the degree of trust and reliability that had developed.

Unfortunately, perfect conditions for operating aircraft in the Atlantic rarely existed and whilst co-operation between escort and carrier was usually of a high order, it often fell to the Master of the ship and his officers to improvise and exert their full professional capabilities to overcome difficult and challenging circumstances.⁽⁷⁾ As more MAC ships became available the number in convoys increased accordingly, thereby raising problems as how they could best be dispersed to operate with maximum efficiency.

During the early voyages, recommendations were made for a general system to be used for all convoys, but because of the differences that existed according to the size, speed and content of a convoy this proved impracticable and it was usually left to the officers concerned to decide on tactics at a meeting held ashore prior to sailing.⁽⁸⁾ Ships on the Atlantic run were allocated to convoys according to the maximum speed they could guarantee to make good in normal weather. There were 12, 10 & 8 knot convoys with many of the ships in the slower convoys being a collection of antique tubs which were subject to constant breakdown causing them to become stragglers which often increased the problems of the Master of a MAC Ship when manoeuvring for flying off aircraft. In many cases the masters of ships in the convoy did not fully understand the situation and refused to allow space for the merchant carrier whilst operating aircraft.⁽⁹⁾

The ASO voyage reports refer regularly to manoeuvrability within a convoy and illustrate the many problems that arose but, with a few exceptions, the skill and

seamanship of the Masters combined with the co-operation of the SOE overcame these enabling aircraft to fly on and off the carrier as often as necessary in extremely adverse conditions.

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9. ADM 217 Various.

7.2 AIR OPERATIONS

On formation at RNAS Maydown the flight was immediately involved in training to gain the level of efficiency that would be effective in anti U-boat warfare. The training was of a defensive nature and complied with the strict regulations issued by the Admiralty regarding the role of MAC ships. This was followed by a three week work up with the parent ship in the Clyde area before joining an outgoing convoy. ⁽¹⁾ The main aspects of the training covered the following factors:

- i) Deck landings, both day and night, offering the Master and mates the opportunity to become skilled at turning the ship swiftly and precisely into wind. This allowed the pilots to take off and land with as little delay as possible so that the ship would only be out of station astern in convoy for the minimum of time.
- ii) Exercises to simulate an attack on a U-boat both by individual aircraft and combined attacks by all aircraft of the flight.
- iii) To practise both depth charge and rocket projectile attacks.
- iv) To carry out navigation exercises including having exercise with the use of both radar and radio (ASVX Aircraft radar) 242/272 Ship Radar – MAB (Radar Beacons).
- v) To blind approach landings (BABS). ⁽²⁾
- vi) To investigate all aircraft equipment to ensure full serviceability by eliminating all snags before joining a convoy.

The tactics used at sea were designed to produce a quick reaction to any threat from enemy submarines and required complete co-ordination from all vessels providing the protective screen around the convoy. For this to happen an effective system of communication was essential so that an immediate link could be formed between the Commodore of the convoy, the Senior Officer Escort and the Air Staff Officer on the MAC Ship. It became routine for these officers to meet either in Derry or Halifax prior to the convoy sailing to decide on such matters as the MAC Ship position in the Convoy, especially if more than one MAC Ship was sailing. They would also discuss flying operations and the system of communication to be used. ⁽³⁾

In normal conditions aircraft were flown off at dawn and dusk to carry out patrols and searches in the vicinity of the convoy but further flying operations were demanded if an emergency arose because enemy U-boats were reported in the vicinity. The Senior Officer Escort (SOE) could obtain information regarding U-boats in three separate ways. A U-boat was on the surface and within about ten miles of the convoy could be detected by shipboard radar without being positively identified as a submarine. More importantly the enemy never fully realised the extent to which the use of radio could be detected, and messages passed between U-boats and their bases could be picked up by escorts using High Frequency Direction Finding (HF/DF) and their position established. These messages were also picked up by the Government Code and Cipher School at Bletchley and the positions of U-boats were transmitted in intelligence reports to all the Senior Officers of Escorts on a daily basis. ⁽⁴⁾ In the event of the SOE requesting Air Support, it became the job of the Air Staff Officer to decide upon the best available technique to be used. Briefing of aircrew was short and to the point. Patrols and searches were allocated the code name of a reptile. The patrols were flights, usually round and round the convoy at the limit of visibility (Vipers) or back and forth to a specified distance ahead (Adders). ⁽⁵⁾ There were also Cobras and Crocodiles. A search which could be a Lizard, Python or Mamba with aircraft flying to a position up to 100 miles from the convoy and searching a wide area around it. The use of code names required little information to be given at the briefing as all Observers and Air Gunners were familiar with the reptile codes and the navigational equipment necessary for any sortie. ⁽⁶⁾ The Air Staff Officer, however, was presented with other problems caused by the prevailing weather conditions which dictated the type of armament the Swordfish aircraft would carry. There were two choices; either rocket projectiles or depth charges. The most favoured was the rocket projectile, a relatively new weapon which greatly increased the offensive capacity against the U-boat because it was armour piercing and so powerful that if it hit the enemy craft in the right place it could be sunk outright. The technique was to approach the target in a dive of 20° and aim just below the waterline of the U-boat from an optimum altitude of 300 feet; four rockets were slung under each lower mainplane and could be fired in pairs, or all eight together, as the pilot chose. ⁽⁷⁾ There was, however, one considerable drawback. A ceiling of at least 1,000 ft. was required to deliver the

attack. In conditions of low cloud it was necessary to use depth charges instead of rockets. ⁽⁸⁾

In the case of low cloud, the Air Staff Officer would only have very unreliable meteorological reports on which to base his decisions and would probably take the soft option and arm with depth charges. The final vital factor with briefing was to give exact times for take off and landings so that the Master of the ship could be facing into wind at these precise times. Speed for this operation was essential and success could only be achieved by the maximum degree of co-operation and co-ordination between the ships officers, the pilots and aircraft handling crews.

Failure to take off and land quickly could result in the MAC ship falling well astern of the convoy. This placed it in an extremely dangerous position quite apart from needing to re-deploy escort vessels to cover the situation. ⁽⁹⁾

The tactics used on sighting an enemy U-boat whilst on a patrol or search were familiar to all aircrew who had repeatedly practised the technique both in the training period at Maydown and in work-up in the Clyde prior to joining a convoy. The first action was to report the position, then close quickly, making as much use of cloud cover as possible to give the best chance of a surprise attack. If the U-boat crash dived the pilot would attack at once hoping to fire rockets or drop depth charges before it was fully submerged, or was still visible even if a few feet below the surface. ⁽¹⁰⁾ In mid 1943 Admiral Doenitz (German Admiral in command of U-boat operations) realised that such attacks on his U-boats were very often successful so the anti-aircraft armament was increased and orders were given to fight it out on the surface. It then became the prerogative of pilots either to press home the attack or wait for support from other aircraft of the flight before making a combined attack, to disperse the anti aircraft fire. Even a combined attack could result in severe damage being inflicted on the attacking aircraft as the slow flying Swordfish made an easy target for anti-aircraft fire. Whilst out on patrol full use was made of radar fitted both in the ship and in the aircraft. The aircraft radar was ASVX (Airborne, surface vessel) which was fitted in

the Observer's cockpit and was a multi-purpose system still in its infancy, difficult to operate and subject to frequent periods of unserviceability.

However, Flag Officer Carrier Training had sufficient confidence in the set-up to encourage frequent use whilst working up, placing no restrictions on the use of the ASV whilst exercises on homing, shadowing and run-up procedures on known or observed targets were practised. ⁽¹¹⁾

This policy during practice did not apply when on operations at sea as orders were contained in CB 04234 (Atlantic Convoy instructions) Article 145 (ii) as to precise use of radar. Aircraft were instructed to show I.F.F. (identification friend or foe, Radar set 242) continuously when airborne. This was of vital importance as should the aircraft become lost, when the distress setting on the set could be used to locate the aircraft. In addition a detailed plan for "homing" of lost aircraft when in convoy was laid down by order of the C in C Western approaches. ⁽¹²⁾ The Master of the MAC Ship, the Senior Officer Escort and the Air Staff Officer took full responsibility for implementation. In order that ship operators and aircrew were familiar with MAB it was switched on whenever the ship's aircraft were airborne during the work up period and the MAB code letters made available. ⁽¹³⁾

MAB became an important system as a navigational aid to Observers as it enabled reasonably accurate bearings to be taken on the position of the ship while the aircraft was involved in long range searches. The MAB Beacon, when switched on, could be picked up by the aircraft ASV. It flashed, in morse code, the letters allocated to the ship which could be lined up with the simple linear screen and a distance and bearing obtained. It was usual with some flights for the beacon to be switched on at agreed times for checking a fixed position for the aircraft. ⁽¹⁴⁾

Observers only had limited training in the use of radar but experience soon improved their confidence and capability. It rapidly increased in importance, not only as a tool for locating submarines, but also as a valuable navigational instrument. In the long run, however, it was still the visual aspects and strict concentration on accurate flying that were to prove the most successful method of hunting enemy submarines.

References

1. ADM 16469
2. Flt/Lt COCKLIN, R. Taped Interview.
3. ADM 217.
4. Lt/Cdr WALSH ATKINS, B. RNVR ASO Adula.
5. ADM 217/257 MacRae, Voyage 9.
6. Observers Notebook and Aircraft W/T Log.
7. Lt COCKLIN, R. RNZNVR Armament Officer, M.V. Adula.
8. Lt GODLEY, J. RNVR CO, 'P' Flight.
9. S/Lt MABLY, J.R. RNVR.
10. Lt JOHNSON, O. RNZNVR.
11. Atlantic Convoy Instructions CB 04234.
12. ADM 16459 Ref: ASV MKX and IIN, Mk 31FF.
13. ADM 16459 Para' 15b section (iii).
14. ADM 217/430.

7.3 AIRCRAFT MAINTENANCE AT SEA

The maintenance of aircraft whilst the ships were at sea was more complex due to the different construction of grain ships and tankers *. The number of technical personnel allotted to both types of ship was the same in spite of grain ships having 4 aircraft to the 3 held on the tankers. ⁽¹⁾

The personnel allocated to individual flights were as follows: ⁽²⁾

- 1 Chief or Petty Officer Air Artificer
- 1 Leading or Air Fitter (A)
- 1 Leading or Air Fitter (E)
- 1 Leading or Air Fitter (O)
- 1 Leading or Air Fitter (L)
- 2 Air Mechanics (A)
- 2 Air Mechanics (E)
- 2 Air Mechanics (O)
- 2 Air Mechanics (L)
- 2 Radio Mechanics Ldg or Petty Officers (AL)
- 2 Radio Mechanics Ldg or Petty Officers (AW)

Working conditions on grain ships were superior to those on tankers because of the availability of a hanger on the second deck which housed four Swordfish with folded wings in a space (fig 1) 142' long by 38' wide. The hanger was served by a single platform lift, 42' by 20' overall, operated electrically and capable of lifting a fully loaded plane of up to 5 tons from hangar floor to flight deck level in fifty seconds. Special

* The tankers without a hanger deck had to rely on all maintenance of aircraft to be carried out on the after part of the flight deck with only wind baffles as protection from the weather.

ventilation, heating, lighting and fire appliances, including a sprinkler system, were provided throughout this area.

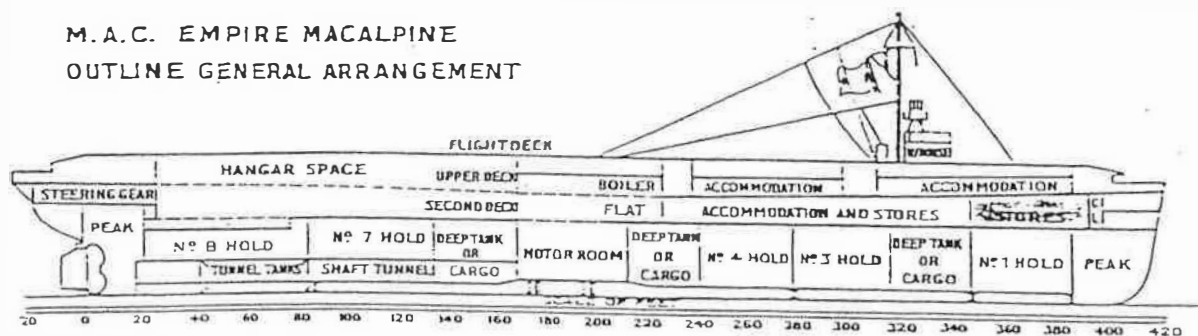
The combined functions of these vessels presented difficulties in meeting naval practice for the disposition of space allotted to magazines, explosive stores and the petrol tank compartment. The latter should have been arranged away from the ship's side and below the water line. In these ships, however, it was necessary to locate these spaces aft. This was only available at the sides of the hangar on the second deck. This presented a more dangerous situation for the ship but was compensated by the fact that stores were readily accessible to mechanics working in the hangar.

To have provided such a space in these vessels would have completely altered the oil cargo piping and associated arrangements and considerably extended the period necessary for conversion work.

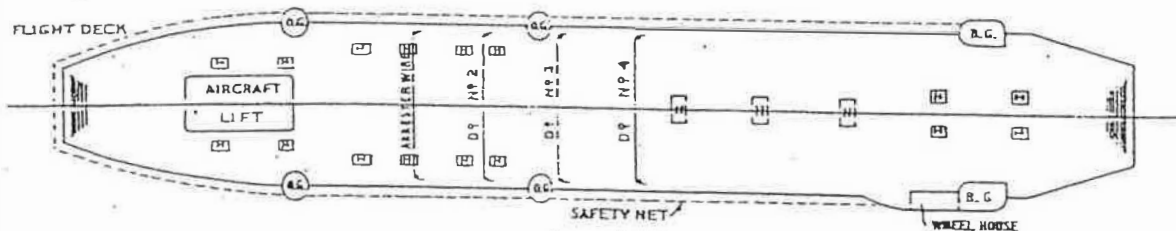
The main area for stores on tankers including the magazines for explosive materials, was in a compartment in the forward part of the ship. However, this was insufficient and every nook & cranny was utilised throughout the ship resulting in dozens of doors, each with a cryptic message to inform crew and mechanics what lay behind. The Swordfish fuel (Avgas) was provided from tanks within number 4 centre tank situated amidships. There were a number of advantages for choosing this particular tank including the proximity to the cargo pump room for installing pumps to service the aircraft, flooding valves for surrounding the petrol tanks in an emergency and ease of ventilation of petrol vapours. ⁽³⁾

Fig. 1 MERCHANT AIRCRAFT CARRIER SHIPS (GRAIN SHIPS)

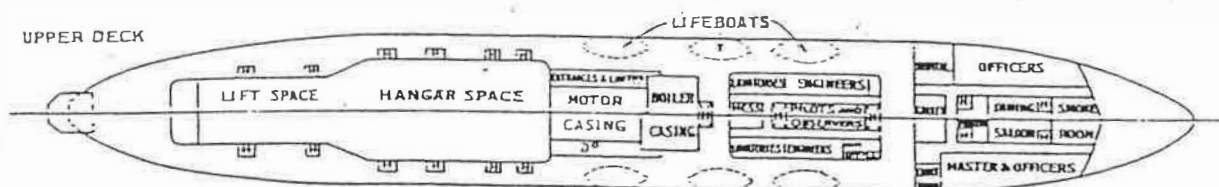
M.A.C. EMPIRE MACALPINE
OUTLINE GENERAL ARRANGEMENT



(Fig. 2)



(Fig. 3)



(Fig. 4)

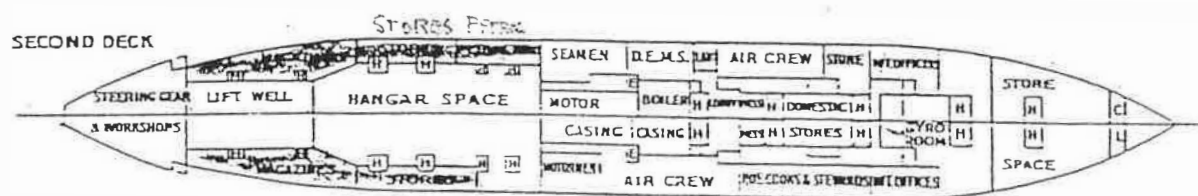
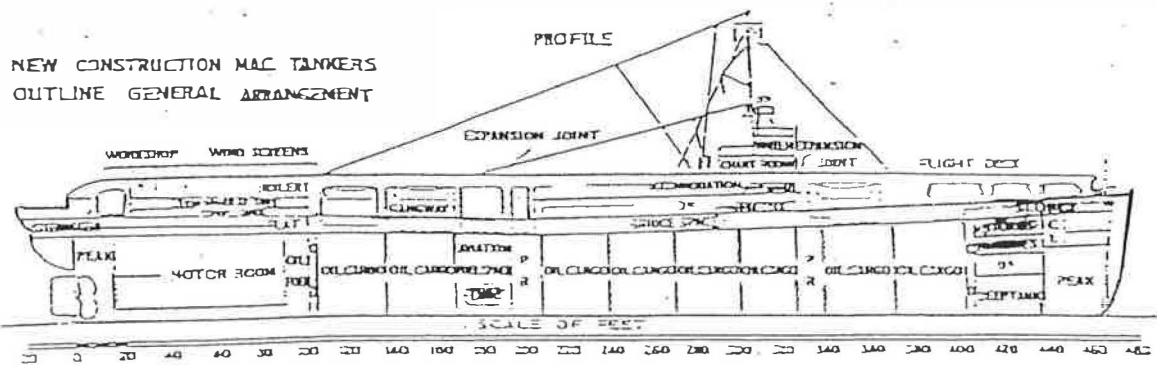
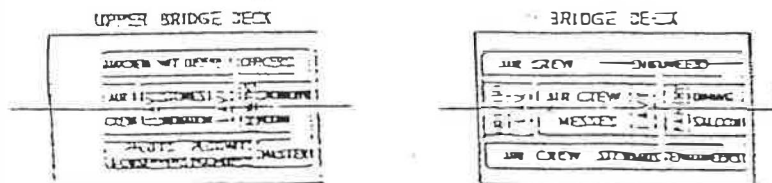


FIGURE 2 MERCHANT AIRCRAFT CARRIER SHIPS (TANKERS)



(F-2 10)

Finger deck and other accessories generally similar to existing makes. Recommended.



Whilst in convoy the Swordfish aircraft of a MAC Ship were at a state of readiness for immediate take-off on a twenty-four hour basis both day and night. Apart from regular searches and patrols requested by the Senior Officer of the Escort, further demands were made on both aircrew and aircraft if U-boats were reported in the immediate vicinity. This demanded a high degree of serviceability at all times.

To achieve this every aircraft had inspections as follows:

- i) Major inspections after every 60 hours flying
- ii) Minor inspection after every 30 hours of flying
- iii) A daily inspection to check that the aircraft was safe for immediate take off and operational activity.

Whilst at sea the Daily Inspection was carried out by air mechanics of each trade, engines, airframes, electrical, armament, radar and radio to standards laid down in Form 700 so that the aircraft could be called upon at any time to fly safely and to perform the requirements of operational duties.

On completion of the inspection the mechanic initialled Form 700 thereby accepting responsibility that the work had been done and that equipment was in a sound working conditions. Any faults that could not be immediately rectified were noted for future action and providing they had no effect on the safety of the aircraft. ⁽⁴⁾

In 'P' Flight on the Adula, mechanics serviced one particular aircraft, thus assuming a greater degree of personal responsibility for their work. This proved to be highly successful and spread later to other flights in the Squadron. In fact it served a dual purpose by allowing the mechanics to become fully aware of the characteristics of one aircraft and the measures needed to keep it in first-rate condition. It thus it became a matter of personal pride to strive to provide the best aircraft on the ship and in the flight. ⁽⁵⁾

Apart from creating a competitive spirit among all mechanics it also encouraged a better relationship between the mechanics and the aircrew associated with the aircraft, because it brought about a realisation of the degree of dependence on each other, and an appreciation of the skills required on both sides. The fact that pilots became more closely associated with engine mechanics and fitters and observers with radio and radar mechanics enabled them to discuss their problems in a way that often resulted in small problems being overcome quickly and efficiently thus improving the operational performance of the aircraft. ⁽⁶⁾

The mechanics quickly came to realise the level of competence of the aircrew by the way in which they handled the aircraft and its equipment and the degree of respect shown was reflected in their attitude and a sense of pride in a task well done. Working conditions on grain ships were far superior to the tankers as the hanger on the former provided both warmth and safety. The mechanics were only involved on the flight deck prior to take off and landing to manoeuvre the aircraft into position, folding the wings and starting up.

It was a much harder task for those on the tankers as all manoeuvring of aircraft and their maintenance had to be carried out on the open flight deck in all weather conditions. The Swordfish aircraft, wings folded back, were secured at the after-end of the flight deck, surrounded by eight feet high steel plates which were hinged and lay flat on the deck when not in use. These plates, when raised, gave some protection from the wind but also prevented personnel from being blown overboard. A secondary precaution was provided by nets rigged some five feet below flight deck level and extending the full length of the ship. ⁽⁷⁾

In spite of these measures, working on an aircraft in icy conditions was both difficult

and dangerous, especially if the ship was pitching and rolling. It was necessary to wear heavy protective clothing and this hampered movement working inside a cockpit or outside the aircraft.

Engine mechanics had a particularly difficult job in servicing an engine some twenty feet off the ground whilst riggers experienced great difficulty in maintaining the correct stress on wires to correct the balance of the aircraft especially if heavy seas were pounding the ship.

The job of an armourer was even more demanding as the manhandling of both bombs and depth charges was hard and arduous work which could, at times, also be extremely dangerous, especially when hoisting rockets and depth charges from the magazine in the bows of the ship.

A Fleet Air Arm Officer was always in charge of this operation having two men on the focsle to operate the winch, a dozen on the flight deck, immediately above it, where the block and tackle were set up to unload each lethal cargo and take it aft to the ready-use storage positions. The rockets were easy to handle but the much heavier depth charges each weighing over two hundredweight, presented some difficulty, swaying back and forth as the winch brought them individually a few inches clear of the flight deck where they were fully exposed to the wind.

It was necessary to take a firm grasp of the heavy cable so as to stop it as soon as the winch stopped turning. It was a difficult job that resulted in injuries to personnel on several occasions. ⁽⁸⁾

On both grain ships and tankers working conditions on deck were appalling especially in heavy weather conditions with the ship both pitching and rolling. Added to this discomfort was the extreme cold which was so often experienced in Northern waters.

It was also dangerous, particularly when revving up aircraft engines for inspection or prior to take off because of the likelihood of walking or slipping into a turning propeller.

It required great skill and determination by all maintenance crews to maintain high serviceability either through routine maintenance or by repairing damaged or crashed aircraft.⁽⁹⁾

References

1. ADM 1/13087 Appendix 3, p.43.
2. Institute of Naval Architects Annual Reports Vol. 87, Figs 1 & 2.
3. Captain ALLEN, R. MN First Mate, MV Adula.
4. S/Lt MABLY, J.R. RNVR.
5. Lt GODLEY, J. RNVR CO, 'P' Flight.
6. Air Mechanic TUKE, J. Notes.
7. Captain ALLEN, R. Op. cit.
8. Lt COCKLIN, R. Armament Officer, MV Adula and MV Miralda.
9. S/Lt BERESFORD, P.T. Deck Landing Control Officer.

8. **MERCHANT AIRCRAFT CARRIERS OPERATIONS**

8.1 **INTRODUCTION - SOURCES OF INFORMATION**

Analysis on the voyages of the 19 MAC Ships is based on the mandatory reports completed by the Air Staff Officers (ASO). These reports relied on statistical information regarding operational activities but also included a narrative which summarised the activities which influenced the ship and all personnel throughout the period of a voyage. The comments reflect the personality and character of the ASO concerned, and therefore vary a great deal in quality. Whilst some are short and almost dismissive, others give excellent detail which brings to life the activities and relationships that existed on MAC ships.

The main source of information is found at the Public Records Office (PRO) at Kew under ADMs 217 and ADMs 199. The 217 ADMs cover the full report of the ASO and are available for 13 of the MAC ships i.e. MV MacRae, Ancylus, Acavus, MacKay, MacColl, MacCallum, MacMahon, MacCabe, Miralda, Adula, Godila, Macoma, Amastra.

Information on the remaining 6 ships is located in ADMs 199 which are convoy reports. In these cases no statistical information is available and the narrative can be sparse and uninformative. The ships are: MV MacAlpine, Rapona, MacAndrew, MacKendrick, Alexia, MacDermott.

An index exists at the PRO covering all ships at sea during World War II. This includes all MAC ships with the exception of the M.V. Rapana. Other methods were used to identify this ship and the only official information available was through one partially completed convoy report.

8.2 SUMMARY OF VOYAGES

A detailed summary of the voyages made by each MAC ship has been compiled, noting the weather conditions, flying activity and significant incidents occurring on each voyage. There follows herewith one example – for the MAC ship MACOMA.

Name of Ship		MACOMA															
Voyage Number	Assigned Flight	Direction	Convoy No	Escort No	Start Date	Stop Date	Sorties	Hours flown	Days Flying Possible	Days Flying	Sightings	Weather conditions	Serviceability	Communications	Crashes/Accidents	Narrative	Comments
1	O	outward	ONS 242		26.6.44	9.7.44	22	46	11	9	Nil	Very satisfactory	95%		1 a/c heavy swell a/c over side - not repairable. ASO Lt/Cdr L J Fritz, Royal Netherlands Navy.	Welfare - see over.	Excellent co-operation with MN both in work and social life.
1	O	homeward	HXS 300		19.7.44	2.8.44	6	17:20	4	2	Nil		100%			Accommodation on ship crowded and ventilation poor, but messing good.	In Halifax AJAX organisation arranged short holidays for half NCO's and ratings.
2	O	outward	ONS 248		11.8.44	25.8.44	18	38:55	8	7	Nil		80%	Excellent co-operation with SOE. R/T 272 - MAB useful in fog.	1 a/c lost overboard ditching 16th Aug.	Weather forecasts from Whitehall poor - noted by Commodore of convoy. AIFAC messages more satisfactory.	No a/c arrived from shore to carry out dawn patrols so made by swordfish from ship in fog conditions. Mentioned C in C WA 041941 B/July/44. U.Boats reported in vicinity.
2	O	homeward	HXF 305		27.8.44	8.9.44	16	33:30	9	7	Nil			242/MAB range decreases considerably in damp weather.		Individual liner homed onto convoy (Sydney Star). 3 ships in convoy torpedoed on last night. No strikes carried out. No further details available.	No reasons given for lack of air cover by Coastal Command.
3	O	outward	ONS 254 MacCabe in company.		16.9.44	2.10.44	17	43:50	12	7	Nil	Most satisfactory.	85%	IAFAC messages transmitted to Commodore by TBY together with prepared forecast.	1 a/c hoisted off for repair in Halifax.	N/a	
3	O	homeward	HXF 312		7.10.44	19.10.44	13	31:55	8	4		IAFAC received twice a day.	98%		No accidents or crashes.	Operation in convoy - message to Admiralty request that MAC ship in slow convoys have a box left vacant to facilitate flying conditions.	

Summary of Voyages

Name of Ship		MACOMA																
Voyage Number	Assigned Flight	Direction	Convoy No	Escort No	Start Date	Stop Date	Sorties	Hours flown	Days Flying Possible	Days Flying	Sightings	Weather conditions	Serviceability	Communications	Crashes/Accidents	Narrative	Comments	
4 F		outward	ONS 35 in company Adula		29.10.44	15.11.44	18	34:20	12	11	Nil	Good	52%	A/c became lost - IFF used. Escort took H/F DF bearings - satisfactory. All radar worked well.	2 a/c crashed on landing - parts used from both to make 1 serviceable aircraft.	Report on operation within convoy. 2 ships.	Difficulties experienced because of inexperienced crews with flight and only a short work up in Clyde before sailing.	
4 F		homeward	SC 161		17.11.44	3.12.44	8	18:20	3	3	Nil	Messages good - barometric readings sound.	100%	Type 242 radar gave problems but MAB useful in poor visibility more use being made of MAB.		Contact made by escort - flying not possible, lack of wind - need for RATOG. In the centre of a very deep depression.	This report again illustrates the vital need for assisted take off if a heavy load is to be carried.	
5 F		outward	ONS 538		15.12.44	1.1.45	16	29:25	8	7	Nil	Very low wind speeds followed by gusty winds.	80%	W/T unserviceable	1 a/c lost overboard 21/12 gusty weather, pilot opened up, engine stalled - crashed into sea.	Crew of ditched a/c rescued by HMCS Hespeler (see attached notes) - returned to MacOma on 23rd Dec.		
5 F		homeward	HXF 331 MacAlpine in company		10.1.45	25.1.45	7	13:10	6	3	Nil	Very rough weather throughout trip.	80%			One dusk patrol carried out by MacAlpine because MacOma too far behind convoy because of difficulties on dawn patrol and difficulty in catching up with convoy.		
6 F		outward	ON 282	C2	1.2.45		7	34:10	7	7	Nil	Heavy swell restricted flying.	95% 1 a/c reserved on board for engine problems	H/F D/F exercise carried out. Not satisfactory - too great a delay in setting bearings.	Nil			
6 F		homeward	SC 168	C9	25.2.45		15	30:15	8	7	Nil	A/c used sparingly because of bad weather.	95%	SOE met at presailing conference at Halifax - very sound co-operation.	1 a/c hit barrier on 26.3 - not used for remainder of voyage.	Good co-operation with SOE regarding the use of a/c at sea.		

Summary of Voyages

Name of Ship		MACOMA															
Voyage Number	Assigned Flight	Direction	Convoy No	Escort No	Start Date	Stop Date	Sorties	Hours flown	Days Flying Possible	Days Flying	Sightings	Weather conditions	Serviceability	Communications	Crashes/Accidents	Narrative	Comments
7 F	outward	ONS 47	B3 (6 escorts)	11.4.45	30.4.45	24	51:45	10	10	Nil	Good reports & results.						
7 F	homeward	SC 175 (Adula in Company)	C2 (5 escorts)	7.5.45	21.5.45	10	20:15	3	3		AIFAC reports passed to Commodore.	100%	Agreed at meeting that flying duties be carried out alternatively - MacOma on odd dates, Adula on even dates.			In company with Adula. Duty ship to prepare weather reports from AIFAC for SOE and Commodore.	Surrender of Germany on 7th May. Flying only if unsundered U.Boats in vicinity - but patrols carried out 300 miles west of UK.

Summary of Voyages

Summary of MAC ship Voyages

Name of Ship		Return Voyages (operational)	Return Voyages (non-operational)*
Empire MacAlpine	(G)	15	3
Empire MacAndrew	(G)	13	
Rapana	(T)	7	4
Empire MacRae	(G)	12	
Amastra	(T)	7	5
Acavus	(T)	6	6
Anculus	(T)	5	4
Empire MacKay	(T)	11	
Empire MacColl	(T)	9	1
Empire MacMahon	(T)	11	
Empire MacCabe	(T)	10	
Empire MacCallum	(G)	9	
Empire MacKendrick	(G)	11	
Alexia	(T)	8	3
Miralda	(T)	10	
Adula	(T)	9	
Godila	(T)	8	
Empire MacDermott	(G)	12	
Macoma	(T)	7	
TOTALS		180	26

Average number of crossings – operational and non-operational 11

Key

G Grain ship

T Tanker

* Acting as ferry carriers or escort oiling ships

8.3 AIRMANSHIP – PILOTS, OBSERVERS, TELEGRAPHIST AIR GUNNERS

Pilots

Pilots on MAC ships were required to have an extremely high standard of airmanship. The Swordfish aircraft was ideal for anti-submarine work and its low stalling speed made it eminently suitable for deck landings. However, when landing unarmed and low on fuel the wing loading of the Swordfish was so low that it floated and buffeted more than a heavier aircraft.

In Atlantic conditions, even in calm weather, take-off and landing required a high degree of skill if accidents were to be avoided and aircraft remain serviceable given the length and breadth of the deck and the slow speed of the ship.

Once airborne, precise flying was essential if accurate navigation was to be achieved. This meant that the Pilot had to maintain a steady height and speed whilst never deviating from the required compass course. Great skill and co-operation with the Observer was essential whilst wind finding; this was an antiquated and difficult procedure but essential to the dead reckoning navigation in use at the time.

The majority of the work completed by the aircraft involved searches and patrols and in most cases proved to be uneventful flying for many hours over a grey sea. This did not mean that there was any time for complacency, for as the distance between aircraft and ship grew, so did the tension. The Pilot had to keep a high degree of concentration, maintaining height, speed and course to ensure accurate navigation if the aircraft was not to become lost; this was the main fear of all aircrew.

It was necessary for the Pilot to understand every aspect of his aircraft so that he knew instantly by touch, sight and sound if anything was wrong. The Swordfish was a single engined aircraft and it required nursing when flying in poor weather conditions. There was little chance of survival if the engine should fail some distance from the convoy. Unfortunately, owing to a variety of causes, emergencies arose frequently

and pilots were called upon to exercise degrees of skill and airmanship well above average, demanding ingenuity and courage.

An early operation was carried out by aircrew of 836 Squadron on 7th March 1943 led by Lt/Cdr. R Slater who made the first landing on a MAC Ship (MacAlpine). This was followed by landings with various loads of depth charges by the remainder of the Squadron. On May 9th Lt/Cdr Slater completed a further 9 landings, the final one in a 45 knot gale. There were no accidents or crashes during these trials. This was airmanship of the highest order and was commended by the Fifth Sea Lord on completion of the trials.

Atlantic weather caused both pilots and ships crews to improvise and take considerable risks especially in the event of fog which could appear rapidly with little warning. On 21 September 1943 S/Lt. R A Singleton returning from a long search was confronted by thick fog. The master of the ship strung out a drogue and with the use of radar and only one practice run, a successful landing was made with visibility of only 50 yards. This feat of airmanship was reported in a national newspaper, an unusual occurrence in time of war, whilst the Pilot was commended by the C-in-C Western Approaches.

On another occasion, S/Lt Galbraith took off at 15.10 on 22 December 1943 on a dusk patrol. On returning to the ship a violent storm was raging, visibility was poor and winds of over 60 knots were recorded. It was decided to keep the aircraft orbiting for as long as possible in the hope the storm would blow itself out. By 16.15 with fading light it was decided to attempt a landing for the aircraft. The ship was turned down wind at full speed and the aircraft signalled to land over the beams in spite of heavy pitching of the ship. The Pilot, however, made a perfect landing and the aircraft was held down by every available officer and man on board. The Pilot and master were commended by Admiralty for fine airmanship and seamanship respectively.

On 25 May 1944 at 1412Z the MAC ship, Ancyclus, in company with MacKendrick, in convoy ONM237 received a report from SOE C3 Group Mamba 058 emergency - two aircraft were flown off from Ancyclus and one from MacKendrick. ★ At 1506Z Swordfish G1 sighted a U-boat on the surface astern of the convoy and made a report to SOE. At 1515Z three aircraft G1, G2, and MZ carried out a co-ordinated attack with Rocket Projectiles which was well pressed home despite intense 'flak'. The three aircraft were severely damaged but all landed on safely. In all three cases the pilots showed the highest standards of airmanship, particularly G1 piloted by Lt. Owen Johnston RNZNVR.

The attack was 'pressed home' and the 'ack-ack' from canon and heavy machine gun fire was intense, the main spar of the port wing was severed and a shell passed through the engine cowling knocking out two cylinders leaving only seven cylinders of the Pegasus engine still functioning.

Lt. Johnston was approximately 130 miles from the convoy and nursed his aircraft back to the carrier at just above stalling speed avoiding opening up the engine in case increased power led to complete failure. The aircraft flew at sea level and approached the carrier below the level of the flight deck before landing safely.

This incident illustrates the extraordinary skill of the Pilot and also indicates the durability of the Swordfish aircraft. Whilst these were exceptional circumstances the high number of sorties demanded a continuous high standard of airmanship because of the unpredictable effects of weather on flying conditions. In a high wind with a heavy pitching deck, the stern of the ship would often rise over forty feet, whilst in a large swell the extra dimension of corkscrewing could be added to the pilots problems. Many observers looking over the side of the aircraft on the landing approach would have grave doubts as to whether a landing was possible but in most cases had complete confidence in the ability of the pilots.

* Senior Officer Escort: C3 Gap requested that aircraft from MacKendrick carry out a search under code name 'Mamba' on a heading of 058⁰ - 1506Z (standard time). Reference Observer's notebook and aircraft W/T log.

In addition, it was necessary to make night landings from time to time which were difficult owing to the poor standard of deck lighting on the ships. On 10 May 1944 S/Lt. P. Gifford returned to the ship after dark with the ship pitching between 30 and 40 feet but on the second attempt made a perfect landing following an efficient batting by the DLCO S/Lt J Stockbridge. *

Further night landings took place in bad weather conditions, MacAndrew (V5) MacColl (VI) and Adula (V8). Throughout the voyages of the nineteen ships many crashes and accidents took place but put into perspective with the number of sorties flown they were very low with fatal accidents and injuries to aircrew minimal. **

The nature of the ships presented many problems but weather conditions in the Atlantic could cause a choppy sea resulting in heavy pitching, whilst a long swell could not only cause a slow and difficult pitch of the ship but could also result in corkscrewing causing the Pilot to make both aileron and rudder alterations. It was considered reasonable to fly with the deck pitching approximately 15⁰ but in many cases this could be higher. It was not uncommon for an Observer looking over the side of the aircraft on a landing approach to see the stern of the ship rise out of the water and expose the turning screws of the ship.

On 16 December 1944 after completing Voyage No.6 with convoy HX321, the crews of 'P' Flight, whilst at Maydown, were summoned to the Squadron Commander's Office to be informed that they had been commended by the C in C Western Approaches for the following:

- (i) Completing over 100 landings on a MAC ship without accident.
- (ii) Completing night operational flights under severe conditions.
- (iii) Landing on Adula whilst refuelling at sea.

* Batting – landing on signals given by Deck Landing Control Officer.

** Detailed in report on accidents and crashes.

These demonstrated exceptional airmanship and deserved commendation, but it required the highest standards of flying to be achieved to even operate on a routine basis.

Observers and Telegraphist Air Gunners

In considering standards of airmanship it is not unusual to concentrate on the Pilot whilst overlooking other crew members involved. The whole aspect of flying, particularly in wartime operations depended, on the skill and ability of all crew members, and in MAC ship flights, the work of both the Observer and the Telegraphist Air Gunner (TAG) were equal in importance to the Pilot. Thus only when the highest standards were achieved and monitored could mutual respect exist between all crew members. This gave the necessary confidence to carry out sorties that were often dangerous and demanding.

The task of the Observer was made more difficult because of the layout of his cockpit which was cramped and open to the elements. In addition, his parachute harness was attached to a metal ring in the deck by a G string which restricted movement. He had to sit on a collapsible stool, centrally positioned but without a plotting table, and still was expected to navigate with the chartboard on his knees. Many Observers improvised and with the help of airframe fitters bored two holes in the forward bulkhead and two in the chartboard. The use of hooks made the board stable and easily used whilst standing up in the cockpit. It was in these conditions that the Observer was expected to carry out accurate dead reckoning navigation, operate the radar set and on some occasions the aircraft radio, although in the latter case this was usually the job of the TAG. Dead reckoning navigation was not easy as it relied on accurate chart work and wind finding, both difficult in the conditions described. Plotting was difficult using a chart board with a swivel type parallel rule whilst using dividers and a pencil with frozen fingers, or wearing gloves, but windfinding presented the greatest problems to the Observer.

The briefing given prior to a sortie resulted in a wind direction and speed being given to the Observers, usually derived from the meteorological reports received and the consequent forecasts made. In most cases this was inaccurate and of little use, resulting in the Observer taking a back bearing on the ship as soon after departure as possible – a method of value but again not very accurate because it was based on meteorological

reports received daily from London or Louisberg in Canada which were not in enough detail to make accurate forecasts.

The wind finding method in use (Australian method – note 1) required close co-operation by all three aircrew members, and took place approximately every twenty minutes using a smoke float which, if attached to the bomb rack, could be released by the Pilot. This procedure did not always go according to plan. If a wind in excess of about 25 knots was blowing by the time the Observer came to take the beam and quarter times the smoke float was so far away as to be barely visible. In many cases the floats were unserviceable and did not function at all leaving the Observer no alternative but to estimate the wind from the sea conditions (note 2). A cautious Observer would find a wind approximately every twenty minutes and adjust his magnetic course so as to keep on the desired track (note 3).

The training of Observers before joining an operational squadron was carried out either at Arbroath in Scotland or Piarco in Trinidad before being exposed to the extreme climate conditions of the Atlantic where the ever changing direction of wind speed and direction together with fog and poor visibility called on a high degree of skill and concentration if a satisfactory navigation plot was to result in a safe return to the ship. However, aircraft did become lost often with tragic results. The *Acarus* on Convoy ON219 was requested to carry out a patrol in spite of the wind being Beaufort scale 6, later increasing to a gale force of 60 knots. The Observer who was relatively inexperienced underestimated the increase and the aircraft became downwind of the convoy, ran out of fuel and ditched in the sea. The crew were lost.

This incident illustrates the vital factor of correct wind finding and also shows that alternative methods of having lost aircraft detected by W/T or radar can also fail.

On 29 January 1943 the *Empire MacCallum* with convoy ON221 to Halifax flew off a Mamba patrol to a distance of 60 miles when the aircraft became lost but was successfully heard by HF/DF and landed after 4 hours. On examination of the Observer's plot it was observed that a mistake had been made in the interception

problem and not allowing for a 30⁰ change in wind direction. The main outcome of this incident was a loss of morale in the flight and a letter from the Fleet Air Arm Liaison Officer criticising poor standards of navigation in several MAC Ships and reference to standards in CAFO 543/4L.

The sortie that Observers dreaded was a search astern of the convoy as it required accurate navigation to ensure that the aircraft would have sufficient fuel to return to the ship. Allowing for the speed of the ship, the slow speed of the Swordfish and a possible head wind, the closing speed could be very low resulting in the aircraft having to ditch in the sea, if any navigational errors were made. In spite of this many sorties were carried out astern to search for U-boats shadowing the convoy or to help stragglers rejoining the convoy.

On the MacKendrick on convoy ON300 9 May 1943, V flight carried out a search astern for a reported U-boat, the two aircraft reaching distances of 135 and 172 miles respectively, both returned safely.

There were, however, many other reports of aircraft becoming lost, e.g. Acarus (Voyage 8), MacMahon (Voyage 3), and MacCabe (Voyage 4).

There were other unreported cases of lost aircraft but in most cases the procedures for landing were sufficient to allow the aircraft to return safely.

The dead reckoning navigation system was supplemented to some extent with the introduction of Radar (Air to sea Vessel MKX) with its simple linear scan enabling Observers to obtain a bearing on the convoy at short ranges whilst MAB (Ship Radar) which was a beacon system was introduced in late 1943 allowing a bearing to be obtained through the ASV set on the aircraft. Whilst these were useful navigational aids they were still in their infancy and could not be relied upon because of frequent unserviceability and unreliable radar mechanics. Reports of radar unreliability were reported by the following ships: MacRae (Voyage 5), Acarus (Voyage 2),

Adula (Voyage 3), MacKendrick (Voyage 10), MacCabe (Voyage 8), and MacRae (Voyage 2). *

* Detailed reports under Analysis of Communications

Note 1

Full Wind Finding Procedure

The full wind finding procedure was as follows:

1. The Observer would instruct the Pilot to stand by to drop smoke float.
2. On releasing the float the Observer would start his stop watch and would wait a number of seconds according to height to allow for the trajectory of the float to its position in the sea and inform Pilot, 'bomb gone'.
3. The Observer would then order the Pilot 'stand by to turn turn'.
4. The Pilot then cornered a rate 2 turn of 180^0 which took exactly 30 seconds.
5. The Observer stopped and restarted his stopwatch.
6. After one and a half minutes re-repeated 'stand by to turnturn'.
7. The Pilot started another rate 2 turn of 180^0 in the same direction as before.
8. The Observer then lined up compass on the side of the cockpit for a beam bearing and noted the exact time when the smoke float appeared at 90^0 .
9. He then lined up the compass for a quarter bearing and noted the exact time the smoke float appeared at 135^0 .
10. The Observer then applied this data to a wind finding table from which he could read off the direction and speed of the wind. (See note 4.)

Note 2

Sea Conditions

The following tabulated speeds of the surface wind are closely related to sea conditions:

Surface Wind Speed	Surface Sea Conditions
10 knots	Appearance of foam
15 knots	Appearance of dispersed white caps
20 knots	Continuous white caps
Above 20 knots	Sea has a distinctly rough appearance
35 knots	Foam blown in streaks from crests of white caps

Note 3

Course and speed calculator

In the event of an aircraft having to carry out a search, the Observer would be briefed on the following:

1. The main line of advance of the convoy.
2. The tracks to be made good to accomplish the search.
3. An estimated wind.

Armed with this information the Observer would draw in the main line of advance of the convoy on his chartboard.

By using the wind given, work out the first course to be flown to make good the desired tack.

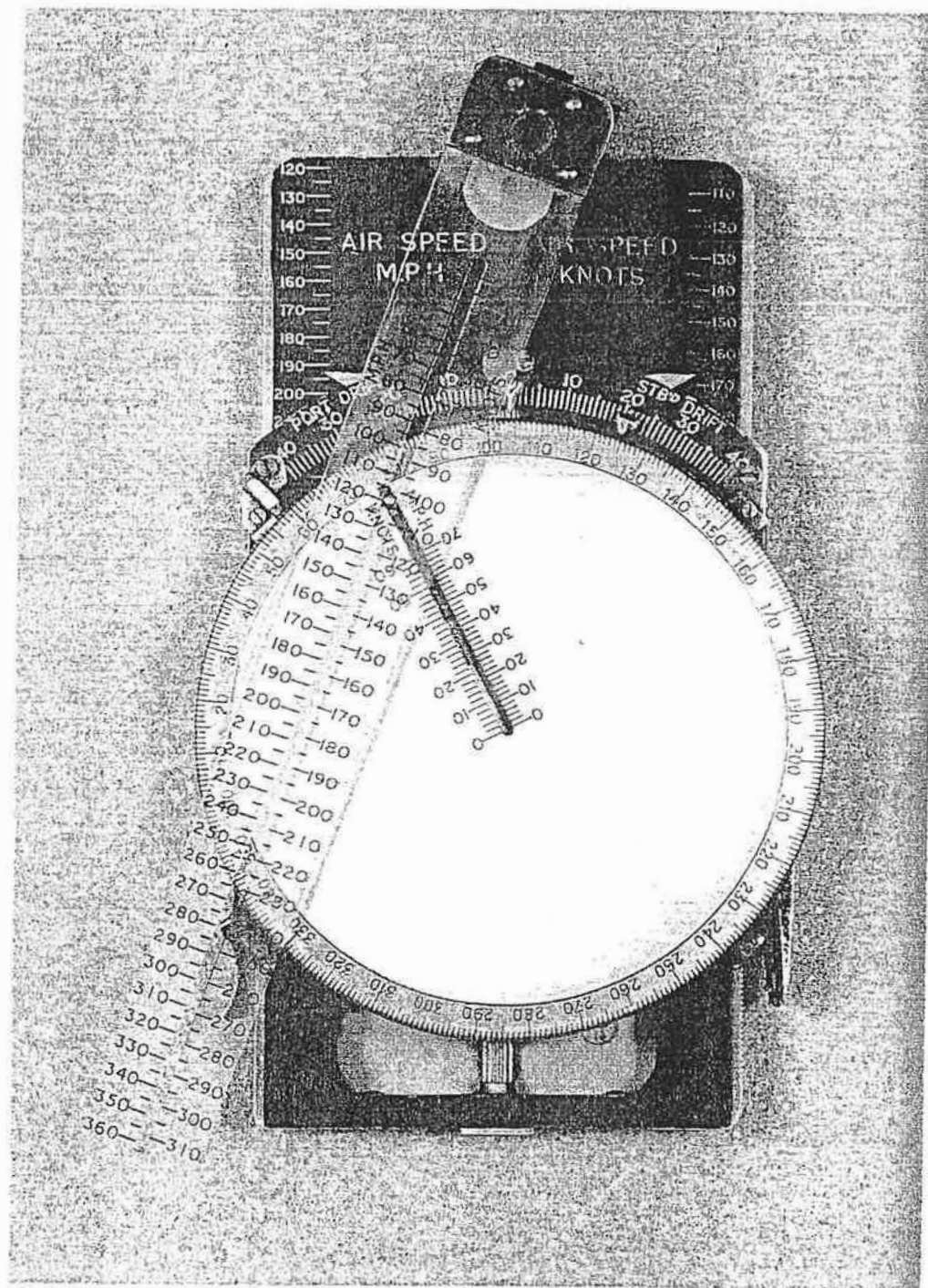
This would involve the triangle of velocities, the problem being solved by use of a CSC (Course and Speed calculator). Some Observers preferred to use a Dalton Computer to which would be added or subtracted the variation and deviation factor. The Course of Speed calculator was simple to use and extremely accurate. The wind speed and direction was fed into the computer together with the True Air Speed in knots (TAS). The circular plate was then revolved until it was in line with the arrow for the desired track. The true course to steer was then read off. Variation and direction were then applied to obtain a magnetic course for the aircraft to steer.

T₁ = 180 SECS.

T.A.S. = 100 KNOTS.

	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	230	240	250	260	270	280	290	300	310	320		
160	148	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66	63	60	
165	149	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79	76	73	70	67	64	61	58
170	150	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80	77	74	71	68	65	62	59
175	151	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66	63	60
180	152	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79	76	73	70	67	64	61
185	153	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80	77	74	71	68	65	62
190	154	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66	63
195	155	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79	76	73	70	67	64
200	156	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80	77	74	71	68	65
205	157	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72	69	66
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225	161	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79	76	73	70
230	162	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80	77	74	71
235	163	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75	72
240	164	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79	76	73
245	165	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80	77	74
250	166	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78	75
255	167	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79	76
260	168	164	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80	77
265	169	165	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84	81	78
270	170	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85	82	79
275	171	167	164	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92	89	86	83	80
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295	175	171	168	165	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	93	90	87	84
300	176	172	169	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91	88	85
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330	182	178	175	172	169	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94	91
335	183	179	176	173	170	167	164	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95	92
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345	185	181	178	175	172	169	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97	94
350	186	182	179	176	173	170	167	164	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98	95
355	187	183	180	177	174	171	168	165	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96
360	188	184	181	178	175	172	169	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100	97
365	189	185	182	179	176	173	170	167	164	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101	98
370	190	186	183	180	177	174	171	168	165	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99
375	191	187	184	181	178	175	172	169	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103	100
380	192	188	185	182	179	176	173	170	167	164	161	158	155	152	149	146	143	140	137	134	131	128	125	122	119	116	113	110	107	104	101
385	193	189	186	183	180	177	174	171	168	165	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102
390	194	190	187	184	181	178	175	172	169	166	163	160	157	154	151	148	145	142	139	136	133	130	127	124	121	118	115	112	109	106	103
395	195	191	188	185																											

COURSE & SPEED CALCULATOR (CSC)



8.4 DECK LANDING PROCEDURES

Deck Landing Control Officers had been operating within the Fleet Air Arm for many years with considerable success. However, with the arrival of escort carriers with a top speed of 18 knots, pilots were presented with a very difficult situation when there was no wind speed to increase the flow of air over the flight deck and crashes on landing increased dramatically. To overcome this problem, a Royal Navy Batting School was set up at Easthaven, Scotland under the Chief Instructor Commander (A) Bob Everett whilst the Admiralty instructed squadron commanders to recommend certain pilots who had good assessments and were physically suitable to attend the course.

The first part of the course was held at Easthaven where the runways were marked out with parallel white lines to represent the deck of an aircraft carrier, whilst aircraft from a second line squadron made a series of approaches and landings under the direction of a trainee DLCO (Batsman) giving appropriate deck landing control signals with the use of bats. If the batsmen passed this part of the course, and the vast majority did, they were dispatched to the Clyde area where the skills supposedly acquired at Easthaven were put into practice on HMS Argus, an aircraft carrier converted from an Italian liner shortly after the First World War. In a matter of approximately four days the Batsmen from Easthaven would land over one hundred aircraft in all kinds of weather conditions before being given a final assessment, nearly always resulting in a pass, a fact which most trainees regretted because it automatically prevented them from returning to operational flying duties.

It was policy to appoint a Batsman to each MAC ship flight in addition to the normal aircrew and it is difficult to envisage a more challenging and difficult task after such basic training than to control aircraft approaching such a tiny flight deck, operating in some of the worst weather conditions in the world.

A New Zealand pilot who had been selected for the training course much against his will, but who had later become a first-class batsman, had emphasised that the essential qualities of a good operator were to judge aircraft and wind speeds, landing attitude,

and have fast reflexes and athleticism. Finally, it was essential to develop a personal style which conveyed both ability and confidence to approaching pilots.

It was also useful to become familiar with the pilots and to study their individual characteristics whilst flying, as most pilots had strong personal views covering the best way to land an aircraft on a deck and would choose to ignore the Batsman's signals if so inclined. It was simple for a DLCO to strike up personal relationships with pilots on a MAC ship. The fact that there were only three or four aircraft on each ship and that aircrew lived in close proximity with each other meant that the batsman acquired both the professional and social quality of each individual pilot so that it was often possible to predict his flying characteristics.

The pilot appointed to 'P' Flight on the Adula as Batsman had no training prior to taking up his appointment and had to rely on his past experience and skill as a pilot on Arctic convoys. It then became a task of mentally transferring thought from the ground to the cockpit of the aircraft and using the bats rather than the stick and throttle to safely land the aircraft. In spite of the lack of training, the pilot concerned became a superb batsman who maintained that it was possible to tell which pilot was approaching by his flying style even when night deck landings were being carried out.

The DLCO had the further responsibility of ranging the aircraft prior to take-off and ensuring that they were all securely lashed down after returning from a sortie. This was an essential duty in heavy weather as any movement could severely damage the planes especially on tankers with no hanger deck. The lack of training for DLCOs did not pass without comment.

The Acarus on Voyage 1 Convoy ON23 had an exceptionally difficult trip including two aircraft badly damaged on landing. In his voyage report the Air Staff Officer Lt/Cdr. Gillingham submitted that every DLCO should have a thorough course aboard a carrier. The DLCO appointed to Acavus had not had any training and only completed four deck landings of his own. One of the two crashes might have been

averted with a more experienced Batsman. However, on the return trip with convoy SC149 he had improved immensely and brought in many aircraft with great skill.

This illustrates two main factors. Firstly that aircrew were on occasions expected to operate in conditions where the expected high standards of skill and ability were not available through lack of training. It also indicates that personnel of the right calibre could adapt simply to the challenge and operate efficiently as a DLCO when the occasion arose.

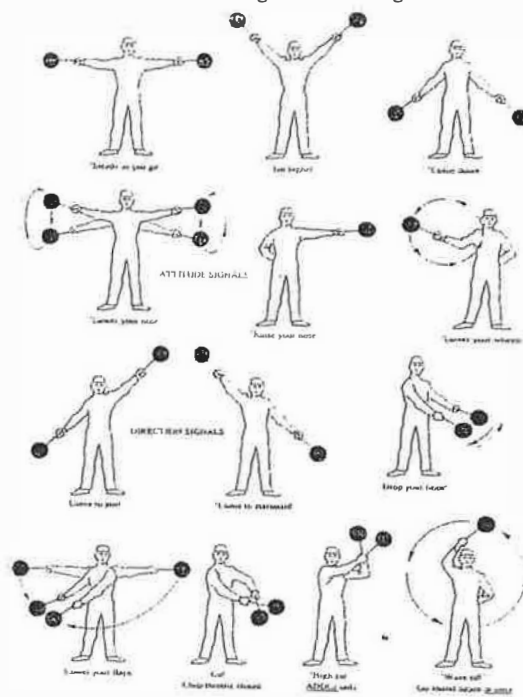
The MacCallum, homeward bound in convoy HX347 was experiencing heavy weather, when a Swordfish returning from a patrol was unable to lower its hook which had jammed, and the safety barrier on the ship was unserviceable. In spite of these problems the DLCO brought the aircraft in safely on the second attempt where it pulled up abreast of the bridge. Both the pilot and the DLCO were commended on their skill by Flag Officer Carrier Training (Letter 25 April 45 No. FOCT 504).

The crews of 'P' Flight after completing voyage No.8 on Adula were congratulated on completing 156 hours of flying with 103 deck landings without incident. Special mention was made of the DLCO for the part he had paid in achieving these exceptional figures. The task could be dangerous should a pilot misjudge the landing and head straight for the batsman standing on the port side of the ship some thirty feet forward of the first arrester wire. In such a case the batsman had no alternative but to jump over the side into the safety nets, a not infrequent occurrence on MAC ships. Most batsmen agree that the Swordfish was a difficult aircraft to land because pilot visibility was poor and there was a tendency to float if the approach speed was too high so that the landing was not made squarely on both wheels. The result could be a collapsed undercarriage even though the Swordfish was renowned for its strong undercarriage and rugged fuselage.



Lt P.J. Beresford DSC, RNVR
Batsman for 'P' Flight, MV Adula

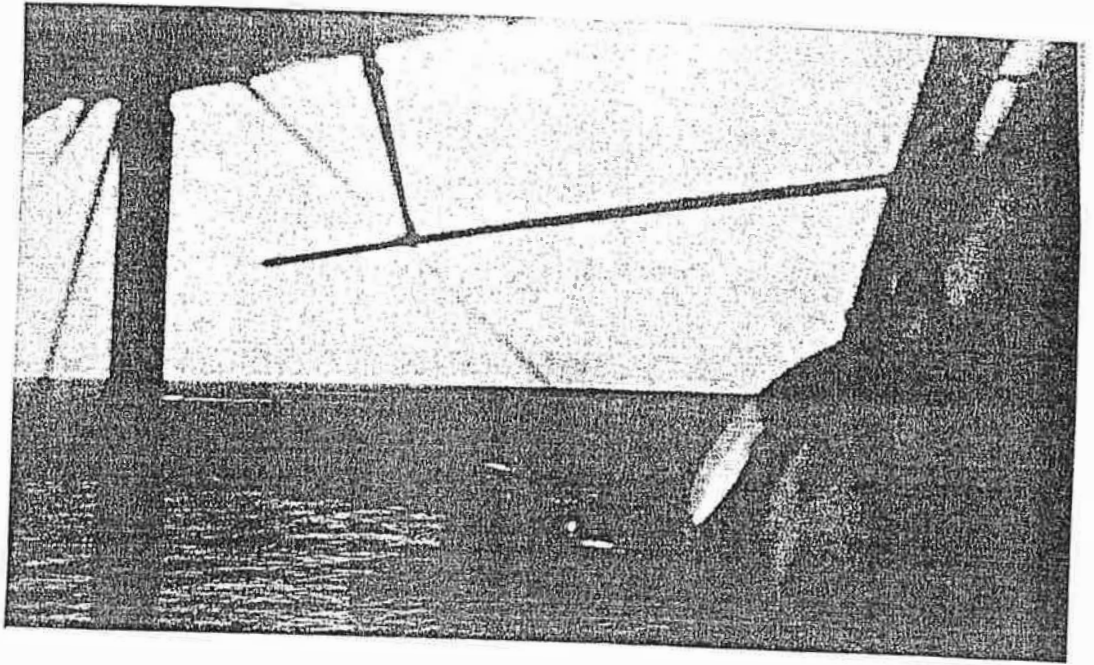
Deck Landing Control Signals



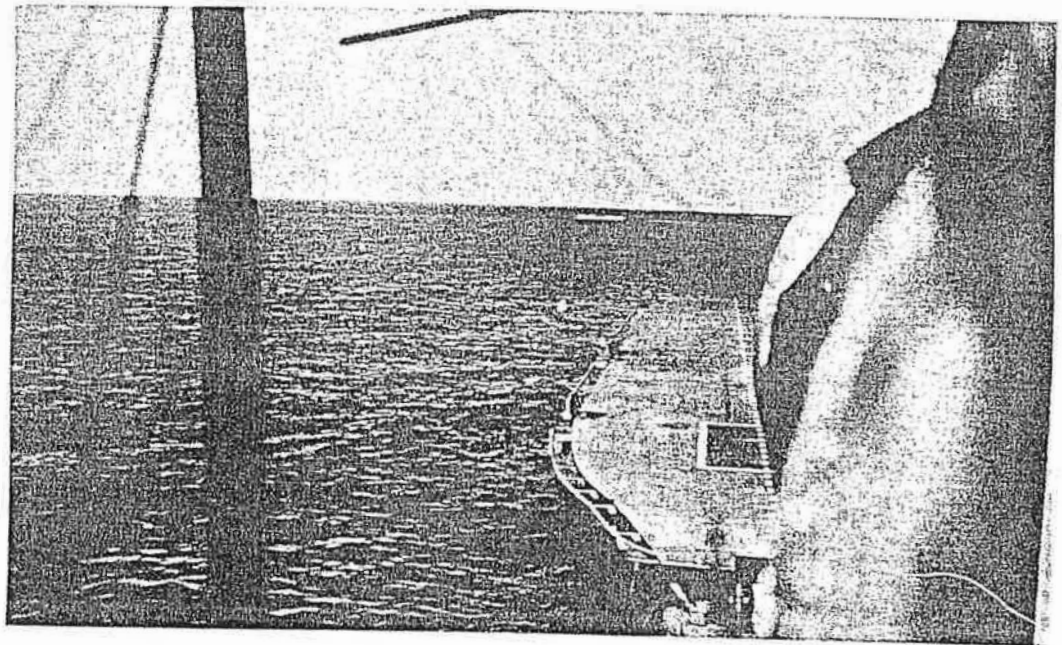
Deck Landing Control Signals

Turning in to land

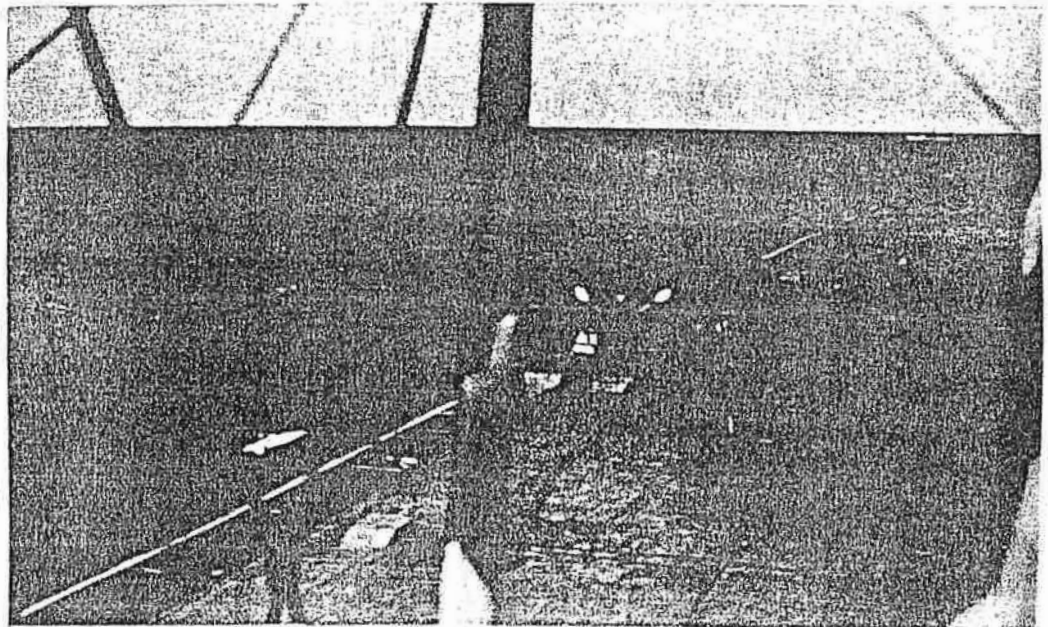
Turning in
to land



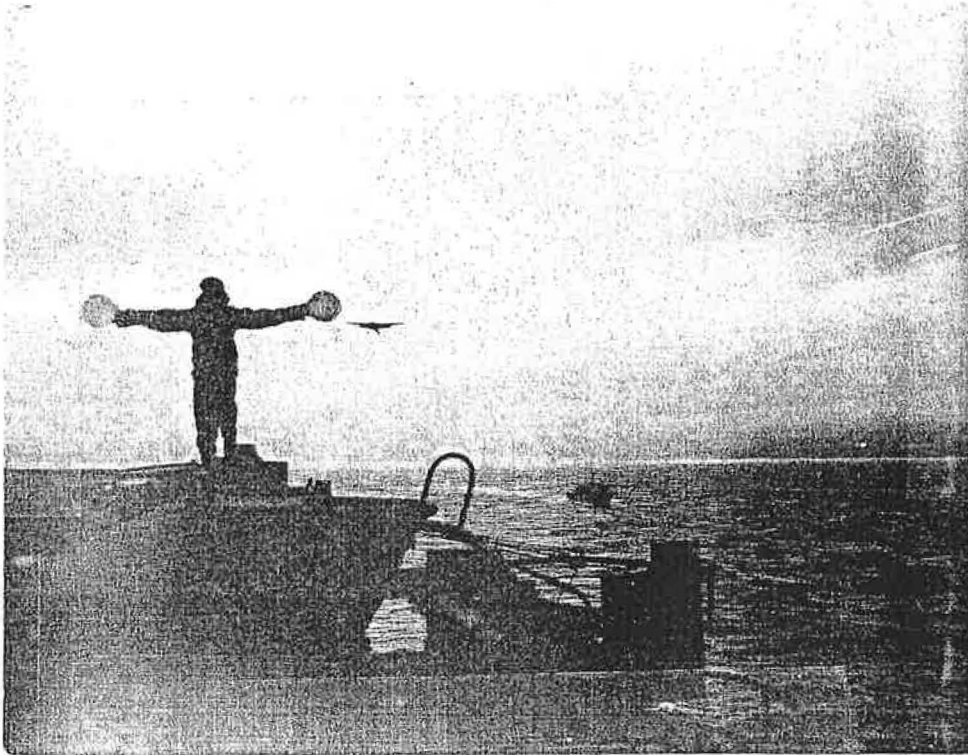
Final approach.
DLCO on port
side



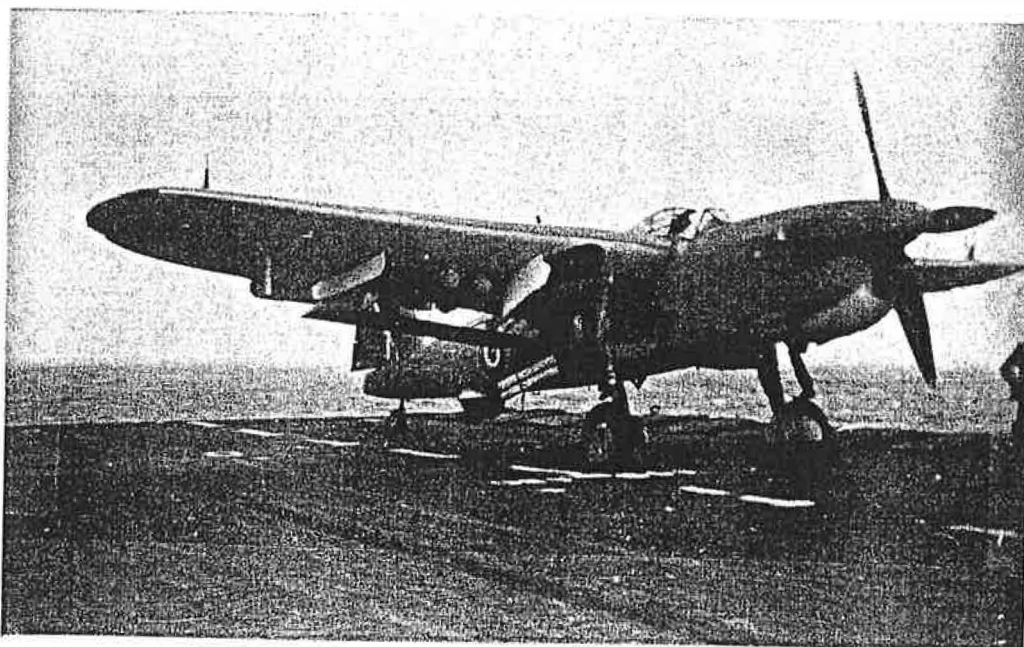
Prior to landing.
DLCO forward of
2nd arrester wire



Barracuda being batted onto MV Miralda



Barracuda being batted on to MV Miralda in the Clyde area in May 1945. Trials to ascertain if the aircraft was suitable for use on MAC ships.



Barracuda on the deck of MV Miralda after landing.

Tankers (No hangar deck) Landing Procedure

1. Aircraft on approach under guidance of DLCO.
2. Safety barrier raised.
3. Chief Engineer raises arrester wires.
4. Side wind screens lying horizontal on deck.
5. Handling party prepared in safety nets.
6. Aircraft lands and hooks to arrester wire.
7. Handling party release hooks and fold aircraft wings.
8. Arrester wires lowered to deck level, safety barrier lowered.
9. Aircraft taxis forward of safety barrier and is secured.

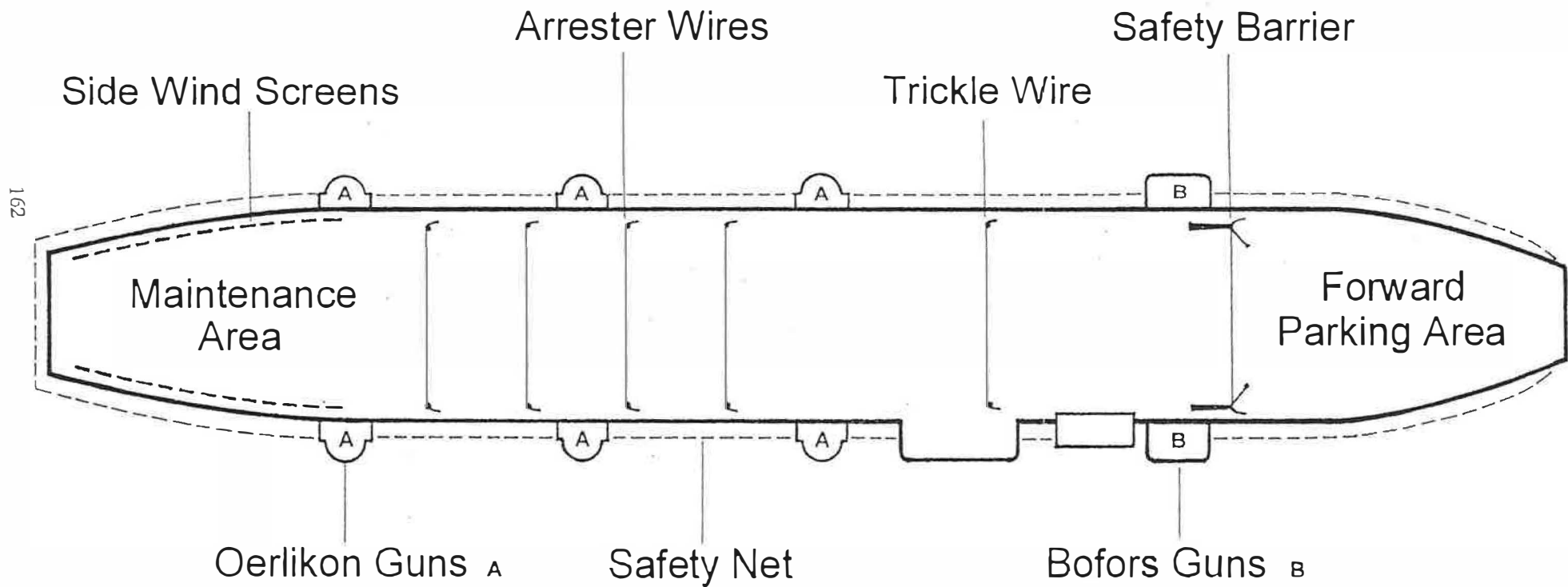
Procedure repeated for second and third aircraft to land.

After all aircraft have landed they are manhandled after ready for next take off or secured in maintenance area where wind screens are raised for mechanics to complete serviceability work.

Tanker flights had 3 Swordfish MKII aircraft.

Mechanics on tankers had to work on an open deck subject to all weather conditions of the Atlantic including rain, ice, snow and high winds. The working conditions were thus unpleasant and dangerous.

TANKERS *Flight Deck*



Grain ships (Hanger Deck)

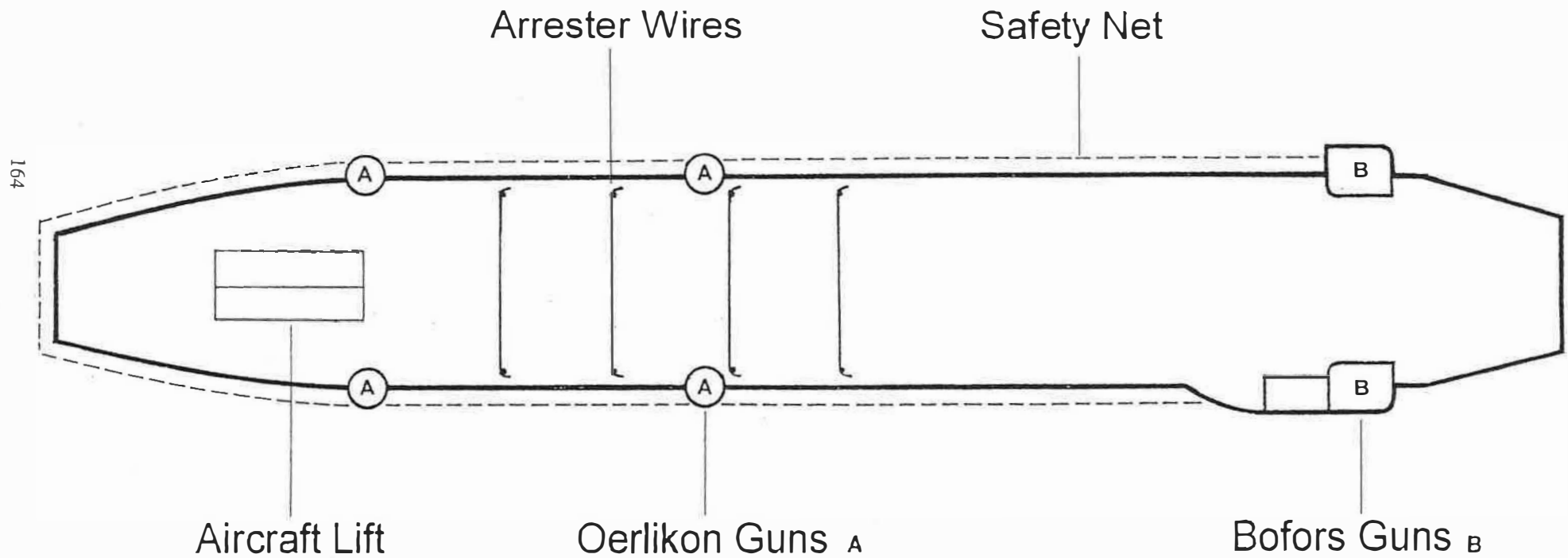
The grain ships differed from the tankers because a hanger deck was installed but no safety barrier was included.

1. Aircraft on approach under guidance of DLCO.
2. Chief Engineer raises arrester wires.
3. Handling party prepared in safety nets.
4. Aircraft lands and hooks to arrester wire.
5. Handling party release hooks and fold aircraft wings.
6. Aircraft manhandled to aircraft lift.
7. Aircraft lowered to hanger deck.
8. Procedure repeated for other aircraft to land.

Grain ships had the considerable advantage of a hanger deck allowing maintenance to take place in relatively warm conditions.

Grain ships had 4 Swordfish MK11 aircraft.

GRAIN SHIP *Flight Deck*



Procedure on an aircraft crashing on a MAC ship

The crash and accident rate on MAC ships, both Tankers and Grain ship was 1 in every 60 hours flown.

The greatest number of crashes resulted in damage or complete collapse of the undercarriage of the Swordfish which was notoriously weak. Whilst this was a problem on Fleet and Aircraft carriers, it was an extremely serious flaw on aircraft working from a MAC ship, especially Tankers.

Tankers

In the event of a collapsed undercarriage on a tanker the damaged aircraft had to be manhandled forward of the safety barrier before the next aircraft could land. The Swordfish was a large and heavy aircraft and it could take a considerable time to move it over a relatively short distance. If another aircraft requested immediate landing it was not unusual to strip the aircraft of essential parts and jettison it over the side of the ship. An aircraft pushed forward of the barrier but repairable then had to be manhandled back to the maintenance area aft of the ship.

Grain ships

On grain ships the damaged aircraft had to be moved to the lift to be lowered to the hanger deck for maintenance.

8.5 CONVOY BRIEFING PRIOR TO SAILING

The tactics adopted for the defence of a convoy were well prepared and structured in such a way that every surface vessel acting as an armed escort was aware of the precise action to be taken in the event of an attack by enemy forces.

The use of MAC ships introduced a new dimension into defence tactics through the use of aircraft as an additional defensive measure, thus placing on the Senior Officer Escort and the Commodores of escort vessels a new responsibility in a field in which the majority of them had no previous experience. The changed situation required a new understanding of the methods needed to operate aircraft from a carrier within the confines of a convoy. The essential requirement was for precise and clear cut instructions to be issued prior to the sailing of a convoy so that all concerned would be confident of acting decisively in an emergency. The question arose as to how these instructions could best be communicated, because on the early MAC ship convoys an escort would draw alongside the MAC ships and pass messages by line or use the visual system with the use of an Aldis lamp. Both of these methods were unacceptable being too slow and complicated. The officers most concerned with this problem were the Air Staff Officer of the MAC ship, appointed to the post because of his training and past experience of air operations.* The Senior Office Escort (SOE) on the other hand was usually a senior officer with years of experience in anti-submarine warfare.

The ideal solution was for the two to meet prior to a convoy sailing to discuss tactical issues and agree on a policy of co-operation and co-ordination acceptable to both sides. These issues could be extremely complicated and involved matters such as the position

*An Air Staff Officer was appointed to every MAC ship to advise the Master on the flying aspect and tactical operations. The Air Staff Officer was usually a Lt.Cdr. RN or RNVR with flying experience as a Pilot or Observer.

of the MAC ship within the convoy, the method of manoeuvrability whilst flying aircraft on and off the carrier and the anticipated time taken to complete the action. A general discussion on such matters gave each representative an opportunity to express their views according to their respective professional ability and agree on a plan of action.

One of the earliest of these meetings took place in Halifax before the departure of convoy SC148 on 12 Dec 1943 which was very successful and set the pattern for such meetings to be arranged, circumstances permitting, either in the Clyde area or Halifax.

Apart from the benefit of clarifying tactical matters a distinct advantage was gained by the personal relationship set up through a face to face meeting, giving each the opportunity to evaluate their general attitude to each other and assess the likely degree of harmony that would exist through the voyage.

The MacKay, in company with the Amastra, sailed in Convoy ONS22 escort group CZ. A meeting took place with the SOE and the ASO's from both MAC ships resulting in a plan being prepared to accommodate two MAC ships in company. It allowed for the positioning of the ships so that both could fly off aircraft at the same time in an emergency but also introduced a roster for a duty ship to carry out routine searches and patrols. The non-operational ship was thus presented with more time for the repair of damaged Swordfish and the mandatory thirty hour inspections for all operational aircraft. Serviceability always had a top priority but placed enormous pressure on all mechanics who had to work under the most appalling conditions either in a restricted hangar space on grain ships or on the open deck on tankers. The Petty Officer in charge of maintenance could set priorities and by skillful use of the extra time available could set realistic objectives to achieve 100% serviceability.

The MacKay returned home in convoy HX268 with a different escort group but unfortunately no meeting was possible before departure. In view of this, instructions

were passed by the SOE using a loud hailer. The ASO reported that although the instructions were clear and precise the degree of co-operation was less effective than that achieved following a meeting. The MacCabe returning in convoy HXF305 had American escort XTC with the SOE in U.S.S. South. There was no meeting before leaving and no evidence that any instructions were issued by the SOE. Throughout the voyage there were consistent problems covering flying procedures brought about by the fact that the SOE had no background at all regarding air operations. It was suggested that a meeting would have helped to minimise the difficulties encountered throughout the voyage.

8.6 COMMUNICATION BETWEEN VESSELS UNDERWAY SUBJECT TO RADIO SILENCE

The convoy signalling system had been well established by September 1939 but the methods had changed little since the First World War.

As more and more ships put to sea in convoy and the number of convoys increased correspondingly, each had a Commodore with a real need for five signalmen: a yeoman, a petty officer telegraphist, a leading signalman and two signalmen to keep a constant watch over a twenty four hour period.

But even before the Convoy System was in full operation there was a serious shortage of trained signalmen. The battle fleets got first priority, the Senior Officer's escort second, the escorts third and the Commodores last. In spite of this, the general standard of operations was excellent because the majority of posts were filled by regular RN ratings, supported by RNR and RNVR reservists, all of whom were highly trained. The emphasis was on morse signalling by Aldis lamp, semaphore, flag hoists and a grounding in international signals and coding for use at close range within a convoy.

Whilst at sea in early convoys their dedication and disciplined approach to the task of signalmen was exemplary and set an excellent example for the 'hostility only' trainees (HO), personnel enrolled into the Navy for the period of hostilities only, who joined a ship after a short fourteen week course. The style of training received ensured that the old methods would continue as the trainees gradually took over from the initial RNCRNR signalmen. Therefore when the MacAlpine joined convoy ONS9 in May 1943 it was no surprise that visual signalling by Aldis lamp was still in use and that the only way to pass written instructions was by Coston Gun. The Coston Gun fixed a line across to ships drawn alongside on which messages could be passed.

Whilst these methods had proved satisfactory in the past they were too complicated and time consuming to satisfy a demand for a method that would allow a simple and reliable interchange of messages that could not be intercepted by enemy forces.

Wireless telegraphy and radio telegraphy were available and in use and had been for a considerable time, but could not be relied upon for two main reasons. Firstly, the sets were unreliable because reception at sea level was poor and badly affected by the weather conditions existing at the time. Secondly, a state of radio silence would be imposed on all ships if U-boats were in the vicinity, to prevent them fixing the exact position of the convoy by HF/DF system. In order to overcome the barrier of radio silence, a new type of equipment was necessary that would allow secure ship-to-ship communication by either voice or telegraphy.

8.7 IMPROVED SHIP TO SHIP COMMUNICATION

The answer to this problem was provided with the availability of the Navy Model TBY-2, ultra portable, ultra high frequency transmitter receiver equipment in March 1949.

Design of these radio sets was to provide secure two-way communication by either voice or telegraph on any one of 130 different channels throughout the frequency range of 28 to 80 megacycles. The equipment was supplied complete in all details including battery power supply and antenna. The set was easily operated and was designed to keep background noise to a minimum over a range of approximately 6-7 miles.

The first MAC ship to be fitted with TBY was the MacAlpine in convoy SC157 voyage number 7 dated 17 March 1944. In his report the Air Staff Officer reported the benefit derived from being able to carry out a conversation with the other MAC ship in the convoy knowing that it was secure and could not be intercepted.

The MacRae followed on 29th September 1944. A successful conversation was established between the Senior Officer Escort, the Commodore and the Air Staff Officer, giving the opportunity for detailed arrangements to be made to update requirements for air patrols and searches, and to arrange duty rosters for all MAC ships in the convoy.

The demand for the TBY grew rapidly and in order that as many MAC ships as possible could be fitted with the equipment, arrangements were made for it to be made available in Halifax in September 1944. The set was manufactured by the Colonial Radio Corporation, Buffalo, USA so that it could easily be dispatched to the port of Halifax. The TBY proved extremely successful with only one exception; the MacKay on voyage 7 reported that the reception on the crossing was below the usual

standard. It so happened that at this time a new and superior set was becoming available on the market, the TBS.6. The main difference from the TBY was that crystal control was employed in both transmitter and receiver to stabilise the operating frequency and minimise drift whilst the range of communication was increased to about 10 miles.

There was a gradual changeover to these sets as they became available, the process being accelerated after a priority request from the MacKay at the end of September 1944 that all MAC ships be fitted at the earliest available date.

The TBY and the TBS revolutionised close communications between ships in a convoy and made manoeuvring within a convoy for flying purposes a much safer process than in the past.

8.8 AIR TO SURFACE COMMUNICATION RADIO/TRANSMISSIONS, WIRELESS TELEGRAPH AND VISUAL SYSTEMS

The Swordfish Mark II was equipped with the T/R1115/6 radio set. Provided this was used by a competent Telegraphist Air Gunner or Observer, it gave an adequate service for W/T or R/T communication between ship and aircraft. This was ideal except for the fact that it was possible for radio transmissions to be intercepted by enemy U-boats, and with the use of HF/DF detection the position of a convoy could be fixed by the enemy.

The SOE of the convoy had daily intelligence reports covering U-boat movements in the area through which the convoy would pass, and had the prerogative to demand radio silence for as long as considered necessary.

In convoy HX274, the MacRae, was subject to radio silence for the whole of the homeward voyage because of reports of heavy U-boat movements, and the Acavus in convoy HX299 maintained total silence for the voyage when 12 U-Boats were reported operating in mid-Atlantic. This meant, in effect, that aircraft would take off on a search on patrol with initially no communication with the ship, except that a routine signal in morse was passed at regular intervals usually at turning points on a search to determine radio contact. At no other time could radio silence be broken unless an aircraft became lost when a signal could be sent requesting a bearing to home onto the ship.

Many TAGs preferred to use W/T because the TR1115/6, known as the Wurlitzer, was capable of transmitting and receiving signals, loud and clear, at much greater distances than when R/T was used. The difference in performance between the two was widened when aircraft were restricted to flying at a low level, the usual height of a patrolling Swordfish being between 1,000 and 2,000 feet.

In spite of this R/T was used with excellent results by MAC ship aircraft.

The first voyage of the MacAlpine as early as May 1943 reported R/T reception strength 3 at 50 miles with the MacAndrew enjoying similar success in the same year.

There was never any doubt amongst aircrew concerning the vital importance of good two-way communication between ship and aircraft; their very lives depended upon it. In this way a close relationship was established between the TAGs, the Radio Mechanics and the MN Radio Officers on the MAC ships based on a mutual respect for their professional ability and a clear understanding that only the highest standards of performance were acceptable. By the middle of 1944 the ASO reports on all voyages consistently refer to the value of R/T communication, the sets being reliable with good strength of signal being passed over ever-increasing distances. This showed that signals at strength 3 were being received at distances of up to 100 miles whilst the Acavus on voyage 5, sent aircraft astern of the convoy, to a distance of 172 miles during which time the aircraft were in constant touch with the ship.

During training, Observers and Telegraphist Air Gunners became proficient in V/S signalling using an Aldis lamp. This method proved to be extremely useful for aircraft patrolling on a Viper around the convoy and within visual distance of the outer screen of escort vessels. The occasion would arise when it was necessary to pass a message to an individual ship for onward transmission to the Commodore or the SOE whilst radio silence was being observed. It was an effective method to overcome the restriction of silence with a guarantee that the message would be passed clearly by the expertise of convoy signalmen.

Apart from routine patrols and searches, aircrew were briefed from time to time to carry out a search for stragglers who had dropped astern of the convoy and were no longer in contact with the convoy.

These sorties were detested by the aircrew because there was always a real danger of time running out on the return leg caused by a sudden change in weather and wind conditions and offering no option but to ditch in the sea. When searching for stragglers the observer never allowed the question of time to leave his mind for a minute.

The object of the search was to locate the stragglers, report their position and capability to the SOE and then use the Aldis lamp to give instructions to the ship.

The Adula in convoy ONS35 experienced severe storms on 8/9 November 1944 which scattered the convoy and left many stragglers well astern by 12 November. The SOE requested that a search be made for stragglers to a distance of 60 miles astern to locate and direct these ships back to the convoy. Swordfish LS276 of 'P' Flight took off at 09.15 and after flying for approximately one hour located the M.V. Underleigh, listing badly to starboard and making little headway.

The only means of communication was by V/S and the pilot circled the ship at approximately 500 ft. As with most merchantmen the standard of V/S signalling was substandard and it took 40 minutes to determine that the cargo of the ship had shifted and there was a serious problem with the engines of the ship. It took a further 15 minutes to pass information on the position of the convoy and its M.L.A. All of the messages were passed in plain language and in this case it was fortunate that the ships crew were British. There was no further time available and the Swordfish returned to the ship after completing over 3 hours in the air which was too close to the limit for comfort.

This sortie demonstrated the problems that arose because of poor signalling techniques of some merchant ships which meant that in many cases the objective of the sortie was not achieved and the ships had to continue independently without any escort cover.

8.9 TACTICAL USE OF HIGH FREQUENCY DIRECTION FINDING EQUIPMENT FOR NAVIGATIONAL PURPOSES

It was inevitable that Swordfish aircraft flying on searches and patrols would become lost when subject to ever changing weather conditions. The slow moving aircraft were affected by high degrees of drift, and the observer thus had a major task keeping on track relying on dead reckoning navigation, which included an unreliable wind finding procedure and fixing position at any time. It was an unnerving experience when an aircrew reached their estimated time of arrival over a convoy and saw nothing except open sea all around. There were emergency navigational procedures that could be taken but with fuel almost exhausted these were often of little or no use. Fleet Air arm personnel had long realised the importance of introducing a system that would assist aircraft that became lost by establishing their position and bearing from a given point with the use of HF/DF radio systems.

With MAC ships an elaborate system was introduced with full instructions being laid down by order of the C in C Western approaches in MAC Training Orders (WAGM 829N 21 Nov, 1943). This system allowed the aircraft to call the MAC ship even if radio silence was being observed. The procedure was as follows:

- i) If a MAC ship aircraft was lost it should call the MAC ship and request a homing course.
- ii) The MAC ship would, if able, obtain a bearing by Type 242 radar and pass the aircraft a magnetic course to steer.
- iii) If a bearing could not be obtained by radar the ship would order the aircraft to shift transmitter for an HF/DF bearing and pass a course to steer to the aircraft.
- iv) If necessary the MAC ship would request all escorts to take bearings if fitted with HF/DF and pass the findings to the MAC ship.

The Type 242 radar was fitted to all MAC ships but its range for direction finding was limited and subject to breakdown whilst HF/DF could be used over a range in excess of 100 miles.

Considerable time was spent on perfecting the use of the HF/DF system. Aircrew, stationed at Maydown between voyages and also in the working-up period in the Clyde prior to joining a convoy, were trained so that both the Observer and Telegraphist Air Gunner could use HF/DF effectively in the event of their aircraft becoming lost.

Voyage reports indicate that HF/DF was highly effective with homing aircraft on several occasions and excellent results were achieved by carrying out exercises whilst on patrol.

The MacKendrick on Voyage 10 in Convoy ONS300 sent aircraft astern of the convoy to search for a reported U-boat. The aircraft flew for 17.2 miles and managed to keep in R/T contact at this distance. On the return leg the observer requested a HF/DF bearing to check his position and received an accurate fix at 120 miles, a fact which raised the morale of the crew and gave added confidence in the HF/DF equipment. Similarly, the aircraft from the Ancylos on Voyage 1 in Convoy ONS24 obtained an excellent homing passed to them by the MAC ship supported by the escort vessels. It was, however, not always such a success story. The Adula on Voyage 3 convoy ONF241 had two aircraft on patrol which suddenly hit fog. The first aircraft homed itself successfully on the ASV equipment in the aircraft. The second aircraft requested a homing but, unfortunately, because the aircrafts T/R 1156 radio developed a fault, the TAG was unable to receive messages clearly, and the aircraft crashed into the sea close to the convoy.

8.10 TACTICAL USE OF RADAR AND BEACONS

Without exception, Air Staff Officer reports point to the vitally important role that radar played during the operational activities of MAC ships. Radar equipment was still in its infancy in 1942, and subject to fluctuating results and frequent periods of unserviceability. In addition, the operators, whether on a ship or in an aircraft, often had not received adequate training to be sufficiently proficient in operating to the demanding standards required.

In spite of this, the operators and radar mechanics on the ships and the observers in the aircraft, learned through experience and trial and error that the equipment could be of immense value, both as a means of detecting surface vessels and as an aid to navigation. The MAC ships were equipped with radar Type 242 which was an interrogator equipment consisting of a responder (receiver) and aerials with the output from the responder being applied to a cathode ray tube in a radar set. The 242 could be used in many situations but its range scale was restricted to 75,000 yards which could be a limited distance in the event of homing a lost aircraft. However, it could be of immense value to the deck officers of a MAC ship whilst manoeuvring the ship in fog or poor visibility.

Both ship and aircraft radar were used so successfully that one of the most incredible landings ever made on a ship was completed in September 1943. The MacAlpine on Voyage 3 in Convoy ONS18 had flown off one Swordfish because of U-boats in the immediate vicinity, but thick fog closed in rapidly. This completely obscured the convoy. In spite of this, the aircraft piloted by S/Lt Singleton returned to the ship and made a perfect landing. The commendation made by the C in C Western Approaches summed up both the competence of all personnel involved and emphasises the part played by radar.

Credit was given to:

- i) The Master of the MacAlpine for manoeuvring inside the convoy solely by radar (Type 242).
- ii) The observer of the aircraft for finding the ship in the centre of the convoy by using aircraft radar ASVX.
- iii) The pilot for making a perfect landing in 50 yards visibility.
- iv) All Merchant Navy and Fleet Air Arm personnel concerned with the operation of the ships radar.

ASO's reports suggest that as ships radar operators became more experienced, the Master's confidence in radar increased and its use became normal procedure for keeping stations within the convoy particularly in poor visibility.

The Master of the MacCallum on Voyage 3 Convoy HXS300 experienced long periods of fog and expressed his gratitude for the excellent service received from the radar operators and mechanics together with their equipment. The Admiralty issued a letter under the authority of Lt. Cdr. J.H. Stewart Moore in December 1943 urging all MAC ships to appraise the benefits that could accrue from a well operated and serviceable Type 242 radar.

There is no doubt that this message had a real and lasting effect on all Air Staff Officers, and it led operators and mechanics to analyse the equipment in the hope of finding methods to improve overall performance. In this way imagination and innovation played a prominent part, the best example being provided by the radar personnel on the Amastra.

One of the great drawbacks of the equipment was the 75,000 yard range scale of the 242 but it was found possible to extrapolate up to ranges of 80,000 yards and beyond. This happened practically every time an aircraft was plotted to the limits of the range scale. Ranges in excess of 80,000 yards were achieved by the Adula, with the MacColl finally reaching a distance of 125,000 yards.

An account of a successful homing of a lost aircraft by Type 242 radar was given in the ASO report on Voyage 3 of the MacCabe. It indicated as follows:

- i) Type 242 radar was effective up to a range of 55,000 yards.
- ii) R/T communication was bad at the time but co-operation between the two MAC ships in the convoy obtained satisfactory results.
- iii) Identification Friend or Foe, even though giving a poor blip, was still of great value.

This aircraft was successfully homed, not because of the radar and W/T equipment, but by the close co-operation of the two MAC ships in the convoy, which co-operated to overcome technical problems.

The aircraft radar was the ASVX, which had a simple linear scan but was not very effective for U-boat detection, although the manufacturers had optimistically calibrated its range from 0-60 miles. In effect the ASVX was designed to give an indication of ranges in nautical miles, and bearings relative to the fore and aft line of the aircraft, of objects situated on the surface of the sea, such as ships and submarines within the horizon of the aircraft. The maximum range depended on the size and nature of the target and the height at which the aircraft was flying.

With a set in good working order the manufacturers claimed the following:

Aircraft Height	Target	Maximum range
2,000 ft.	Surfaced submarine	12 miles
5,000 ft.	7,000 ton ship	35 miles
10,000 ft.	Battleship	70 miles

The equipment operated according to the standard principles of radar technique. A series of pulses was radiated into space by a special aerial beam as a known scanner. An object which came within the limits of the scan would return these pulses as echoes

which were fed into a radio receiver. The resulting DC pulses were displayed on a cathode ray tube screen in the aircraft.

The equipment was not very effective for U-boat detection although many observers made constant use of it and, on gaining experience, claimed that it was possible to detect a snorkel at a distance of approximately five miles. The greatest problem was that it was extremely difficult to keep serviceable and it was often a full-time job with observer and radar mechanic working long hours together between flights to have the set in reasonable working order.

There have been claims made that many aircraft observers used the ASV exclusively for navigational purposes. This would not only have been foolhardy but extremely dangerous. Not only was the equipment subject to frequent failure but it was also unlikely that a large convoy would show up on the screen at a distance of more than 30 miles. It was therefore of little use as a navigational aid when at the extreme end of a leg on a search of up to 100 miles. However, it was an additional aid when aircraft were on patrol flying around the convoy at a fixed distance in poor visibility. In these circumstances the convoy could be kept constantly in touch on the radar screen enabling a bearing and distance to be available at any time, a comforting thought not only to the observer but also to the whole crew.

Identification Friend or Foe

In addition to the ASVX fitted in the Swordfish, IFF equipment (Identification Friend or Foe) was also available. * This equipment operated in conjunction with the radar Type 242 fitted into MAC ships. The IFF was a special combined receiver and

* The information given has been obtained directly from Observers of 836 Squadron who operated the equipment, or from short Air Staff Officer reports from the 217 ADMs.

transmitter which, on receiving a pulse of the frequency to which it was tuned, immediately radiated a pulse on that frequency. This would produce on the tube of the radar a pulse many times longer in amplitude than the normal echo for an object at the same distance. MAC ship Training Orders No.156 para (ii) state that IFF was to be shown continuously when airborne and was to be switched to the distress signal if requesting a homing when lost.

MAC ship Training Orders dated 20th December 1943 refer to the radar equipment known as MAB which was a beacon that enabled aircraft to obtain a bearing and distance from their ship when on search or patrol. No further information was available on this equipment either in the radar and radio archives at HMS Collingwood or in the libraries of Marconi, Ferranti and other major manufacturers of such equipment.

During the work up period in the Clyde prior to sailing, MAB code letters were passed to the ship by Flag Officer Carrier Training and code wheels were cut which enabled the identification letters to be transmitted (MACTO 156 para[iii]) by the MAB.

The beacon worked in conjunction with the ASVX used in the Swordfish Mk2 and when switched on appeared on the screen operated by the Observer. The code letters flashed in morse to establish identity and were followed by a long echo which enabled the observer to line the aircraft up fore and aft down the range calibrator. It was, therefore, possible to obtain a bearing and distance from the ship, providing assistance in obtaining an accurate fix of position and heading.

An interesting account of MAB appeared in the ASO report on the Amastra Voyage 1 Convoy SC148. Results obtained with the MAB were most satisfactory even when the MAB or the ASV were slightly off time, in which case the observers had to detune their ASV sets to obtain optimum results. This presented no difficulties and a range of

50 miles at 1,000 feet was obtained by this method. It was, however, found impracticable to have the radar Type 242 and the MAB operating simultaneously because the radar triggered the MAB and the aircraft received a garbled blip in consequence.

A report from the MacCabe Voyage 5 Convoy HMX298 indicated that the maximum range obtained at 2,500 ft was 45 miles but it was considered that far greater ranges were obtainable.

Two aircraft returning from a search from Adula Voyage 2 convoy ONF235 reported seeing the MAB at 65 miles from 1,000 ft very large but not very legible, but at 72 miles and 1,100 ft, very large and clear. The observers had no doubt that it could have been seen at a greater range.

On the Adula and Miralda, the MAB was switched on only for a routine period, usually for about three minutes on the hour and the half hour. In this way it did not interfere with the working of the radar.

It was usual to find that increased range was a result of aircraft flying at a greater height, but this did not appear to have always been the case with MAB. An observer on the MacMahon Voyage 2 in Convoy SC160 obtained the remarkable range of 60 miles at 200 feet, whilst an observer from MacCabe was happy to pick up a clear echo at a range of 30 miles at 500 ft. In this latter case it was particularly encouraging as the aircraft was returning to the ship in very poor visibility.

The equipment did, however, provide problems, as it was difficult to keep in a serviceable condition, probably due to the inexperience and inadequate training of the radar mechanics. This resulted in the equipment not being used on both the outward and return voyages on the MacCallum on Voyage 3 whilst the MacCabe had a similar experience on Voyage 8.

There can be no doubt that MAB was popular with observers as an aid, but because of inconsistent performance, it would have been a dangerous policy to have relied upon it at the expense of accurate dead reckoning navigation.

9. INCIDENTS

9.1 CRASHES & ACCIDENTS

Prior to joining an aircraft carrier, pilots received training in deck landing based around the common safety regulations. This allowed them to adopt a technique to suit their own flying characteristics. However, training was usually carried out in circumstances and weather conditions far removed from a MAC Ship on operational duties in the North Atlantic. The pilot was assisted in overcoming many of the basic problems by the performance characteristics of the aircraft used on MAC Ships. the Swordfish Mk2. It was an easy and uncomplicated aircraft to fly, had a minimum of controls and refinements and no nasty vices. The pilot could therefore give most of his attention to the mission in hand. For its size it was very manoeuvrable and had a low stalling speed, an essential feature in deck landing. The Pegasus engine was reliable and responded quickly, when required, to any change in power.

There were, however, several adverse factors associated with the plane to which the pilot had to be constantly alert. Although it had excellent all-round visibility, this was restricted when in a nose up attitude for deck landing, causing the pilot to rely to a great extent on the ability of the Deck Landing Control Officer. If it was unarmed and low on fuel the wing loading was so low that it floated and buffeted, often giving the pilot only seconds to make a correction in order to avoid trouble.

It is understandable that accidents and crashes on MAC ships between 1943-1945 were commonplace and occurred at the rate of approximately 1 crash for every 65 operational hours flown (Figures based on data available only). These crashes naturally varied considerably in severity ranging from minor damage such as a damaged oleo strut, broken tail wheel or burst tyre which could be repaired in a matter of a few hours, to serious damage resulting in the aircraft being written off and jettisoned over the side of the ship.

The grain ships had the advantage of a hanger deck where aircraft could be removed from the flight deck and worked on by the mechanics in the relative comfort provided through shelter and warmth. A crippled aircraft on a tanker was a particular nuisance because it had to be repaired on deck with only wind breaks for protection from the elements. In addition the damaged aircraft had to be secured right aft whilst Swordfish took off, which cut down their take-off length, and then manhandled up to the bows forward of the barrier for each landing on. In zero temperatures it was hard and demanding work.

An experienced pilot with many deck landings to his credit on both escort carriers and MAC ships considered that pilots making a deck landing on a fleet or escort carrier needed to be able to cope with certain conditions of weather and ship movement, in order to make a good landing providing the element of human error was not too high. If this was to be the case the following factors had to be overcome:

1. A last minute change of wind speed or turbulence caused by the movement of the ship or the wind being diverted by the bridge structure. The pilot was forced to make an immediate decision to either land the aircraft or go round again.
2. Wind gradient reduced air speed and in the event of a sudden drop in the wind there was a tendency for the aircraft to stall. This, once again, led to a non-uniform approach and made it more difficult for a pilot to make allowances for the ship's movement.
3. The correct method to maintain height was by skilful use of the throttle and to literally allow the aircraft to hang on the propeller. In this state, control of height and the lateral movement of the aircraft required high standards of airmanship.

4. The Deck Landing Control Officer played a vital role in assisting the pilot on the final movements of the approach but the final decision to land on had to be the prerogative of the pilot.

The short length of the deck and the relatively slow speed of the ship meant that more skill was required to land on a MAC ship if the above factors were to be overcome. Inevitably the crashes on the ships were influenced not only by the prevailing conditions existing at the time but in many cases by pilot error.

An accident which occurred on the MacCabe on Voyage 3 is a perfect example of a situation which affected all aspects of a deck landing – difficult conditions, pilot error and the influence of the DLCO.

“On the 6th May 1944, Aircraft N1 (Pilot – Lieutenant (A) C E Plummer, RNZNVR Observer – S/Lieutenant (A) D F McCallum, RNVR Air Gunner – A/P.O. W.S. Shotton, FX 77299) returned from a dawn patrol and circled to land on. Conditions prevailing at the time were a moderate swell and a light wind. The ship was turned into wind, and the affirmative given. The aircraft approached to land and was too high, the DLCO waving him round again. Two more approaches were made (during which time the wind increased to 30 knots over the deck) and the aircraft was waved round both times. On the fourth approach at 07.39 the aircraft came in on a normal approach and towards the end was waved down by the D.L.C.O. The aircraft came down but appeared to float and eventually touched down by the fourth wire, bounced and went on. At this moment the ship pitched, and the aircraft hit the barrier with its wheels and finished up on the tail of the aircraft parked on the starboard side forward of the barrier.

The crew were assisted out, being uninjured, and hoses from the forward foam generators were run out and foam was turned on. It is estimated that in less than two minutes a fire had started, and developed so quickly that in a matter of seconds

all three aircraft were alight. The Air Staff Officer then ordered all men away as both parked aircraft had full petrol tanks, and two aircraft carried 8 rocket projectiles each. At the same time the Master turned the ship and brought the wind on the port quarter. The petrol tank of the aircraft which crashed blew up, and five rockets fired.

After a short time the hoses were manned again, and the fire was gradually brought under control. At the same time a party from the ship's crew was dealing with the burning petrol which was running down onto the fore deck and forecastle. By 0807 fires were completely extinguished and the full petrol tanks had been prevented from catching fire, also no more rockets fired.

All aircraft were destroyed, except for the engines of the two parked aircraft, which did not suffer. The crew were found to be shaken but uninjured, except for a bruised knee. During the fire two escorts came up and stood by to give assistance".

A similar crash took place on the MacColl on Voyage 8 when the pilot missed all the wires before hitting the top of the barrier before continuing on and colliding with a second aircraft parked in the forward space. Both aircraft went over the side of the ship and into the sea.

Barriers were fitted on tankers but not on grain ships, but the accident rate was approximately the same on both types of ship. Unfortunately, the undercarriage of a Swordfish was weak and subject to collapse on a heavy landing and, as the majority of crashes were caused in this way, many aircraft became unserviceable for long periods of time. In the event of an undercarriage being completely destroyed a 'Stringbag' became difficult or impossible to manhandle forward or aft as necessary, to allow the other aircraft, to operate and so it would often be pitched overboard without delay or ceremony. Useful parts were removed such as the wireless, the clock, the bomb carriers and the radar set. Then an announcement was made that the 'corpse' of the aircraft would be ditched within the next half hour. The result was that the whole

ship's company descended on it like ants, and in an amazingly short time the entire aircraft had been sawn and ripped apart for souvenirs and was distributed in small pieces all over the ship. In the three year period that MAC ships were in operation, approximately 50 aircraft were jettisoned in this way from both tankers and grain ships. Accidents were usually caused by extreme weather conditions, as witnessed on the MacKay Voyage 2 Convoy ON217, when a violent storm caused the lashings to break on a parked aircraft. This then collided with the other two aircraft completely destroying all the aircraft of the flight.

There were many minor accidents but an unfortunate incident took place on the MacCabe on Voyage 3, resulting in an air gunner being killed. A rocket was accidentally fired from an aircraft parked on the after end of the flight deck. The rocket passed through another aircraft and killed the air gunner, Petty Officer Shotten, who was cleaning his gun.

A mechanic was also injured from blast effect and other personnel were treated for slight shock and minor injuries. It is of interest that Petty Officer Shotten's remains were committed to the sea in the presence of the whole ship's company and a salute was fired by a guard formed from both Naval and Army personnel. (The Army personnel were DEMS gunners).

Ship	Type - Grain or Tanker	Date in Service	Return Voyages	Days at Sea	Sorties	Flying Hours	Flying Days	% of Flying days to days in convoy	Crashes			No of crashes/ accidents to hours flown
									Minor	Serious	Craned off or jettisoned	
AMASTRA	T	Sep-43	6	167	47	87:55	26	16%	1	1	-	1.45
MACRAE	G	Sep-43	12	338	290	638:50	128	37%	3	4	2	1.90
ANCYLUS	T	Oct-43	5	141	97	188:55	51	36%	3	2	2	1.32
ACAVUS	T	Oct-43	6	172	94	246:30	49	35%	3	2	3	1.30
MACKAY	T	Nov-43	12	290	146	316:55	73	25%	-	3	8	1.30
MAC COLL	T	Nov-43	9	269	212	411:50	103	38%	4	5	4	1.40
MAC CALLUM	G	Dec-43	8	224	233	538:00	74	33%	2	4	4	1.60
MAC MAHON	T	Dec-43	10	292	281	576:50	117	40%	6	1	4	1.52
MAC CABE	T	Dec-43	10	260	252	576:10	100	45%	2	4	3	1.64
MIRALDA	T	Jan-44	9	236	209	453:30	101	52%	3	2	-	1.90
ADULA	T	Feb-44	9	246	227	498:20	106	43%	1	1	2	1.12
GADILA	T	Feb-44	8	223	240	519:40	77	43%	1	1	3	1.10
MACOMA	T	Apr-44	7	215	197	450:00	87	47%	1	4	3	1.60

Figures Relating to Crashes and Accidents

Ship	Type - Grain or Tanker	Date in Service	Return Voyages	Days at Sea	Sorties	Flying Hours	Flying Days	% of Flying days to days in convoy	Crashes			No of crashes/ accidents to hours flown
									Minor	Serious	Craned off or jettisoned	
MAC ALPINE	G	Apr-43	2	174	18	41:30	15		1	1	-	1.42
MAC ANDREW	G	Jul-43	2	149	30	50:45	14		1	-	-	1.50
RAPANA	T	Sep-43	1*	14**	10	-	-		1	1	-	n/a
MAC KENDRICK	G	Dec-43	2	53	39	206:00	22		1	-	1	1.10
ALEXIA	T	Dec-43	1	38	31	68:25	11		1	2	1	1.25
MACDERMOTT	G	Mar-43	1	25	27	60:00	14		-	-	1	1.60
* homeward only												
** estimated												
This sheet represents voyages researched under ADM 199 Convoy Reports because no records exist under ADM217 used on sheet 1. ADM 217 give a full Air Staff Officer report including statistics for the voyages of all ships on sheet 1. ADM199 Convoy Reports rarely give full information. It has, therefore only been possible to obtain limited figures for the actual voyages recorded and not the total number of voyages completed during the operational life of the MAC ships included on this sheet (2).												

Figures Relating to Crashes and Accidents

9.2 WEATHER & METEOROLOGY - EFFECTS OF ADVERSE WEATHER CONDITIONS

The MAC ships crossing the Atlantic from the Clyde to Halifax were subject to the full elements of the weather which, at all times of the year, could be violent and unpredictable. This is best emphasised by Voyage 5 of the MacRae in Convoy ON216.

At 1510 on 22 December, Swordfish C1 took off on a dusk patrol, the weather being favourable with a clear sky, practically no wind and a steady barometer. By 1530 the aircraft had returned and a violent storm was raging, visibility was poor, it was pouring with rain with a wind speed of over 60 knots blowing. In view of the rapidity with which the weather had changed and the steady barometer reading, it was decided to keep the aircraft orbiting the ship for as long as possible in the hope that the storm would blow itself out as quickly as it had arisen. The aircraft landed safely one hour later.

The violence of the weather encountered by this aircraft was exceptional but emphasised the extreme circumstances that could be encountered whilst out on a sortie including sudden and unpredictable changes that made a return to the ship and a safe landing hazardous, testing to the extreme the capability of the pilots. Heavy weather was constantly experienced. The ASO of the MacAndrew drew up a special report on weather conditions at the end of Voyage 5, Convoy HX276, because no flying was possible at any time during the 17 days of the outward trip due to the pitch and roll of the ship. The average conditions experienced gave a wind of 45 knots with a cloud base of 200 feet and visibility restricted from 500 yards to 1 mile. The return trip was hampered by severe gales which allowed only 16 short sorties to take place. It happened that when these sorties did take place the wind was ahead with a swell on the quarter causing the ship to roll badly and corkscrew, making landing very uncomfortable.

Sudden storms and high winds were encountered by the MacMahon on Voyage 7 leading to a navigation fault with the aircraft becoming lost but being successfully homed by HF & DF.

A change in wind direction was always a problem to observers who would always try to find an accurate wind approximately every 20 minutes but experience taught them to keep a constant watch on the surface of the sea which could give a sound indication of change in wind speed and direction. This applied in particular if an extended search was being carried out astern of the convoy up to a distance of 100 miles or more. The cruising speed of a Swordfish was around 75 knots whilst the convoy would be making good a speed of 10 knots, so that in the event of a sudden wind change, the navigator could find on his return leg that the closing speed would be very slow. In the event of not allowing for this there was no alternative but to ditch in the sea if fuel ran out before the convoy could be reached. The MacColl on Voyage 8 sailed through a series of depressions causing the ASO to note that it was the worst weather experienced to date. This resulted in the aircraft being securely fixed to the deck for the greater part of the voyage and no flying took place.

The Miralda on Voyage 5, Convoy HX310, had the particularly nasty experience of passing through the centre of a tropical storm. The anemometer in the ship only read up to 60 knots but it was estimated that it blew up to a steady 70 knots for several hours and gusted up to at least 90 knots for several hours. Several green seas reached the flight deck aft but not high enough to damage the aircraft which had been well lashed with 120 fathoms of 1¹/₂ inch rope to every possible securing point in addition to the usual wire lashings. The aircraft did not suffer any damage although it was thought at one time that the controls and fuselage were bound to be strained by the enormous pressure placed on the aircraft.

The MacKay on 26 May 1943 was in position 57° 31' N 12° 14' W steering 314° speed 9 knots in a wind from the South West force 10 with very heavy seas just forward of the port bow and a considerable swell. All aircraft were parked in the normal manner with Swordfish (D1) ahead with wings spread, the other two aircraft astern of her to port and starboard with their wings folded. Wind shields were up and

lashings of considerable strength were added to normal securing gear. At 2000 the ship gave an exceptionally heavy roll in a squall and D2 broke all her lashings, jumped her chocks and turned right round.

The whole flight was turned out to handle the situation but the aircraft was 'taking charge' on the deck where it was difficult to even stand up and too dangerous to approach the aircraft; it was also very dark. Eventually, the stricken aircraft ran against D2 whose undercarriage collapsed under the strain and her tailplane became jammed against the windshields.

However, worse was to follow. D3 had withstood the initial fury of the storm and had remained untouched but she was suddenly hit by a strong gust of wind and literally took off sideways, turning upside down and becoming wedged against D2. In the morning it was found that all three aircraft were tightly jammed together against the starboard windshields which were also severely damaged. The remains were discharged in Halifax where it was hoped that two of the aircraft might be made serviceable once again.

The strength of this storm showed the chaos that could be caused on the ship itself, especially on the tankers with no hangar deck to shelter the aircraft and demonstrates the dangers encountered by all personnel working on the decks of MAC ships in severe weather conditions. The aircrew acknowledged that high winds and heavy seas were commonplace in the Atlantic and prepared themselves accordingly to meet these conditions, which was not always possible if fog or poor visibility descended on the convoy. Fog would not allow a ship to manoeuvre in convoy even with radar, whilst it presented an aircraft with an almost impossible task of making an approach or landing. However, an exception to this was made when the MacAlpine on 21 September 1943 launched an aircraft when U-boats were pecking at convoy ONS18, in patchy fog which rapidly closed in completely.* It resulted in one of the most incredible landings ever being made on a MAC ship which reflected credit on the

* S/Lt R. A. Singleton RNVR landed on MacAlpine with visibility of 50 yards assisted by the skilful use of radar by his Observer and the seamanship of the Master of the ship.

Master of the ship, the pilot, observer and radar operators for professional ability and the degree of co-operation between all concerned. Many other incidents caused by fog were reported often with fatal results. An aircraft from the *Acavus* on Voyage 7 was unable to find the ship and forced to ditch but the crew were saved whilst aircraft from the *Adula* on Voyage 3 returning in fog ran out of fuel and ditched one mile from the ship after attempting to land three times. Sadly, all of the aircrew were lost. Thus, poor visibility became not only the greatest enemy to aircrews but the greatest fear. It was understood that there was always a good chance of returning and landing in heavy sea conditions but that the odds were against them in poor visibility and fog.

Good fortune did, however, favour one aircraft from the *MacColl* when several hundred miles off the coast of Ireland in convoy HX289, Voyage 3. Two aircraft had taken off to patrol because of considerable activity by U-boats in the vicinity, in spite of patchy fog. Both got safely into the air but within two minutes the starboard aircraft reported itself in thick fog and requested permission to return to the ship. The second aircraft hit the fog some ten minutes later and was also given permission to return to the ship but when it reached the position of the convoy it was completely obliterated. The aircraft circled for half an hour but was unable to get even a glimpse of the carrier when a message was received to jettison any unnecessary load and set course for the nearest land 275 miles away on bearing 120°. The aircraft by now only had half a tank of fuel left and a ground speed of 80 knots. In spite of this the aircraft flew for over two hours and preparations were made for ditching when the observer picked up an echo which was a large rock off the coast of Ireland. The pilot crossed the coast and made a perfect landing in a field.

It was the usual practice for every flight to appoint an observer as the meteorological officer of the ship, his duty being to prepare a weather forecast from reports sent out twice a day from Whitehall and Louisberg in Canada under the International Atlantic Fleet Analysis Code. The Telegraphist Air Gunners were detailed to read and decode the messages which usually gave limited information regarding centres of pressure and isobars. From this information the observers, who only had limited training in

meteorology, would draw up a chart and present a weather forecast which was treated with scepticism by the Commodores and SOEs who did not appreciate the work that was attached to this duty. It did allow an estimate of the wind speed and direction for aircraft leaving on a sortie but most observers preferred to find their own wind direction as soon after take off as possible.

This does, however, indicate that the Admiralty were well aware of Atlantic conditions and were doing all possible to predict the conditions likely to be met.

9.3 SIGHTINGS AND ENGAGEMENTS

The first sighting of an enemy U-boat was made by aircraft from the MacAlpine in Convoy ON518 on 22nd September 1943. The result of this encounter was not a success story even though a combined attack was made by two aircraft from B Flight. Aircraft B2 flying on patrol at 3,000 ft in good visibility, sighted a U-boat making approximately 18 knots on the surface and sent a first sighting report but received no acknowledgement. It was bad tactics for a single Swordfish to attack, so the aircraft circled the U-boat and waited for support. Fortunately, the sighting message had been received and a second Swordfish appeared armed with two depth charges. The combined attack was met with fierce opposition from a heavy concentration of guns around and immediately in front of the conning tower and on the afterdeck. The first Swordfish attacked with rockets firing a first ripple at approximately 1,400 yards. This fell short. A second firing at 800 yards went over the target. The second Swordfish made a dive bomb attack with depth charges through a heavy barrage. The depth charges fell about 200 yards wide with one not exploding. The aircraft returned safely. This was the first action for untried MAC ships and there was much need for an improvement in their tactics. The attack was not co-ordinated, the depth charges were of little use against the surfaced U-boat and the radio failure created many problems.

On 25th May 1944 the Ancyclus on Voyage 5 in company with the MacKendrick in convoy ONM 237 received a message from the Senior Officer Escort C3 Group, Mamba 058 emergency. Two aircraft were flown off from Ancyclus and one from MacKendrick but because of the low wind speed the planes could only carry 4 R/P's and a small load of petrol. At 1506 Lt. Owen Johnson flying Swordfish G3 reported by R/T a U-boat on the surface astern of the convoy. The three aircraft G1, G3 and M2 carried out a well co-ordinated attack with R/Ps which was pressed home well in spite of intense flack but all aircraft were severely damaged. G3 sustained damage to the port wing, the supporting spar being severed and a large part of the actual mainplane destroyed whilst a cannon shell hit the engine cowling and knocked out two parts from the Pegasus engine. It was not possible to use full power on the

engine and the aircraft staggered back to the ship flying a little above stalling speed before landing safely. Shortly after the attack the U-boat (U 853) dived apparently at leisure and the shadowing aircraft dropped a marine marker on the position of diving. It is certain that the submarine was not sunk but possible that it sustained damage, forcing it to return to its base.

The most tragic event to occur during the whole period of MAC ship operations took place on 8 July 1944 with the sinking of a friendly French submarine La Perle, with aircraft from the MacColl. Little documentary material was available until very recently due to the highly sensitive nature of the incident. The following details were given by S/Lt. Alan Pratt RNZNVR who actually took part in the attack by aircraft of 836 Squadron 'A' Flight.

A sighting was made of a submarine which was thought to be an enemy U-boat and at 1355 hrs a combined attack was made by all three aircraft of the flight with rockets and depth charges. Heavy anti-aircraft fire was encountered but the result was successful and the submarine sank within two minutes with no survivors.

The La Perle was en route to the Caribbean and it is believed that the mistake was owing to a failure in communication as a signal from the C in C Western Approaches to the Commodore of the Convoy with information that the area covered was subject to restricted bombing was never received. A constant watch was kept by all crew members on a patrol for any object that might signify the presence of a U-boat but it was easy to make a mistake over identification after hours on a patrol because of over enthusiasm should a periscope or a partly submerged submarine be spotted. *

* Relevant extracts from the MAC ship MacColls log follow together with the findings of the investigation into the incident and the letter of reprimand (p.201-203). Further analysis and a summary of the relevant signals are also given in notes 1 and 2.

A deep search was carried out by aircraft from Miralda Voyage 3 on 21st June 1944 on receipt of intelligence received of a U-boat position. Flying at 4,000 ft the pilot saw a definite wake forming in the sea below and ahead, and dived to investigate. The object was dark brown in colour and there was a vertical lump amidships. There was no sign of any underwater wake which suggested that it was probably a whale of which there were many in the vicinity. The Miralda was again involved in an unsubstantiated sighting report (Voyage 7) when a periscope was attacked ahead of the convoy. The other MAC ship in convoy, Adula, carried out patrols over the scene but saw nothing and believed no contact was ever made.

The Godila in convoy ON229 on Voyage 1 had S Flight aboard manned by a member of the Royal Netherlands Navy. A positive sighting was made on 28 March 1944 in position 51° 24' N, 31° 30' W and a combined rocket attack made on a U-boat which was astern of the convoy. The results of the attack were unobserved.

The Macoma in convoy SC161 received a contact signal from an escort five miles ahead of the convoy. It was a moonlit night at the time and flying would have been possible but for the lack of wind and there would not have been the slightest chance of getting an aircraft off the deck. The ASO regretted that rocket-assisted take-off gear was not available because it would have changed the whole situation. This equipment was available to many MAC ships by the end of 1944 adding increased offensive capability to the Swordfish aircraft.

In all there were 20 sightings and attacks made by MAC ship aircraft whilst on convoy duty. This appears low compared with the number of sorties flown. A U-boat would not generally stay on the surface near to a convoy unless it was approaching for an attack and then, if necessary, it would be prepared to stand and fight any aircraft making an attack.

In the case of radar, an experienced observer with a serviceable set would be capable of homing in on a surfaced submarine at a distance of up to thirty miles, but would never have any success in identifying a periscope. However, with the introduction of the snorkel, it was claimed that a detection could be made at a distance of five miles.

Aircrew from Mac ships completed hundreds of hours searching for submarines with very little success because very few sightings were made over a three year period of operations.

The chance of making a sighting depended on the use of radar, the ASVX or the good fortune of being in the right place at the right time. The early radar was unreliable and subject to breakdown placing great pressure on the radar mechanics on the ship who worked tirelessly with the observer of the aircraft to maintain a reasonable standard of serviceability.

When in good working order the radar set, operated by an experienced observer, could pick up a surfaced U-boat at a distance of approximately thirty miles. It was impossible to pick up an echo from a periscope showing above the surface even at short distances, but with snorkel being fitted to U-boats, a larger target was presented and some experienced observers claimed that a homing could be made at a distance of up to five miles. In the long run it came down to the simple fact that three pairs of eyes would have a better chance of detection than any of the technical aids available at the time.

YEAR	AIRCRAFT		PILOT, OR 1ST PILOT	2ND PILOT, PUPIL OR PASSENGER	DUTY (INCLUDING RESULTS AND REMARKS)
	Type	No.			
1944					TOTALS BROUGHT FORWARD
July 8	SWORDFISH	HE956	SELF	S/L. MORISON L/A LYNCH	A/S PATROL.
" 8	"	"	"	"	A/S PATROL.
" 9	"	"	"	"	A/S PATROL.
" 10	"	"	"	"	A/S PATROL.
" 12	"	"	"	"	A/S PATROL.
AUG 2	"	"	"	"	A/S PATROL.
" 2	"	"	"	"	A/S PATROL.
" 3	"	"	"	"	G.A.D.A. ON SOE.
" 5	"	"	"	"	A/S PATROL.
" 6	"	"	"	"	A/S PATROL.
" 6	"	"	"	"	A/S PATROL TO MAYDOWN.
July 18	"	LS218	"	"	LOCAL V FORMATION.
" 19	"	"	"	"	NIGHT MANOEUV.
" 19	"	"	"	"	OBS.
					R/P & D/F.
					<u>INSTRUMENT</u> <u>FLYING</u> <u>COURSE.</u>
" 31	OXFORD	135	L. O'FLYNN.	SELF.	I.F.
" "	"	"	"	"	"
" "	TIGER.	101	S/H. HILL	"	I.F. & SPINNING. I.F.
Sept 1	OXFORD	135	L. O'FLYNN.	"	I.F.
" 1	"	"	"	"	I.F.
" 1	"	"	"	"	I.F.

GRAND TOTAL (Cols. (1) to (10))
 559 Hrs. 05 Mins.

TOTALS CARRIED FORWARD

SINGLE-ENGINE AIRCRAFT				MULTI-ENGINE AIRCRAFT						PASS- ENGINEER	INSTRUMENT FLYING (incl. in cols. (1) to (10))	
DAY	PILOT	DUAL	NIGHT	DAY	1ST PILOT	2ND PILOT	DUAL	1ST PILOT	2ND PILOT		DUAL	PILOT
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
73.30	47.55	5.00	31.55							8.10	19.50	2 101
	1.55				SUCCESSFUL							1
	1.50											1
	1.15											1
	1.20											1
	1.35											1
	2.05											1
	2.20											1
	1.55											1
	2.25				LANDED							2
	1.55											1
	2.00											
	2.00											
	1.26											
					2.15							
	1.15											
	2.45											
					EGLINTON.							
-50							50				50	
1.00							1.00				1.00	
1.45											1.45	
1.00							1.00				1.00	
1.00							1.00				1.00	
1.05							1.05				1.05	
74.15												
74.10	47.55	5.00	34.10	4.55							25.30	2 112
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)

Empire MacColl log covering the sinking of the 'La Perle'

FINDINGS OF THE INVESTIGATION

The investigation into the Communications Department of H.M.C.S. "DUNVER" in accordance with C in C CNA 192359Z discloses that:-

1. There has been no definite allocation of the duties of Ship's Signal Officer and Ship's C.B. Officer, and the following situation exists:

(A) The Commanding Officer stated that Mr. Hibbert, Signal Bos'n, Royal Canadian Navy, had assumed the duties of Signal Officer for the last two round trips.

(B) Mr. Hibbert, however, was under the impression that he was responsible for Visual Signalling only and that Lieutenant Wilson was responsible for the conduct of W/T, R/T and Coding.

(C) The First Lieutenant stated that Mr. Hibbert was responsible for nothing in the Communications Department as he was borne for Training.

2. Lieutenant Wilson on joining H.M.C.S. "DUNVER" was called upon to perform the duties of Staff Officer, Group Signal Officer, Ship's Signal Officer, Group H.F.D.F. Officer and Ship's C.B. Officer which precluded his fully carrying out the duties as Group Signal Officer. It is considered that as he has latterly only been doing duties of Staff Officer, Group Signal Officer and C.B. Officer full attention should have been given to the duties of Group Signal Officer and closer supervision exercised over signals of the Group, particularly those of the Senior Officer's Ship.

3. It is further considered that Lieutenant Wilson by his attitude of indifference towards his duties as Group Signal Officer has shown himself to be temperamentally unsuited for duties within the Communications Branch.

4. It is felt that the confusion caused by the situation outlined above has led to a lack of supervision of the Communication Staff in H.M.C.S. "DUNVER". This is borne out by the following:

(A) Insufficient attention is paid to clear and thorough passing instructions.

(B) No effort is made to ensure receipt of messages by an addressee, when the signal has been passed through a link.

(C) The rough copy of the Senior Officer's 071705 shows no passing instructions. No trace of the rough copy of Senior Officer's 071857 can be found as it apparently never reached the Signal Distributing Office.

(D) Signals were sighted which have the recoded version, the coded version and the P/L version on the same sheet. This was queried and the reason given for this was the inability to obtain sufficient Signal Pads. This reason is not considered valid since no complaint has been received by Staff Signal Officer at Newfoundland on this score.

5. In view of the above it is considered that no blame can be attached to the ratings of the Communications Staff of H.M.C.S. "DUNVER" since their supervision has been inadequate and unsatisfactory.

RECOMMENDATIONS OF THE COMMITTEE.

It is recommended that:-

1. A definite allocation of the duties of Ship's Signal Officer and Ship's C.B. Officer be made at once and that these allocations be fully understood by Officer and ratings concerned.

Department of National Defence

Naval Service

Ottawa, Canada.

23rd September, 1944

IN REPLY PLEASE QUOTE:

N.S. TS 11156-715

N.S. TS 11150-381

Vol. 1 (Staff)

TOP SECRET

FROM: The Secretary, Naval Board,
Naval Service Headquarters,
Ottawa, Canada.

**Letter of reprimand regarding
the sinking of the 'La Perle'**

TO: The Secretary of the Admiralty,
Whitehall, London, S.W. 1,
England.

With reference to the Board of Inquiry concerning the sinking of French Submarine "LA PERLE" on the 8th July, 1944, which was sent to you by The Commander-in-Chief, Canadian Northwest Atlantic, on the 28th July, 1944, his file C.N.A. 0032, attached is a copy of the Investigation of Signal Department H.M.C.S. "DUNVER" which is referred for your information.

2. I am instructed to inform you for the information of Their Lordships that Commander George Hay Stephen, D.S.C., O.B.E., R.C.N.R., the Senior Officer of C-5 Group, has incurred the severe displeasure of the Department for failure to exercise complete control over the escorts in his command, and that Lieutenant John Harris Campbell Wilson, R.C.N.V.R., has incurred the severe displeasure of this Department and has been reverted to general service for not exercising closer supervision over the signals of the Group.

3. I am further to inform you for the information of Their Lordships that the following Officers are considered largely to blame for this unfortunate incident for the reasons shown:

Lieutenant-Commander (A) H.B. Dangerfield, R.N.

Air Staff Officer of M.A.C. Ship "MacCALLUM", who failed to see that the aircraft, before taking off, had sufficient information regarding recognition procedure between aircraft and friendly submarines and who, in fact, was not sufficiently well versed in such procedure himself. It is considered that he showed a complete lack of executive ability on the receipt of S.O.E.'s signal at 1358 asking whether the aircraft had been informed of the presence of a friendly submarine. When asked what he did on receipt of this signal (Question 143), he replied "Well, quite frankly I didn't know what to do."

Lieutenant (A) Francois Otterveanger, R.N.N.

This Officer, the pilot of aircraft T-1, was the first to sight "LA PERLE" and co-ordinated the attack. "LA PERLE" was in sight for over an hour before the attack was delivered. She steamed steadily on the surface and challenged the aircraft with the letter "L", which apparently was the correct challenge of the day. A pilot's feelings on sighting the submarine on the surface and the excitement which would cause him to thrust all ideas out of his head other than the one to attack is understood; however, an hour is considered a long time for an enemy submarine to steam steadily on the surface without making any endeavour to escape or engage the aircraft by A/A fire. It is also impossible to condone the pilot's complete disregard of the submarine's challenge, even though, as he states in his evidence, Question and Answer 226, "This conveyed nothing at all, because it is one of the usual tricks of the 'Jerries'".

R.T. Morgan
SECRETARY, NAVAL BOARD.

Note 1

Analysis of the Sinking of 'La Perle' – Convoy ON243 – 8th July 1944 *

The sinking of the La Perle, a friendly French submarine, represented a disastrous operation for MAC ships. The submarine was sunk at 1410Z on 8 July 1944 in position 55°27'N 33° 50'W as a result of a concentrated attack by Swordfish aircraft from the MAC ships Empire MacCallum 'T' flight (4 aircraft) and the Empire McColl 'A' Flight (2 aircraft). These MAC ships were escorted by Group C5 (Commander G H Stephen in HMCS Dunver). The escort group had received daily situation reports which included La Perle from C in C Western Approaches (see Note 1), but signals instituting bombing restrictions were not passed to the group.

However, adequate information was available to the SOE to indicate that La Perle would pass sufficiently close to the convoy to be within the area of its patrols. The signals to HMCS Dunver were passed to the Commodore with a request that they be forwarded to the MAC ships.

From the time of the first sighting report until the attack was carried out an interval of more than one hour elapsed and it was not until then that the SOE appeared to realise that the submarine was the La Perle. Even at this stage no urgency was apparent and no attempt was made to communicate directly with the aircraft to stop the attack.

A combined attack was carried out by the six Swordfish aircraft using both rockets and depth charges. In the official report no mention was made of any anti-aircraft fire but

S/Lt A Pratt from A Flight on the McColl claims that there was fairly heavy resistance from the submarine. The submarine sank within two minutes, leaving only one survivor, Chief Petty Officer, Emile Le Clerc. Apart from the general failure of communications, the situation was worsened by the fact that the Commanding Officer of T flight was advised of recognition signals in force but disregarded the correct recognition procedure of the La Perle.

* Reference: Findings of Board of Enquiry ADM 16387

A Board of Inquiry was set up in St. John's, Newfoundland, and came up with a damning report. The greatest criticism was of the Senior Officer Escort for failure to exercise complete control over the escorts in his command and that the ships signal officer failed to exercise close supervision over the signals of the group.

Two MAC ship officers were also severely reprimanded. The Air Staff Officer of the McCallum gave insufficient information regarding recognition procedure between aircraft and friendly submarines because he was not sufficiently well versed in the procedure himself.

The Commanding Officer of T Flight was severely admonished for completely disregarding the submarine's recognition signals which correctly flashed the letter of the day (letter L) and pressing ahead with the attack which he co-ordinated with the other aircraft.

In spite of the greater part of the blame being placed on the Senior Officer Escort (HMCS Dunver) and his signals officer, the tragic result was to a great extent caused by MAC ship airmen who showed incredible incompetence in neglecting basic operational and tactical procedures.

The only satisfactory result of this tragic incident was a recommendation by the Admiralty that the Dunver's Signals Officer and all ratings concerned fully understand the duties allocated to them.

Note 2

Summary of signals regarding the sinking of the 'La Perle' ★

1. Submarine report from C in C, Western Approaches - 071529Z July 44 Position for friendly submarines:
La Perle making 8 knots diverted to pass through new position. 56°10'N 33°20'W
New Course 085°.
2. To FONF from La Perle: My position 0712000Z
53°08'N 36° 45'W. Ref: Alter course for La Perle.
3. From C in C, Western Approaches:
French submarine La Perle en route 56°10'N 36° 20'W reports position 071200Z 53° 08'N 36 ° 45'W.
4. Admiralty message passed to C in C, Western Approaches:
All friendly submarines total bombing restrictions La Perle (attack restrictions also - position reported).
Restricted area 20 miles abeam, 50 miles fore and aft 081359Z July 44.
5. Whitehall from Dunver - 081531B July 44:
1 submarine on surface bearing 294 ° distance 33 miles course known based on fix at 1300.
6. Admiralty from Dunver - ONM 243:
Am attacking enemy submarine (Respeler & Westminster to assist) 081544Z July.
7. Admiralty (C in C, Western Approaches) from SO C5 Group Position given,
submarine sunk by Swordfish aircraft in position 55° 10'N 33°W 081745B July 44.

★ Reference: ADM 237/731.

8. To Dunver from C in C Western Approaches: Report situation herewith. No date.
9. C in C, Western Approaches from SO C5:
Your 081746 and my 081745 refers - greatly regret submarine sunk was French La Perle - only survivor CPO Emile Le Clerc now on board Hespeler.
10. To Escorts OMM 243 from Admiralty:
Detach 2 escorts to search area and render assistance.
Report evidence of aircraft pilot, regarding identity of submarine and whether recognition signal stems 0812020B July 44.
11. C in C, Western Approaches from Admiralty: Cancel search when useless 090025B July 44.
12. C in C, Western Approaches to Admiralty: Requesting Board of Inquiry 091319B July 44.

10. RELATIONSHIPS BETWEEN MERCHANT NAVY & ROYAL NAVY PERSONNEL

There was no single circumstance that characterised the harmonious relationship that developed between the Merchant Navy and Royal Naval personnel serving in MAC ships because it was something that appeared through a mutual respect for each other, based on high esteem for professional ability and a recognition of the need for a social awareness that would lead to a happy and efficient ships company. The Admiralty must have realised that to establish social inter-relationships where there were wide social and professional differences would require a flexible approach which could only be found in strong leadership coupled with exceptional man management capability.

The first indication that things were moving appeared in MAC Ship Training Orders dated 20.12.43 under the heading of Relations with MAC ship officers. It stated that in all respects the Master was both the Captain and Commander of the ship and that he would depend on the Lieutenant Commander, (Air Staff Officer) for advice on all matters relating to the Service (Fleet Air Arm).

It was the duty of the Air Staff Officer to gain the complete confidence of the Master and the Ships Officers. Unity, upon which the fighting efficiency of the ship was dependent, could only be achieved upon a basis of complete and wholehearted co-operation.

Several months before this notice had been promulgated, trials had been carried out on the first MAC ship to be put into service, and the first return voyage across the Atlantic made. In that short time a pattern had been set that was to establish a standard of professional respect and harmonious interrelationships amongst all ranks of both services. This was brought about by the exceptional ability of two men – Lieutenant Commander Ransford Slater RN – Commanding Officer of 836 Squadron and Captain William Riddle in Command of the Empire MacAlpine of the Ben Line, the first MAC in service. Ransford Slater was the son of Sir Ransford and Lady Slater of Cookham Dean. Slater senior was in the Colonial Services and Governor of both Jamaica and the Gold Coast, and young Ransford was educated at the R.N. College,

Dartmouth from 1927 – 1931, but did not train as a pilot until 1936. In December 1941 he joined 830 Squadron in Malta where he had a distinguished record, being awarded the DFC before becoming CO of 836 Squadron in July 1942. He served with this squadron until it was reassigned as the official MAC ship squadron. His widow, Katherine Hollins, described Ransford as an extremely attractive man who was people-minded and had the ability to mix well with people in general. This statement was reiterated by John Tayler, an Observer in 836 Squadron who served under Ransford. John Tayler, in writing an account of 836 Squadron, said of Ransford Slater that he had the capacity to dedicate himself utterly, to give his affection to his Officers, TAGs and Ground Crew alike and assure himself that their welfare received top priority. His ability to communicate, combined with a strong style of leadership, coupled with a quick sense of humour made him what was described as an incomparable CO.

Captain William Riddle was the Master of the first MAC ship to enter service and was in command of the Mac Alpine when trials were carried out with 836 aircraft prior to joining Convoy ONS9 for the Atlantic crossing to Halifax in Canada. Captain Riddle had long connections with the Royal Navy. The son of a Provost of Galashiels, he joined the Royal Navy at the age of 15 and trained under sail, rising to a full Lieutenant. He left the Navy in 1911, but enlisted in the Army in 1914 where he served until 1920, when he joined the Merchant Service in the Ben Line. He was Master of several ships before being given the command of the MV Mac Alpine. He was responsible not only for the handling and safety of the ship, but also for both RN and MN personnel on board and for harmonious relations between them. He was described as a big man in every way, and because of his wide background of ships and the sea in both services and his experience of command in war and peace, he was the ideal choice for this new venture.

Following the trials in the Clyde area which had demonstrated both superb seamanship and airmanship, a period of intense training took place, in which the leadership of Ransford Slater was evident in every respect. Ransford's skill in landing on a small deck was passed on to his pilots, whilst the care he took to see that the morale of the troops was good and every effort made to make them feel that their contribution to the enterprise was vital.

Most important, however, was his insistence that the RN/MN barriers were broken down and good relationships established. To help achieve this, the 'Royal Navy' logo on the Swordfish were replaced by 'Merchant Navy'; the ship's call sign was 'Bearsden' the home of Captain Riddle and the aircraft given call signs Riddle Able, Riddle Baker and so on. The officers were encouraged to take an interest in the working of the ship, whether it be with the deck officers, engineers or radio officers, or any other aspect in which they were interested; whilst the Doctor treated both MN and RN personnel in a fine sick bay and interested himself in the workings of the anemometer as a secondary duty. There is no doubt that these inter-relationships were the forerunner of a mutual respect that was to develop for the professional ability of both RN and MN personnel as they undertook their respective duties on operations and realised that a harmonious relationship was essential to an efficient fighting ship.

The relationships were developed as personnel began to understand the degree of skill and dedication that was necessary to carry out individual tasks, often in difficult and dangerous circumstances requiring swift and courageous decision making. In no way was this more clearly demonstrated than in the period prior to the taking off and landing of aircraft at sea within the confines of a convoy. The duty of the ship was to manoeuvre into wind in the quickest possible time without falling too far astern of the convoy. It was a process that involved the Master and deck officers, engineers and seaman in an exercise that needed a close degree of co-operation from all hands to be successful.

The duty of the Air Staff Officer was of vital importance as it was his task to ensure that the Deck Landing Control Officer and Fleet Air Arm personnel were on hand to prepare the aircraft for the signal to take off, and to clear all three aircraft from the deck in the minimum of time. The time factor was even more important when aircraft were returning from a sortie. Once the ETA was known, the ship needed to be in position at that time for the aircraft to land. It became possible for all 3 aircraft to land in a period of three minutes, an incredible achievement involving the skilful handling of the aircraft on landing and manhandling them into position.

It did not take long for both FAA and MN personnel to realise the precise skills required to carry out this operation and the degree of co-operation necessary throughout the exercise. Commander Tug Wilson, the first Air Staff Officer on the Mac Alpine, said that Merchant Navy officers and men showed admiration for aircrew of MAC ships and that their very presence on the ships proved to be a great booster for morale.

This feeling was given even greater emphasis by an incident that occurred on Voyage 3 of the Mac Alpine when a Swordfish piloted by S/LT R Singleton made an amazing deck landing in fog with visibility of only 50 yards. The result was a commendation from the Commander in Chief Western Approaches as follows:

- i) The Master of the ship, Captain W Riddle, for manoeuvring his ship in convoy to land an aircraft solely by radar aid.
- ii) The Observer of the aircraft, Lt Cdr J Palmer for operating his air radar with extreme accuracy to find his parent ship.
- iii) The Pilot of the aircraft, S/Lt R Singleton for approaching the ship and making a good landing in air visibility of 50 yards.
- iv) On the FAA ratings and MN personnel for the accuracy with which ships' radar was operated.

Nothing could indicate with greater clarity the degree of co-operation that existed and the mutual trust in the competence of all concerned to carry out their respective tasks to the highest standards. It should be remembered that these skills were being carried out hundreds of times by all 19 MAC ships on operational duties and the task was made even more difficult when more than one MAC ship was included in a convoy.

These spectacular and dangerous incidents which gave rise to exceptional skills helped to level all barriers between personnel, not only because of mutual respect, but also to develop a genuine empathy between the two services.

In December 1943, convoy ONS 216, S/Lt Galbraith took off from the Mac Rae on Voyage 2, on a dusk patrol with a clear sky and practically no wind. One hour later, on returning to the ship, a violent storm was raging, visibility was very poor and the only ship in sight was the escort trawler. It was pouring with rain and a true wind speed in excess of 60 knots was recorded. In view of the rapidity with which the weather had changed and the steady barometer reading, it was decided to keep the aircraft orbiting the ship for as long as possible in the hope that the storm would blow itself out as quickly as it had risen.

However, this did not happen and in view of the failing light, it was decided to make an attempt to recover the aircraft. The ship was turned full speed downwind and the aircraft signalled to land on over the bows. In spite of steaming downwind, the wind speed over the deck was between 55 and 60 knots with the ship pitching heavily. The DLCO attempted to bat the aircraft onto the deck from a position by the bridge, but in spite of being supported by two MN deck officers, he was unable to maintain his balance. Further danger was encountered by the fact that evasive action had to be taken by the ship on two occasions due to ships going out of control and suddenly looming up out of the rain and cloud. The pilot nevertheless made a perfect landing and the aircraft was held down by every available man on board, Fleet Air Arm and Merchant Navy together.

It was considered that great credit was due to both the Master and the Air Staff Officer for making a combined and courageous decision, whilst the pilot received special commendation for a fine landing in the worst possible conditions.

The C-in-C Western Approaches commended all concerned for the splendid seamanship of the Master, the airmanship of the pilot and the sound judgement of the ASO. ★

★ Communication M. 01580/44

Nothing could have done more than this to enhance the already excellent relationship that existed between MN and RN personnel on the Mac Rae. There is no doubt that an emotional bond existed between aircrew and MN personnel and any fatal accidents were deeply felt on both sides.

In January 1943 the Acavus flew off a Swordfish on patrol at dawn, but the weather deteriorated and poor visibility set in, resulting in the aircraft being lost, and because of poor radio reception and an IFF failure, it was not possible to home the aircraft. Acavus reported that not much endurance was left and then shortly after that the aircraft must have ditched.

The Master of the Acavus requested permission to leave the convoy and to drop astern in order to search for the lost aircraft to a distance of 40 miles. This was a highly dangerous decision to take as it put the ship in considerable jeopardy from shadowing UBoats. However it illustrated the lengths to which MN personnel were prepared to go to assist colleagues in distress.

This was an unsuccessful attempt as the aircraft was not found and all three crew members were lost. The feelings of all concerned were contained in a letter from the SOE on HMCS Assiniberine who said that the aircrew were lost whilst carrying out a patrol which might have had vital consequences to the safety of 65 ships, and that he would never cease to regret that homing of the aircraft was unsuccessful.

This sentiment was obviously echoed on Acavus and would have brought home to all crew members the need for co-operation and goodwill at all times for a happy and efficient ship.

In early 1944 during voyage 1, an aircraft returning to Empire Mac Callum from an ADDER patrol made a high approach, drifted to starboard and hit the bridge, slewed over the bow and finished right side up in the water. The ship's motor lifeboat was lowered and sent away and picked up the crew after twenty minutes, mainly due to the effort of 3rd Engineer T K Gurne who dived overboard from the lifeboat three times into the sea, whose temperature was 38 degrees Fahrenheit in order to assist the airmen into the boat.

The C-in-C Western Approaches considered that the gallant conduct of this officer to be worthy of special commendation. The interesting fact to arise from this commendation is that it was addressed to the Hain Steamship Company, St Mary's Axe, London EC3, dated 23rd June 1944, thus giving official recognition to the Merchant Navy.

A vitally important job on the MAC ship was the maintenance and operation of the arrester gear, the responsibility of the Chief Engineer. On tankers, the whole system of arrester wires and safety barrier were steam operated and controlled usually by the Chief Engineer, or an Engineering Officer for take off and landing. The barrier was hinged and lay flat during take off; the arrester wires also lay flat during take off, but were elevated to one foot above the barrier by vertical steel studs and controlled by the Engineer from a position in the nets close to the DLCO, so that they could work in harmony for a deck landing. The engineers took this task extremely seriously as it was realised that any fault on the equipment could cancel any flying operations.

On voyage 8, convoy HX 319, the Mac Kay experienced very heavy weather and high winds which caused damage to the ship including a fracture to the main steam pipes leading to the arrester gear. The Chief Engineer and an electrician worked in an extremely difficult area, close to an expansion plate, and succeeded in carrying out necessary repairs within 48 hours. It was considered to be an exceptional feat, showing great engineering skill and dedication.

Many MAC ship pilots had experience of flying from escort carriers which were of a similar hull design, but had a draught of 17 feet which could not be varied. These were very lively in bad weather, whereas in tanker MAC ships, extra ballast could be pumped in to get the draught down to 24 feet or more, making them much more stable. In order to achieve this stability a complex system of deballasting and loading a ship every time the MAC reached Halifax was devised.

The system was ably described by Captain R S Allan, who was First Mate in the Adula, which like all MAC ships, had the navigating bridge on the starboard side. He explained that the trick was to take out all the ballast except about 200 tons in number

3 port wing. This balanced the weight of the bridge and kept the ship upright. A centre tank was then loaded to capacity with fuel oil and then the port wing tank was deballasted and gradually oil was bled from the centre tank to the port wing tank as the ballast was pumped out to the shore and the upright position was maintained.

Whilst this operation was being completed, the aircrew would have left the ship and most of them would have been totally unaware of the work being carried out by their MN colleagues to create maximum stability of the ship when at sea and completing flying operations.

Another achievement of MAC ships was to successfully oil escorts at sea, thus vastly increasing the endurance of these ships and making them tactically more effective. The latter part of 1944 saw several ships being fitted with oiling equipment whilst in Halifax harbour, the first of these being the Mac Rae in September, before joining convoy HX 308, when several attempts to oil escorts were unsuccessful.

A more substantial report came from the ASO of the Adula concerning the process used. The ship had been supplied with neoprene hoses with aluminium snap couplings which were an absolute delight to use, the long sections of hose being stored in the nets. Oiling was quite a simple operation with most of the skill being required by the escort which had to pick up the end of a 200 foot long hose. It was possible to oil up to 6 corvettes on one day, but on two memorable occasions, two aircraft were flown off whilst oiling was taking place.

The following report by the FAA LO and the commendation from the Director of Trade Division emphasises the recognition of both professional skills, but also the high degree of co-operation between MN and FAA personnel.:

Report by Fleet Air Arm Liaison Officer on Oiling

1. Whilst oiling an escort from a MAC ship or CVE, the hose lies down the starboard side of the Flight Deck, about 10 feet from the walkway. It is passed over the arrester wires by means of wooden ramps and over the rounddown through rollers. The width of a MAC ship flight deck is only 60 feet, 8 – 10 feet less than a CVE's deck, and this

leaves the pilot an extremely narrow take off path (50 feet). (NB the average width of an aerodrome runway is roughly 150 feet!).

2. In the VINDEX, it was considered by the pilots to be reasonably dangerous to take off with only 60 feet of deck, as the aircraft might quite easily slide or skid 5 or 6 yards during its run up the deck, especially when the ship is rolling or pitching. Captain Bayliss did not like turning into wind whilst oiling an escort astern, as the escort has only to make a small error of judgement to part the hose whilst turning. Therefore the 'turn' was usually executed 10 or 20 degrees at a time, using up to 15 degrees of helm. This was in an escort carrier with plenty of sea room. The pilots and the bridge personnel considered it quite 'exciting!'
3. Therefore, from the pilot's point of view, taking off from the much smaller deck of a MAC ship whilst oiling with only a few feet either side of the aircraft (the wheels of an aircraft are 9 feet apart) requires no small measure of skill. This is the first time it has been attempted from a MAC ship.
4. Further, I consider that manoeuvring in the box of a convoy, at dusk, with an escort oiling astern and with a present day Merchant Seaman at the helm, in moderate weather conditions, requires a certain amount of initiative, experience and good common sense which were shown by the Master on this occasion. The decision and responsibility was that of the Air Staff Officer.

One of the luxuries on a MAC ship was that a doctor was included in the ship's complement. The fact that the doctor was available to all members of the ship, whether RN or MN, meant that he was in a unique position to foster good relationships between the two services. The doctor on the Adula, David Moffat, had recently joined the service after qualifying at St Bartholomews. He was a superb medic, who administered to not only the sick and the lazy for everyday ailments, but also carried out minor surgical operations in the event of more serious ailments, usually caused through careless handling of mechanical equipment or aircraft accidents. His services were especially welcomed by the Merchant Navy crew, who were usually treated on merchantmen by the First Mate, who had received only rough and ready

medical training. To be treated by a Royal Navy Lieutenant was a vast improvement and greatly appreciated.

In addition to his medical duties, Doctor Moffat, through enthusiasm and interest, found his way to the heart of the ship's activities by taking on sundry duties, of which his medical training had taught him nothing. The first of these tasks that he took on was to become competent with the anemometer for taking the wind speed over the deck immediately prior to take-off, standing in the middle of the flight deck, struggling to keep his footing as the ship pitched all over the sea and then dashing for the safety nets as the first aircraft surged forward.

Another non-medical task he undertook was that of auxiliary cook, a necessary chore brought about by the time restraints caused by the strict union rules under which Merchant Navy personnel worked. The last meal of the day was at 1800 hours and the stewards did not start work until 0730 hours, so no food or drink was available to aircrew taking off on patrol at four or five in the morning. This meant that aircrew would be flying on an empty stomach, (not recommended by the Doctor) and would have to wait an hour or more on return for even a hot drink. Arrangements were therefore made to bring food supplies on board, together with a primus stove. The Doctor would then have mugs of cocoa, plates of fried eggs and fruit juice waiting for the aircrew in the chartroom, before stumbling out to the waiting Swordfish.

Ransford Slater as CO of 836 Squadron had seen from the start that full success depended, more than anything else, on building and maintaining the best possible relations and the greatest mutual respect between the civilian Merchant Navy crews who would sail the MAC ships and the Royal Navy and the Royal Navy Volunteer Reserve aircrews who would fly their Swordfish. There was a natural antipathy between officers of the two services with no justification at all. The Royal Navy officers possessed an innate superiority, whilst the Merchant Navy officers, who were often far more competent professionals, regarded their Royal Navy counterparts as over-privileged snobs. This attitude was overcome to some extent because the majority of Fleet Air Arm aircrew belonged to the 'Wavy Navy', serving for hostilities only, who came from a wide variety of social backgrounds with little or no class-consciousness at all, rather than the straight-laced career officers with their Dartmouth

training and traditions.

This was certainly not the case with Ransford Slater, a far too intelligent man to have felt personal antipathy himself, because he inspired in his officers a deep personal pride in the Merchant Navy involvement.

All the Royal Navy personnel were enrolled in the Merchant Navy from the time of joining a ship by signing the ship's articles as deckhands, and were supposed to receive a shilling a month and a bottle of beer a day to bring them under the Master's jurisdiction (the money was never paid, but the beer was left in cabins every Sunday). In addition, Slater had realised that this would entitle the aircrews to wear the small silver Merchant Navy badge in the lapel of the naval jacket, which had never been done before. It was presented by the Master when signing the articles, and unfailingly worn with pride thereafter.

Life on board gave the opportunity for personnel to mess together and establish friendships. The officers found that activity centred upon cabin, saloon, lounge, chartroom (briefing room) and flight deck.

In some ships a fairly formal arrangement prevailed with the Master, Medical Officer, Chief Engineer and First Officer eating together at one table, with other officers seated together at other tables. On the Adula, the Air Staff Officer attempted to break down formality by drawing up a roster which saw Pilots and Observers joining the Engineering Officers in their saloon at regular intervals, thus increasing the social contact which was of such great importance.

Living conditions for the NCOs and maintenance ratings again varied from ship to ship being better on tankers because more space was available. There were normally 14 to 16 personnel in a Mess, with adequate room and personal lockers. There was plenty of hot water and pretty good food which was provided by a Merchant Navy cook. Relationships with the Merchant Navy crew members was generally good, but they lived apart on board, mainly due to working hours.

Morale amongst these personnel was good because they were in the main competent members, who could witness the success of their work by the high serviceability of the aircraft, and who held an amazing affection for the Swordfish aircraft and its capability. It did not take long for a growing admiration and respect to develop for the Merchant Navy crew, upon whose professional and technical ability depended operational activity and general safety.

The atmosphere was very informal. Aboard ship and often ashore, Fleet Air Arm Officers wore civilian clothes, but whilst flying a battledress top with bars of rank and wings. The lounge on the ship was a rather shallow compartment lined with comfortable cushioned settees. Some ships had a bar, but it was more usual for the Chief Steward to deliver spirits, beer and tobacco as requested to officer's cabins. It was not unusual for small social gatherings to take place in cabins, but if they grew in size, to spill over to the lounge. It was a case of making amusements when off duty, otherwise it was a matter of card-playing and desultory chat, especially if bad weather prevented flying. In some ships, ship's officers would join cabin gatherings and also play darts and deck hockey, which helped to develop a spirit of camaraderie.

Deck hockey was the main sport played on MAC ships, providing the best opportunity for vigorous exercise. It was a brutal game played with great enthusiasm mainly because of the highly competitive element introduced by the formation of a hockey league on most ships. Teams were taken from personnel throughout the ship including aircrew and groundcrew, with the Merchant Navy forming several teams including Deck Officers, Engineers and Radio Officers. The game could become over-enthusiastic, and it was fortunate that safety nets were rigged around the ship or many players would have finished up in the sea. It proved to be not only an exercise for letting off steam after days at sea with no flying activity, but also proved to be an excellent liaison with the Merchant Navy because of the competitive spirit enjoyed by all.

A short stay in Halifax harbour allowed for further leisure pursuits ashore. The usual watering-hole was the Lord Nelson Hotel which held regular dances attended by aircrew and Merchant Navy Officers from the ship, usually with WREN partners from the local naval base. These were good affairs even though they ended by 11.45

pm as the last boat back to Bedford Basin was at midnight. The naval ratings and the Merchant Navy personnel were well provided with entertainment ashore at the local Ajax Club which not only laid on entertainment, but arranged for the servicemen to visit local families for a few days.

Air Staff Officer reports included a mandatory section on Merchant Navy/Royal Navy co-operation, and almost without exception these indicated a happy relationship based on mutual respect for professional ability and personal friendships that developed.

This new relationship in MAC ships was only a small part of the story concerning both services. In June 1943, the First Sea Lord, Admiral of the Fleet, Sir Dudley Pound, issued a letter to the Master of every British ocean-going Merchant Ship, giving an account of the Battle of the Atlantic to date, and relating the challenge which still lay ahead. In it was a tribute to the enormous contribution made by the Merchant Navy, in both lives and suffering, and to their co-operation and discipline within the convoy system and an acknowledgement that the battle could not be won by individuals, but by teamwork. This letter swept away the old prejudices of the past and emphasised that the remaining days of the war would be fought in a new-found spirit of mutual respect.

11. **DISCUSSION**

The effectiveness of Merchant Aircraft Carriers cannot be measured solely on the assessment of operational achievements.

Human endeavour, imaginations and innovation, coupled with brilliant technological ability were all instrumental in creating a unique and realistic hybrid merchant ship with the reasonable and obtainable objective of creating continuous air support for Atlantic convoys through their voyages in the Atlantic theatre of war.

The following sections will attempt to illustrate facts determining the overall effectiveness of MAC ships from their inception in 1942 to last operational voyage in May 1945.

1. Ship design and equipment.
2. Organisation and Administration.
3. Aircraft capability.
4. Professionalism – seamanship and airmanship.
5. Leadership and morale.
6. Relationships.

11.1 SHIP DESIGN AND EQUIPMENT

The years between the two World Wars had been bad for the armed services and especially for the Royal Navy. Between 1919 and 1939 the service was dominated by an Admiralty more concerned with sustaining the strength of the Battle Fleet within the terms of international agreements than with experimenting with, and investing in, weaponry that might keep the Atlantic sea lanes open for the movement of convoys.

Instead, the Admiralty chose to concern themselves with problems that might be caused by German surface raiders in the event of another war. Such a threat would require widespread deployment of large numbers of warships and made few allowances for defence against a determined U-boat offensive.

At the outbreak of war in September 1939 it soon became clear that the U-boat would be a significant factor in the growing conflict, and the reintroduction by the Admiralty of the convoy system quickly became a necessity, in order to attempt to counteract shipping losses from submarine attack. Royal Navy escorts were quickly discovered, not only to be short in number but antiquated with ASDOC systems (when fitted) out of date and inefficient.

The first real British initiative was not taken in the Atlantic Battle until July 1941 when the Admiralty's Director of Research and Development (AIR) introduced the CAM ship, a vessel fitted with a catapult-launched aircraft intended for convoy protection.

After the fall of France the Germans were able to introduce the Focke-Wulf Condor aircraft into the Atlantic battle, by basing them at Bordeaux. The Condor had a range of 2000 miles and could deliver a payload of 4 x 550lb bombs. For both these reasons it quickly became a serious menace to allied shipping and could only be countered by fighter attack aircraft. The aircraft was the Hawker Hurricane Mark I which was modified for catapult work in a period of five weeks and fifty ships selected and equipped accordingly. The CAM ship was therefore not merely the first type of merchant vessel to actively engage the enemy in the air but the instrument from which the philosophy of the Escort Carrier came to be fully understood.

A reasonable assumption would be, therefore, that the CAM ship was the instrument that germinated the idea of the MAC ship. That this could be the result of such lateral thinking is all the more remarkable. The CAM ship was a merchantman that flew the red duster and carried a commercial cargo and was probably conceived by the Directorate of Research and Development who were working on the problems of aircraft movement from small carriers. More important however, even that the technical achievements, was the change in attitude of the Admiralty in accepting the fact that air cover was essential for convoy protection. Another component was the speed at which the project progressed from the initial proposals to the flying off of the first Hurricane in combat. This had required not only imagination and professional expertise but close co-operation between all departments concerned with a readiness to make decisions in a decisive manner even when a high element of risk was involved. It is certain that the process was expedited by a Directive drawn up by the Atlantic Committee under Churchill's authority in March 1941 giving top priority to CAM ships. A year was to pass before Merchant Aircraft Carriers were officially considered during which time air support to convoys had improved and become more efficient with the use of bases in Iceland and the introduction of aircraft such as the Hudson with increased endurance. However, the U-boats were still fighting a successful battle particularly in mid Atlantic where a crisis point had been reached.

As with CAM ships, new weaponry was required and speed of production was essential if the improved technology and tactics employed by the U-boat was to be overcome. MAC ships were first considered early in 1942 but it was not until later in the year that their immediate need became apparent and urgent. Fleet Air Arm personnel who were actively involved in operations believed that their involvement came too late and had they been introduced earlier when the Atlantic battle was at its height, their overall effectiveness would have been far greater. The view held was that a delay was caused by the sceptical view held by the Admiralty regarding the ability of Merchant Navy sailors to handle the complicated techniques covering flight operations and that there was not enough evidence to convince them that aircraft could operate safely from small carriers with a low top speed.

The Naval Staff had tabled requirements that the vessels should have a speed of 14-15 knots and dimensions capable of providing a deck of 490 ft length by 62 ft breadth. This type of ship could only have been produced by the Naval Construction Department but because of standing commitments no berths were available. Also, the ships built by this Department went to sea as fighting ships under the White Ensign. At an early meeting held at the Admiralty on 7th May decisions had been reached on the function of MAC ships, the most important being that the vessels would fly the Red Ensign and be commanded by a Merchant Navy Captain.

The Red Ensign, therefore, became the decisive factor in the design and construction of MAC ships which would be constructed by the Departments of Merchant Shipbuilding and repairs as a fighting ship but a merchantman specially constructed for defensive operations. The Department carried out a survey of berth capacity of the yards under their control and the time factor involved and realised that radical decisions had to be made. Proposals were submitted to Naval Staff which were simple and effective giving full consideration to manpower availability including skilled workers, new technology such as prefabrication and the time factor involved.

An analysis of these proposals concluded that to produce the Grain Ships on time standardisation was essential and that by using the hull of the standard tramp steamer, ships could be built from selected yards having the necessary equipment.

The hull of the tramp was therefore, to be the base around which the Grain ships would be built meaning that standardisation would greatly improve the speed of production and assist in fundamentals affecting the design. The deck would be 460 ft by 60 ft wide - with a speed of 10/11 knots. Modified proposals based on the conversion of the tramp were submitted to Naval Staff, who, whilst acknowledging the difficulties placed before them, reluctantly agreed to the plans. This was a bold decision on behalf of the Naval Staff because there was no past experience on which to make a sound judgement on unknown factors. It was obviously hoped that standards of airmanship amongst pilots and the professionalism of Merchant Navy Masters would overcome the difficulties and dangers which would arise from this type of ship.

A spirit of compromise was necessary at this stage if the whole process of producing MAC ships was to succeed and not falter at the first step. Outline plans were produced for the shipbuilders and at a meeting in the Admiralty on 2nd June there were approved and production commenced.

The building and conversion of tankers were under consideration concurrently with Grain ship proposals but once again there was a delay because of Admiralty reservations. These reservations concerned the use of such ships because of the dangers involved with the carriage of fuel cargoes of low flashpoint. Two main factors changed this attitude. Firstly, a Cabinet decision was issued calling for the fullest expansion of the MAC ship programme for completion by the winter of 1943. The second was the intervention of John Lamb, a Senior Technical Superintendent of the Anglo Saxon Petroleum Company. A superb engineer, he had taken up the idea of Merchant Aircraft Carriers with great enthusiasm and had submitted proposals which tackled the technical difficulties facing the Admiralty.

Agreement was reached and orders were for thirteen tankers in all, four already under construction and nine for conversion from existing vessels. To speed up production the nine vessels for conversion were all 'triple twelve' type tankers which had the same dimensions and all belonged to the Anglo Saxon Company. Standardisation, as with the Grain ships, was the primary reason that the ships were produced so quickly, but innovation by the design planners introduced ingenious systems for the more complicated structures needed to complete an efficient aircraft carrier.

The first ship to be completed was the MacAlpine, a Grain ship, which was in service by April 1943 and a further eighteen ships were ready for service within a period of 19 months. In all, eleven yards carried out the work with great enthusiasm and skill considering the unusual nature of the work and the need for improvisation. The building of the MAC ships was both effective and successful because it not only illustrated the British ability of imagination and innovation but more importantly, indicated that a change of attitude towards the Merchant Navy was taking place with a realisation that a spirit of compromise in dealing with MAC ships was the only way forward.

11.2 ORGANISATION AND ADMINISTRATION

The effort to create an infrastructure that could efficiently handle the operational activities of MAC ships was put into operation immediately the first ships were ordered and construction commenced. It was an enormous logistical exercise which was dominated by the time factor and the necessity to meet strict deadlines if the ships were to sail in convoy by the middle of 1943.

The fact that the administrative system was in place and working effectively by the time that the *MacAlpine* carried out trials was a considerable achievement. The reasons for this success were a combination of factors that helped to streamline the 'red tape' of the administration and create interest and enthusiasm into a project that had many sceptical senior officers in the Admiralty.

To ensure that full use was made of past experience the Trade Division of the Admiralty was made responsible for the co-ordination of policy and arrangements covering the supply and fitting of all defensive equipment in connection with merchant ships. This defensive equipment included operational aircraft and specialist personnel and equipment required in connection with their operation whilst embarking in merchant ships. The practical implication became the responsibility of the DEMS (Air) section which had hitherto dealt with CAM ships but was re-constituted to carry out the responsibilities of the Trade Division in connection with MAC ships. For efficiency it was essential for the Trade Department to maintain a close liaison with all Admiralty Divisions concerned and the Ministry of War Transport involving a large number of Departments and Committees all with vested interests. Working through naval channels would have suggested considerable bureaucracy which would result in slow progress being made.

This, however, did not turn out to be the case. A proposal to set up a special MAC ship Committee to deal with all matters centrally was rejected as there were already a sufficient number in place to handle the situation efficiently and any addition would only increase bureaucracy.

Also the reports on committee meetings detailed in ADMs indicated that there was a real sense of urgency and enthusiasm to have the first MAC ships ready for operational use by mid 1943. The important fact about these meetings was that they were well controlled, a difficult task as the number present was often high. However, it was usual for quick decisions to be made, even over complicated and controversial matters, and strict action plans and deadlines agreed.

Speculation on the reasons for this approach offer several interesting theories.

- i) The U-boat War was at such a critical stage that even the most conservative senior officers would not turn down an approach that might solve the impending crisis.
- ii) The Cabinet decision, issued through the anti-submarine committee, that MAC ships should be in operation by a given date (mid 1943).
- iii) The knowledge gained through experience that air support was an essential feature for the protection of convoys from submarines.
- iv) The possibility of both a change in thought and attitude for members attending committee meetings with a different background and training to regular RN officers. By 1942 RNR and RNVR personnel were taking over many of the duties and tasks originally performed by RN officers and by this time many such personnel would have been serving on committees and involved in preparation work relating to MAC ship activities.

These officers and ratings would generally have differing social and professional backgrounds which would give them a more flexible attitude to service life rather than the more practicable but autocratic style of the RN personnel. In addition the RNVR (Hostilities only) officers would have volunteered to join the Fleet Air Arm and therefore have a more decisive attitude regarding the use of aircraft in anti-U-boat warfare.

Also, these officers probably had a more adventurous approach resulting in the belief that the MAC ship idea represented a reasonable risk which RN officers might not take because of the effect it could have on career prospects if it went wrong. The

amount of influence that attitude and concept had on meetings and preparation work cannot be accurately assessed but it was probably considerable and worth consideration.

The whole process of finalising organisation and administration details was extremely complex and it would be impossible to believe that meetings and inter personal relationships between departments passed without serious and fruitful negotiations taking place. There were areas where severe differences appeared and it was only after agreeing to compromise that a settlement was reached and the matter could proceed forward towards the final objective.

By the time that the *MacAlpine* was ready to sail with Convoy ON59 on 25th May 1943 the administration and organisation was in place and the following challenges had been overcome and put into effect.

- i) The role of the MAC ship and its place in the chain of command when at sea with a convoy.
- ii) The use of terminal ports on both sides of the Atlantic with appropriate facilities to handle both grain ships and tankers together with an airfield to receive MAC ship flights.
- iii) An area for embarkation of MAC ship flights with adjacent training facilities.
- iv) A system for the supply and replacement of stores and equipment with suitably placed units to handle emergency requests.
- v) The appointment of a Headquarters unit for the appointed Squadron within reasonable flying distance from the area of embarkation.
- vi) Allocation of aircraft and aircrew together with maintenance staff to 836 Squadron to form the necessary flights to MAC ships as they became operational.
- vii) System of aircraft maintenance ashore and at sea.

Before becoming operational, flights completed a marking up period in the Clyde under the control of Flag Officer Flying Training. The MAC ship then joined a convoy and came under the operational control of the C in C, Western Approaches commanded by Admiral Max Horton.

Max Horton was a man of vision, determination and action and had experienced great success in anti-submarine warfare which enabled him to see the considerable potential of MAC ships for additional protection for convoys.

In ADM 13074 letter W.A. 2554/0756 Admiral Horton stated that MAC ships require more assistance in planning and flying training than do any other type of aircraft carrier on account of the unusual factors incorporated in their design and performance.

All new MAC ship flights assembled at RNAS Maydown before flying to the Clyde area to join a ship. If conditions allowed, there would then be a work up period of approximately two weeks before sailing with a convoy. The training that took place was conceived and design by Flag Officer Carrier Training (FOCT) and was extremely effective. The objective as to familiarise both the Mercant Navy personnel and aircrew with the basic requirements of flying operations and bring home to all concerned the need for close co-operation if the highest professional standards were to be achieved.

The requirements were laid down in MAC Ship Training Orders (MACTOs) which first appeared in print in early 1943 laying down the priority area of training considered to be the most essential to cover within the limited time scale. The work-up therefore provided a platform from which all concerned could operate with confidence whilst building up the standards of efficiency through real experience at sea under much harder conditions. The first MAC ships to become operational were fortunate enough to have well organised technical facilities backed up by a strong administrative and organisational structure to meet their everyday needs.

The administration surrounding the overall organisation of both ships and aircraft had shown a remarkable flexibility by Admiralty Departments and Senior Officers to overcome bureaucratic systems and scepticism regarding the whole project. There had been a realisation that time was an essential factor and that the only way to succeed in achieving the deadlines set was through decisive decisions, co-operation and a need to compromise over difficult problems.

It illustrated above all a change in attitude notably towards the Merchant Navy but also an indication of a new approach to air support through a radical air innovation concept which could have a considerable impact on the future development of aircraft carriers and their position in naval air warfare.

11.3 AIRCRAFT CAPABILITY

The early years of the war had involved the Fairey Swordfish aircraft in several spectacular operations, which had earned it a reputation as a rugged and reliable aircraft.

These operations had been of an offensive nature, and the aircraft had operated either from land bases or large Fleet aircraft carriers. The situation changed in 1942, when it became apparent that convoys were in need of close air support and the Swordfish had been switched to anti-submarine work. The aircraft had proved itself effective when flying from escort carriers on the Arctic convoys to Murmansk, where they chalked up considerable success against the U-Boat.

The Swordfish Mk II became the standard aircraft for MAC ship operations, which was no great surprise as 836 Squadron was already equipped with these aircraft, and experienced aircrew were available for the trials and first voyage of the MacAlpine. The early Air Staff Officer reports and MACTOs * indicate that little or no debate ever took place as to whether the Swordfish was the most suitable aircraft for the MAC ships, considering the number of unknown factors that existed in operating from these ships.

The Chief Advisor Operational Research in ADM14179 (December 1942) had warned of problems of a novel nature, both technical and tactical, that would affect escort carriers and MAC ships once operational.

The fact remained that whilst experience had been gained on escort carriers, this was only of limited value for those planning operational activities from a MAC ship with entirely different characteristics and facilities for operational flying.

* MAC ship Training Orders, promulgated by Flag Officer Flying Training.

The Swordfish Mk II initially had a Pegasus III engine which was both rugged and reliable, but did not have a variable pitch propellor. To overcome this problem, the aircraft were fitted with a fine pitch propellor, which increased lift for take-off and landing, essential when weather conditions only gave a low wind speed along the flight deck. To fly off a fully armed and fuelled aircraft safely, it was estimated that a minimum wind speed of 22 knots across the deck was necessary. The fine pitch propellor, whilst assisting take-off and landing, also had its downside because with the aircraft airborne and cruising at the required at the required height, the true airspeed was considerably reduced. In an aircraft that was already slow, any further reduction in speed seriously affected tactical efficiency. An early voyage (voyage 3) by MacAlpine had resulted in an unsuccessful attack on a U-Boat because aircraft had made individual attacks rather than wait for support from other aircraft from the flight and operate a combined attack.

Admiral Dönitz had realised by early 1943 that his U.Boats stood a better chance of survival if their anti-aircraft firepower was strengthened and the U.Boat fought it out with aircraft on the surface, rather than dive and be subject to depth charge attack. The result of this was that on a sighting it became mandatory to call up all available aircraft and join together for a combined attack, regardless of the time taken for the aircraft to assemble prior to attack. The U-Boat then had time to decide on the necessary action to take, and prepare its defences for a rocket or depth charge attack.

The lack of speed also made accurate navigation more difficult for the Observer, because the big biplane was subject to considerable drift in high wind conditions. The dead reckoning system of navigation was dependent on accurate wind finding. The system used was laborious and depended upon close co-operation between Pilot and Observer for extremely accurate flying and time-keeping. This was particularly difficult if the aircraft was experiencing a high rate of drift, which could result in the wind found not being completely accurate. This had a knock-on effect with the Observer's chart work, upon which depended an accurate fix of the aircraft at any given time. Operational effectiveness depended on this situation.

A technical flaw that proved to have damaging and costly effects on the serviceability of the Swordfish was the fragile nature of the undercarriage, which often collapsed

following a heavy landing. As a result, a Swordfish could become difficult or impossible to manhandle forward and aft of the flight deck to allow other aircraft to operate, and had to be pitched over the side of the ship as quickly as possible. *

This problem was less acute on the grain ships which had a larger deck where aircraft could be repaired clear of the flight deck, provided that the damaged aircraft could be moved quickly to the lift on the after part of the flight deck. The design of MAC ships incorporated certain technical features that were unavailable in creating a hybrid vessel, but included details that did not occur in a conventional aircraft carrier. The fact that it often became necessary to dispose of an aircraft that was otherwise mechanical sound apart from a damaged undercarriage, was not only costly, but severely undermined the serviceability of a MAC ship flight.

The Admiralty must have been aware that a weak undercarriage would present major problems to aircraft operating from MAC ships because the Director of Operational Research had pinpointed the need for a radical change to be made by suggesting that the fitting of a tricycle undercarriage to the Swordfish would improve performance and safety. There is no doubt that this was an imaginative idea, but not practical at the time as it would have been almost impossible to remove aircraft from flights for conversion of the undercarriage which would be both time-consuming and costly.

In addition, it would lead to skilled manpower being moved to undertake the work, and would have a detrimental effect on naval Swordfish production. The fact remains that the Admiralty made no effort to strengthen the undercarriage between 1942 and 1945, because the loss of Swordfish aircraft during this period was probably considered to be reasonable when considering the role and objective of MAC ships.

The only improvement to the Swordfish occurred early in 1945 with the introduction of Rocket Assisted Take Off (RATOG). The Swordfish could now be flown off with a full fuel tank and a maximum weapon load in low wind conditions. The difference

* Records available from ADMs 217 and 199. 39 Aircraft jettisoned over the side of the ship between April 1943 and May 1945, 18 because of damaged undercarriage. 28 jettisoned from tankers, 11 from grain ships.

was dramatic, as it immediately improved the confidence of the aircrew, and increased tactical efficiency. The fine pitch propeller could now be discarded and replaced with a coarse pitch one, which increased the cruising speed of the aircraft.

The fact remained that the new system was a welcome innovation, but came too late for it to have any real effect as the Atlantic battle was drawing to a close.

Undoubtedly, the Swordfish was lacking in some aspects of design and performance when operating from MAC ships, but there is enough evidence to show that overall it was highly effective in meeting its objective of providing added protection to convoys sailing in the Atlantic theatre of war.

The aircraft was both rugged and reliable, being fitted with the Pegasus engine which was enormously successful. The ASO records only report on one aircraft being forced to ditch through direct engine failure, and two having engine failure on take off. The engine could sustain considerable damage, as was experienced by aircraft from the *Ancylus* when making an attack on a U-Boat and coming under extremely heavy fire. Two engine cylinders were knocked out, but the aircraft still staggered back to the ship over a distance of approximately 130 miles.

Apart from the undercarriage, maintenance was relatively simple and the degree of serviceability kept high through the skill and dedication of the mechanics, who worked in appalling conditions, especially on tankers where the after part of the open flight deck was the maintenance area.

It was an indisputable fact that aircrew had great confidence in the aircraft and even looked upon it with affection. It was definitely preferred to any similar type of Fleet Air Arm aircraft flying at the time. The argument that another type would be more efficient, especially on MAC ships, has often been discussed, but the reality of the situation was that only two other types were available, the Albacore and the Barracuda.

The Albacore had certain benefits. It was metal clad and less vulnerable to flak, whilst an enclosed cockpit was an additional luxury. On the other hand, it was less responsive and heavier to handle than a Swordfish and needed a longer take off run.

The Taurus sleeve valve engine, as used in the Albacore, was not as reliable and more difficult to maintain than the Pegasus, a considerable disadvantage. Finally, there were fewer Albacores in operation and production and it is doubtful if they could have been made available in sufficient numbers to satisfy MAC ship requirements.

The Barracuda had a greater speed and a superb engine, but the approach speed was high and it would have been far more difficult to land on a MAC ship. ADM reports give no indication that the Admiralty ever considered using either of these aircraft, although in February 1945, a Barracuda made trial landings on the Miralda in the Clyde area ⁽³⁾ It is not known if the trials were carried out for future MAC ship use, or for the purpose of gaining information concerning the future of short take off and landing facilities.

There is no doubt that the Swordfish was an effective aircraft when used from MAC ships for anti-U-Boat operations. Despite the fact that there were considerable shortcomings in its operation, its greatest asset was the degree of confidence that it instilled into the aircrew who flew in them. The psychological aspect of these difficulties did not adversely affect the aircrew because there was a realisation that high and dedicated standards of airmanship would overcome them. The Swordfish remained an aircraft that could carry out sorties successfully and make a safe return to the ship. The accident rate was high and costly, especially with aircraft jettisoned over the side of the ship, but there is no evidence to suggest any improvement could have been gained by the use of another type of aircraft.

Not only did the Swordfish achieve the role which was set for its operational use of protecting merchant ships, but it set a precedent for aircraft requiring short take off and landing ability, which was then being actively investigated by the Director of Operational Research for the purpose of gaining information concerning the future of short take off and landing facilities.

11.4 PROFESSIONALISM - SEAMANSHIP AND AIRMANSHIP

Merchant Navy

The rigours of war, and in particular, the ferocity of the U-Boat attacks on convoys, had made survival of an Atlantic crossing a primary objective. Survival could only be achieved through a determined mental attitude, discipline and standards of seamanship demanded by a respected profession.

The Merchant Navy officers were proud of their profession and were dedicated to achieving levels of service which could only be reached through theoretical knowledge, certification of competency and experience gained in their respective specialisations of deck, engineer or radio officers. The early years of the war had witnessed the need for above average ability when called upon to operate within the convoy system. This required a disciplined and co-operative attitude towards the Royal Navy escorts which relied on the Master of the Merchant ship being a competent seaman. The Master had to be capable of making sound decisions at short notice when faced with inevitable emergencies, either when taking evasive measures, or when damaged as the result of U-Boat attacks.

The convoy system became a normal routine to the crews of Merchant Navy vessels carrying a commercial cargo. This developed into a routine existence punctuated by emergency drills and 'Action Stations' when U-Boats were reported in the vicinity. The majority of Merchant Navy seaman realised that, in spite of extremely heavy losses in the first years of the war, to sail with a convoy represented the most effective method for the protection and safety of their ship. This required of them the highest professional standards of skill and ability.

The inception of MAC ships as an anti U-Boat weapon drastically changed the duties of MN personnel on these vessels. It placed new responsibilities on them and required new skills on top of their normal working procedures, to cover the complex issues connected with the operation of what was effectively a small aircraft carrier. Success or failure depended to a great extent on the attitude and seamanship of the Master and deck officers, although the co-operation of all crew members was essential. It was fortunate that the Master of the MacAlpine, the first MAC ship to become operational, had served for several years in the Royal Navy before joining the Merchant Navy, where he became Master of several ships before his MAC ship command. His wide background of ships and the sea in both services, in peace and war, made him the ideal choice for this new venture.

The MacAlpine carried out the initial trials with fully loaded aircraft from 836 Squadron in adverse weather conditions, thereby proving that it was possible to operate from these ships. * Prior to taking over command of a MAC ship, the Master underwent a short course in carrier operations and anti U-Boat warfare, followed by a short working-up period with a Flight, before joining a convoy. The training period was very short and basic in content so that the Master had to rely on skill and experience in seamanship to manoeuvre within a convoy without losing station, whilst turning into the wind to fly off and land aircraft, a delicate and dangerous operation. However, during the time that MAC ships were in operation there was only one report of a collision whilst this manoeuvre was being completed.

The success of flying operations depended on a close liaison being established between the Air Staff Officer on the ship and the Master, who had to rely on the former giving sound tactical advice. The final responsibility about whether flying should take place rested with the Master, so he became actively involved with the tactical aspects of an operation. Difficult decisions had to be made from time to time concerning the safety of aircrew after an aircraft had ditched in the sea and a boat lowered to pick up survivors. On two occasions the Master risked the safety of his ship to carry out such

* Swordfish MkII aircraft armed with depth charges and a full load of fuel.

an operation which involved seamanship of the highest order from the crew manning the lifeboat. * This resulted in a commendation from the C-in-C Western Approaches for the skill and dedication of all involved.

Whilst the deck officers were those most associated with extra responsibilities, the engineering personnel were also actively involved. An important job on a MAC ship was the maintenance and operation of the arrester gear, which was the responsibility of extremely complex and required highly skilled personnel for general servicing. Whilst flying was in progress, the Chief Engineer actually operated the arrester gear from a the Chief Engineer. With the gear out of action, it was impossible for flying to take place. Maintenance was a full time task for engineers as the machinery involved was position close to the Deck Landing Control Officer (DLCO) so that they could work in harmony for landing aircraft. Not only was this duty well outside the normal professional duties of an engineer, but it also involved an important personal relationship with the aircrew on the ship. The safe landing of a Swordfish on a MAC ship depended on three factors:

- i) The skill of the Deck Landing Controller to monitor the approach and final landing of the aircraft.
- ii) The co-operation and co-ordination of the Merchant Navy Engineer to operate the ship's arrester gear at the appropriate time.
- iii) The confidence of the pilot in both the Deck Landing Control Officer and the Merchant Navy Engineer.

The system forged a three way relationship which, when working well, developed not only mutual respect, but also helped to maintain high morale on the ship.

The Radio Officers also played a vital role in the communication system of the time. The officers were trained by Marconi and noted for their expertise, especially for the speed and clarity with which they could send morse code. With aircraft now flying from the ship, surface to air communication became one of the most vital aspects of air

* Avacus, voyage 2 – rescue detailed in summary spreadsheet.

operations for tactical efficiency. The radio sets used in the Swordfish were difficult to use and keeping two-way communication at reasonable strength depended on the skill of the MN operators and the Observers and Telegraphist Air Gunners in the aircraft. The importance of two-way communication cannot be over-emphasised, because not only did tactical efficiency depend upon it, but aircrew could rely on HF/DF bearings should the aircraft become lost. It was not unusual for good personal relationships to develop between Observers and Air Gunners and the Radio Officers on the ship due to their respect for the professional attitude of the Radio Officers.

The Merchant Navy personnel ensured that the MAC ships proved to be a vessel capable of fulfilling its role as a defensive weapon within the convoy system. They also were proud to be members of a crew sailing in a unique type of vessel providing them with a status respected by all crews in a convoy. At a Masters' convoy briefing held in Liverpool it was asked if a MAC ship would be included in the convoy. Given the information that one would be present, all the Masters in the room stood up and cheered because there was a realisation that these small carriers provided air support across the Atlantic thus ensuring a degree of safety that had never before been available. This would not have been possible without the superb professional attitude of the MN men who crewed the ships. Jobs which required extra knowledge and skills outside their own area of expertise were taken on and made to work efficiently, often requiring imagination and innovation to be successful.

The attitude of MN personnel to serving on a MAC ship was favourable. It increased working hours and involved the handling of unusual tasks, but this was accepted without any resentment being shown. At the time union membership was strong and dictated working conditions and terms of service, but there is no evidence to show that this had a detrimental effect on the working of the ship. The Fleet Air Arm personnel on the ship would normally have had no indication of the effect of union membership apart from minor incidents when help was refused because of union restrictions, but there is nothing to suggest that union activities soured the excellent relationship that existed between the two services.

The Merchant Navy officers and men were all members of a trade union which laid down the exact hours of work; most men would not work a minute of overtime, even

in wartime, even at sea, or even in the face of the enemy. The stewards' working day began at seven-thirty in the morning when they bought a cup of tea to each officer in his cabin at eight o'clock and not a moment sooner, whilst the last meal was at six in the evening. This meant that if aircrew were taking off on an early evening flight, no food was available until breakfast the following morning. This did not cause any problem on the *Adula* where the Medical Officer volunteered as cook, an office which he performed admirably.

On another occasion, ready use stowages for rocket projectiles positioned on deck had been smashed by heavy seas. The CO of the flight, knowing that a dawn patrol was imminent, asked the ship's carpenter if he could repair the stowages as a matter of urgency. The carpenter replied that he would be happy to complete the work, but not that day (which was a Sunday), because of union regulations.

These activities were of a minor nature and did not cause any friction between MN and FAA personnel. There is no evidence that differences of greater significance ever took place.

Fleet Air Arm

The first Commanding Officer, L/Cdr Ransford Slater, a regular RN Officer, had a distinguished flying career before being officially appointed in July 1942. In leadership style he could be considered a benevolent autocrat who rigidly enforced standards in the squadron through his exceptional ability in man-management, concentrating on maintaining morale at a high level in order to achieve the highest operational efficiency.

As a pilot, Ransford Slater led by example and his fine airmanship in the initial trials completed on the MacAlpine not only showed that it was possible to land on short decks, but used a technique that was to be followed by all future pilots. ★ Tragically,

★ Trials in the Clyde area from 5th to 18th March 1943.

Ransford Slater was killed in a flying accident six months later, but he left behind both an example and professional standards on which 836 Squadron built a significant reputation. *

The situation that existed in late 1942 differed considerably because very few regular RN officers were appointed to 836 Squadron, the vast majority being RNVR (Hostilities Only) officers. The number was supplemented by officers from New Zealand (RNZNVR) and Canada (RCN). Also Dutchmen of the Royal Netherlands Navy supplied the aircrew for two MAC ships, the *Gadila* and the *Macoma*. The majority of the personnel in the Squadron thus in no way resembled the regular RN officers, who chose a profession and full time career with promotion depending on leadership qualities and operational performance.

The RNVR personnel represented a different culture brought about by a wide social and educational background coupled with experience of working in civilian life, often in a highly regarded profession such as lawyers, accountants, teachers, engineers and police. Whilst the Royal Navy had not been their chosen profession, they had volunteered for the Fleet Air Arm, and although lacking the training of RN officers, had brought into the service enthusiasm and social attributes that would enable them to acclimatise quickly to the unique lifestyle experienced in MAC ships. The professional standards required of Fleet Air Arm pilots, observers and air gunners was instilled into them from the moment that basic training commenced. Standards of discipline and flying training were only completed after rigid theoretical and practical examination before joining an operational squadron. These standards were to be tested to the full on MAC ships where performance demanded airmanship of the highest order.

The aircrew were faced with two main technical problems: flying off a ship with a slow maximum speed and short deck, and having to rely on the co-operation and seamanship of a Merchant Navy Master who probably had little or no experience of

* The name of Lt/Cdr Ransford Slater is synonymous with 836 Squadron and Merchant Aircraft Carriers and resulted in a society being formed under his name which still exists to the present day.

operating a carrier within a convoy in varying weather conditions. The records show that there was little need for apprehension on either side because, in spite of doubts that existed, the competent flying ensured that aircraft operated successfully from the MAC ship decks with an accident or crash rate of approximately 1 crash for every 60 hours flown. Incidents occurred where exceptional airmanship qualities were necessary, together with a need for imagination and innovation, to extricate the aircrew from dangerous situations, also requiring the co-operation of the ship.

Observers needed maximum concentration for long periods of time to obtain accurate navigation for fixing their position whilst making full use of the radar equipment both for detecting objects on the surface of the water and as a navigation aid. The ASVX set in the Swordfish MkII was extremely difficult to operate, and it was only with experience and improved operating ability that it became an extremely useful device used until replaced by the radar type 1460 in May 1945. The successful use of the old ASVX until May 1945 is a tribute to all observers who used the equipment and set a high standard in radar operation.

When a Flight joined a MAC ship the only successful route to effective operation as a carrier depended on the highest professional standards being reached by both the ships personnel and the airmen concerned. To the aircrew, the handling of the ship and manoeuvring in convoy for flying operations was viewed with both admiration and respect for the seamanship involved. To the Master and crew of the MAC ship, the skill, determination and dedication applied by the aircrews was airmanship of the highest order. From this grew a feeling of mutual respect for each other which developed into a strong and durable trust which could only be upheld if standards were maintained. A third dimension was a competitive spirit that developed between MAC ships, based on all-round performance of both ship and squadron flights. ★ This was

★ The aircrew and maintenance personnel signed Ships Articles, and were paid one shilling a week and a bottle of beer. The Admiralty also permitted these RN and RNVR personnel to wear the MN badge in their lapel which they did with pride. This undoubtedly gave them a great sense of belonging to a ship and did much to cement good relationships with MN colleagues.

understandable due to the crew of a MAC ship being proud to serve on such a unique type of vessel, whilst the aircrew also took great satisfaction from facing a challenge demanding skill, courage and determination.

The combined strength of officers and ratings who made up 836 Squadron provided twenty-three Flights for 19 MAC ships completing 208 return voyages from the first voyage of the MacAlpine in convoy ON59 on 28th June 1943 to the final crossing by the Macoma in May 1945.

Professional standards in the British Merchant Navy were accepted as being amongst the best in the world and progress in rank regardless of speciality demanded both theoretical knowledge and practical experience to achieve the required degree of ability.

The rigours of war and, in particular, operating in convoys in all weather conditions, called for seamanship requiring an above average skill if a ship was to survive repeated U-Boat attacks. The Master and crew of a normal ship such as a tanker would have accepted the conditions and dangers that existed as a normal hazard, whilst having confidence in their own ability as seaman to overcome any immediate problems that might arise.

The introduction of the MAC ship however, was to stretch professional standards far beyond the requirements of the past because the crew now had to control a hybrid, a ship with a flight deck in addition to the normal commercial cargo. The ship was now a small aircraft carrier. The implications were enormous and had an immediate and direct effect on all the Merchant Navy crew. There were two distinct areas that needed to be addressed, the complex issue of flying aircraft from the ship, and the integration of MN personnel with the RN airmen responsible for flying operations.

The Master of each new MAC ship received a short course at RNAS Maydown which included the basics of anti U-Boat warfare and the operation of aircraft within a convoy before having some practical experience in the Clyde area with a newly formed flight prior to joining a convoy.

11.5 LEADERSHIP AND MORALE

The Admiralty decision to use RNAS Maydown as the headquarters for 836 Squadron resulted in a fragmented and complex chain of command. This required flexible powers of leadership that could adapt to the dual challenge of operational flying duties and unknown technical factors involved with MAC ships. Also additional personal qualities and characteristics were essential to form a sound relationship with Merchant Navy crews sailing with the ships. The most sensitive appointment within the structure was that of the Commanding Officer of 836 Squadron.

It was fortunate that Lt Cdr Ransford Slater was the first CO of the reconstituted 836 Squadron. He had not only the ability and personality to develop a sense of cohesion and esprit de corps within the Squadron, but also to inspire a pattern of leadership style that was a superb example for future Commanders of MAC ship flights (6.2). Slater was a man of personal charm and an inspirational leader with considerable operational experience. He had the qualities to motivate personnel through personal example and good communication whilst managing all under his command to work towards the common objective of providing effective protection for merchantmen in convoy.

From the start he endeavoured to impart into his subordinates a deep personal pride with their Merchant Navy involvement, a task made somewhat easier because the majority of officers were RNVR who came from a wide range social backgrounds and professions rather than the autocratic backgrounds of RN trained officers.

Command of a MAC ship flight did not depend entirely on seniority. There was a general rule stating that at least one voyage must be completed to gain experience before being appointed as CO of a flight.

With 24 operational flights on nineteen ships, the style of leadership differed according to past experience and professional background of each flight commander, but the general pattern was influenced by the example of Ransford Slater and the relatively informal lifestyle that existed on a MAC ship.

Aboard ship and often ashore, FAA officers wore civilian clothes and even in the air the only concession to Royal Navy dress was a blue battledress top with bars of rank and wings. This did not mean that there was any decline in overall standards, or that there was a lack of discipline.

The style of leadership amongst the flights developed not in a strict autocratic form, but on democratic lines which allowed an imaginative Commander to harness the individual talents of his subordinates to the advantage of the flight as a whole. The wide selection of social and professional backgrounds available, together with the enthusiasm of personnel from the Dominions proved that this could be a rewarding system. The emphasis was thus on flight development and teamwork which was reflected in harmonious and effective working on board ship, and which generally resulted in a happy ship with high morale.

High morale was maintained first and foremost by the creation of a sound working relationship between members of the ship's crew and the Fleet Air Arm personnel. In working to the highest professional standards to achieve efficient carrier operations, a sense of pride developed in the ship, resulting in self respect which related to the morale on board. High morale, however, was difficult to maintain for many reasons. In general, it was affected by the level of activity that took place on an Atlantic crossing. Merchant Navy crewmen worked a twenty four hour shift system and were therefore fully occupied. It was different for the aircrew of the ship's flights, who often had long periods of inactivity because unfavourable weather conditions restricted flying, causing frustration leading to boredom and a drop in morale if not checked. *

In the absence of flying, secondary duties could be of value for the aircrew, but liaison with maintenance teams played an important part in developing personal relationships

* This factor was clearly understood and underlined by the Air Staff Officer of the Avacus who reported during voyage 1 that morale was affected if there was insufficient flying during a voyage, and that efforts should be made to fly at least once every 48 hours if the weather and U-boat situation allowed.

– the pilots with air mechanics, fitters and armourers, the observers with radar mechanics, and the Telegraphist Air Gunners with the radio mechanics. Mutual interest in respective jobs and a realisation of the dependence on each other helped to keep morale high. ★

The living standards amongst the maintenance ratings were good in comparison to those on a Royal Navy ship, with more favourable comments coming from those on grain ships. The accommodation was satisfactory, hygiene factors exemplary and the food excellent. Relationships between the men and aircrew were good, especially when a mechanic was appointed to service one particular aircraft, which often developed a mutual interest between them, cemented by affection and admiration for the Swordfish.

Social activities on board were limited, but Merchant Navy and Fleet Air Arm aircrew mingled well together with harmony, depending to a great extent on the Air Staff Officer and the First Mate of the ship. Some helped to maintain a comfortable atmosphere by arranging various communal activities, the most favoured being a deck hockey championship. This was a hard, physical game and helped to maintain some level of physical fitness, whilst at the same time ensuring a spirit of competitiveness between teams taken from all departments of the ship.

However, it was a case of making one's own amusements which often evolved around card playing and desultory chat.

On one MAC ship, the atmosphere on board was being poisoned by an embittered, morose and solitary Air Staff Officer, who was quickly posted and replaced by a merry, outgoing Royal Navy Officer who raised morale by simply exuding bonhomie.

★ A Medical Officer, usually a Lieutenant RNVR, was appointed to each ship. This was appreciated in particular by the MN personnel who were not used to having professional medical help with well-equipped sick bay on board. Their professional ability and the effort made to maintain high standards of health and physical fitness helped.

High morale on ships was essential if effective operational standards were to be maintained. Arrival in Halifax would usually result in a few days ashore. Aircraft flew off to the RCAF airfield at Dartmouth where aircraft were serviced and Observers and Pilots carried out the 'swinging of compasses', an essential matter if dead reckoning navigation was to be accurate. The work ashore was a refreshing change from life on board the ship and the duties were cheerfully carried out, giving the aircrew a chance to relax and enjoy a change of environment for a few days, which also came as a welcome relief.

Good living conditions and social activities, both on board and ashore undoubtedly helped to alleviate the boredom which could easily arise after several days of little activity, and also helped to keep the level of morale on all MAC ships at a level which allowed satisfactory levels of efficiency.

A clearer understanding of the mental attitude of Merchant Navy seamen and Fleet Air Arm personnel can only be comprehended fully by those who actually served on MAC ships. Because the design, role and operation of the ships was unique, it presented a challenge to all crew members, which required professional standards above the usual levels experienced on Aircraft Carriers.

The aircrew met this challenge with a spirit of enterprise, enthusiasm and determination which overcame the problems and dangers involved, resulting in MAC ships successfully completing their role of convoy protection. The enthusiasm for success was also evident amongst the Merchant Navy crew, who took pride in their association with the airmen and their Swordfish aircraft with whom they developed a deep and harmonious relationship.

A report from the MAC ship *Empire MacColl* returning from Halifax in convoy HX281 indicates the high regard in which MAC ships were held and the effect that they had on the general morale of all ships in a convoy. The convoy was scattered early in the voyage by very heavy weather and a blizzard, including the *Commodore*

and escorts. The MacColl, by skillful use of its aircraft, arranged a new rendezvous for the whole convoy to reassemble. A message from the Commodore was received as follows:

“I have been inspired to see the precision with which your ship has been handled and the flying operations carried out. Please accept my congratulations. It is considered that the ship has shown that Merchant Aircraft Carriers have a remarkable effect on the morale of the convoy and more than fulfil the function for which they were built.”

11.6 RELATIONSHIPS

The Royal Navy with its rigid code set out in King's Regulations (KRRN) and an uncompromising tradition rooted in the social class structure had, especially among its officers, regarded the Merchant Navy as an inferior service operated by uneducated and often poorly trained officers and seamen who were undisciplined and unruly. It was with this superior attitude that the RN entered the war in 1939. Little respect existed in the RN for the Merchant Service and there was concern about their ability to operate efficiently in the very strictly controlled convoy system.

There was no reason for this concern. In the Royal Navy many men had a love-hate relationship towards the sea and the next trip was always going to be the last. However, a strong sense of comradeship evolved because survival was dependent on co-operation among all ranks. A sense of pride was needed to keep a warship in a high state of readiness for immediate combat. Discipline was often obtained by team spirit and a sense of achievement rather than rigid implementation of KRRN.

The Merchant Navy, often called the fourth service, was not an official fighting force. On a merchantman the war could be considered to be a people's war in much the same way as there was a people's war in the air-raid shelters. As in the shelters, there was a great sense of comradeship between officers and seamen and discipline was respected because, as in the Royal Navy, survival may well depend on it. The Merchant Navy worked in what might be described as a democratic system whereas the Royal Navy was tied to an autocratic and rigid system. It was, therefore, understandable that there was little respect and limited confidence among the two services for each other.

In June 1943, a personal communication from the First Sea Lord, Admiral of the Fleet Sir Dudley Pound, was sent to the Master of every British registered ocean-going Merchant ship in an effort to raise morale after the disastrous months off the American coast when shipping losses had been amongst the highest of the war. The communication was designed to acknowledge the enormous part the Merchant Navy

had played in the war through both suffering and loss of life, and to pay tribute to their disciplined and co-operative approach to the convoy system. In this respect, the communication did come as a boost to morale but there was also a realisation that the Battle of the Atlantic and, in particular, the convoy war, could not be won by individuals alone. Team work was essential.

When this communication was issued, MAC ships had been in operation for only a short time but the essence of the communication for teamwork and co-operation had already been fully realised by all Fleet Air Arm personnel who had already joined a ship.

The effective use of a MAC ship depended upon the complete co-operation of both Merchant Navy and Fleet Air Arm personnel and the abandonment of any past prejudices that might have existed between the two services. Relationships soon developed as personnel began to realise the degree of skill and dedication that was required to undertake many of the necessary tasks. Achievement in such tasks developed a sense of individual pride which earned mutual respect and sound human relationships. The result was usually a happy and efficient ship.

The Commanding Officer of 836 Squadron, the Flight Commodore and the Air Staff Officers were selected, whenever possible, not just for their ability to understand the qualities of good leadership but also the quality to develop sound professional and social relationships with merchant service officers and men.

The difficult question of discipline was solved by a simple compromise which was promulgated in MAC ship Training Orders. The order stated that all RN personnel sign Ships Articles and shall be under the full disciplinary control of the Master and subject to the Merchant Shipping Act, although by virtue of their being found on the books of HMS President III, they will at all times remain subject to the Naval Discipline Act. Therefore Naval Offenders could be dealt with either under the Merchant Shipping Act or Naval Discipline Act but not both. Air Staff Officers were to take early steps to investigate offences and to caution offenders that their statement may be used in evidence. Unless offences were very major, disciplinary action could be deferred until arrival at the next port.

Whenever possible it was desirable that Masters should avoid taking disciplinary action against service offenders. This system worked well and there are no documents which show that ASO's had to take serious action. It was a system that was accepted by both Royal Navy and Merchant Navy officers and did not have any detrimental effect on personal relationships.

There was another factor which helped to cement a sound relationship between the two services. The Fleet Air Arm was manned mainly by 'hostilities only' personnel who came from a wide range of social backgrounds with no class consciousness at all; they were gregarious by nature. Because they entered the Air Branch as volunteers they brought with them an enthusiasm and dedication to carry out tasks to which they were appointed, and a sense of pride for the service to which they belonged. The personnel of both services found that a great deal in common existed between them, brought about by a sense of pride and tradition in the relevant service. There can rarely have been a situation during World War II when two services were so dependent on each other to carry out an effective role and, as a result, build up a spirit of mutual respect brought about by professional excellence and happy social relationships.

The message from the First Sea Lord had emphasised the value, courage and sacrifice exhibited by the Merchant Navy during the early years of the war and had illustrated the change of attitude that had taken place in the Royal Navy. Any sign of prejudice was finally broken down by the airmen and seamen of the MAC ships whose social and cultural background enabled them to develop a more flexible approach to life on board an operational vessel. This created high morale and happy and friendly relationships.

12. CONCLUSIONS

The MAC ship was not the first ingenious device to be introduced by the Admiralty to overcome a crisis in the battle against the U-boat, brought about through the lack of air support for convoys operating in the Atlantic theatre of war.

In late 1941, the Germans had used the Condor aircraft for reconnaissance and locating of convoys with great success, a measure that was eventually countered by the introduction of the CAM ship, the first vessel that was successful, but extremely costly because the aircraft had to ditch in the sea. The pilots also faced an extremely difficult situation. However, it did represent a turning point in research and development and brought in a new era in anti-submarine warfare giving an impetus to those responsible for the future production of Escort Carriers capable of flying and landing on aircraft on a vessel that could give close support to convoys.

By mid 1942, the battle of the Atlantic was at its high and allied shipping losses at a critical level and air support was urgently required in a blind spot in mid Atlantic through which convoys had been passing. To counteract this problem the Admiralty first considered the production of Merchant Aircraft Carriers in mid 1942 with the intention of having them operational by the Spring of 1942.

It was apparent, however, that these vessels would not be of strategic value but act as a tactical or interim measure in the anti-submarine campaign. There was from the start, misgivings amongst Naval Air Staff covering the design and operational capability of MAC ships, a fact compounded by the cynical view taken of Merchant Navy personnel because of the lack of training and experience in handling an aircraft carrier at sea. It was, however, to the credit of both Admiralty and Naval Air Staff that a compromise was reached and production went ahead with all speed because of pressure from both the Cabinet and anti-submarine committee for completion by 1943.

From this point on, a juxtaposition of events brought about the success of the MAC ship in achieving its role of providing close air support to vessels in convoy on the North Atlantic crossing. Success and effectiveness can be measured by the

complementary and parallel development of ship, aircraft, tactics and inter-relationships. Inter-relationships were to be the motivating factor throughout the whole lifespan of MAC ships and in no case was this better illustrated than in the design and production of the ships after the initial problems had been amicably settled through flexibility of attitude and sensible compromise.

Points at issue between departments concerned with the operation of these vessels as aircraft carriers, the production departments and the shipbuilders of the eleven yards used were discussed and settled at conferences and settled. The result, that nineteen ships were built or converted in a period of eighteen months was a remarkable achievement illustrating the imagination, ingenuity and dedication of all who co-operated in the project.

The ships proved to be suitable for convoy protection being both stable, even in adverse weather conditions and sufficiently manoeuvrable for flying operations within the restricted area provided within a convoy.

Synonymous with MAC ships was the Swordfish aircraft flown by 836 Squadron aircrew which was a survivor from the early days of the war. It was slow, cumbersome and judged by the conditions of the time, obsolete and lacked any kind of human comforts.

In spite of this it had a considerable record, mainly of an offensive nature and held a certain mystique and was held in great affection by most aircrew who would rather fly in a Swordfish, than the modern Albacore or Barracuda.

Anti-submarine tactics were extremely demanding often requiring flying to take place in adverse weather conditions, occasionally at night. This not only required the highest standards of airmanship from pilots and aircrew but equal standards of seamanship from the Merchant Navy personnel.

More important was the need to understand the extent to which they depended upon each other and the degree of trust and respect that was shown towards each through pride in both ship and squadron.

The cynical attitude that existed amongst Merchant Navy personnel was never apparent on MAC ships. From the start Fleet Air arm aircrew and personnel showed every respect towards their Merchant Navy shipmates and loyalty to the ship from which they served.

Overall Effectiveness

Statistics relating to Merchant Aircraft carriers indicate that the ships were effective in performing the role for which they were conceived and designed; to give added protection to convoys on the Atlantic crossing against U-Boat attack through the use of close air support. At the time that MAC ships were first being considered in mid-1942 the battle of the Atlantic was a crisis point and the sinking of allied shipping was a matter of grave concern for the Admiralty calling for immediate and effective action. The result was an unprecedented degree of co-operation between the Admiralty, the Naval Air Staff, the Controller of Merchant Shipbuilding and Repairs and selected dock yards. The result, 19 MAC ships, built or converted in a period of approximately eighteen months in yards lacking familiarity with naval equipment and governed to a large extent by the necessity of conserving both labour and materials compatible with producing an adequate input in the shortest possible time.

The design was brilliant but basic, allowing for simplicity in the conversion of the ships. The outcome was a merchantman that could continue to carry a full cargo but operate successfully as an aircraft carrier. The economic value of these ships is sometimes forgotten because greater attention is paid to the more dramatic picture presented by air activities of the vessels. There is no doubt that at the time of production these vessels represented the least costly carriers ever produced even if they did only accommodate three or four aircraft. This, however, is insignificant on realising that on each return voyage from Canada the grain ships carried nine and a half thousand tons of grain and the tankers ten thousand tons of oil. The value to the UK of these cargoes cannot be overestimated and should be considered as one of the major achievements of MAC ships. Flying from MAC ships demanded a high degree of skill from pilots to overcome the problems presented by a short and narrow deck and a low ship's speed of around eleven knots. These difficulties were lessened considerably by using extra ballast to get them down to a 24 ft. depth and thus increasing the stability in bad weather conditions.

In addition, advice given by the National Physical Laboratory before construction commenced had resulted in small alterations being made to the rudder of the ships

which had helped to inspire manoeuvrability, an essential requirement when operating aircraft, within the confines of a convoy. In addition, the naval equipment requirements in a carrier – such as arrestor gear and safety barriers – were of a high quality and provided few problems. However, in ships that were so hastily constructed there were weaknesses which did affect their operational efficiency such as the lack of a hangar deck on the tankers, resulting in maintenance work being completed on an open deck with little protection from the North Atlantic weather. Nevertheless, in spite of the shortcomings, the little carriers did provide an effective platform from which aircraft could operate to provide additional convoy protection.

In the two years from May 1943 to May 1945 the nineteen MAC ships completed 324 Atlantic crossings including 270 operational voyages as convoy escorts and 54 as non-operational vessels when on 16 occasions they acted as ferry carriers loading approximately 20 aircraft on each occasion. In considering the success of air operations, credit is due to the organisers and administrators responsible for the creation of 836 Squadron with 23 flights for a total of 19 MAC ships. This was a unique squadron because instead of being a single cohesive unit that flew and fought together, its component flights became autonomous when at sea under their own flight commanders but still remaining part of 836 Squadron.

The initial trials carried out by Ransford Slater and aircrew from 836 Squadron had proved that the Swordfish aircraft could operate from MAC ships even in poor weather conditions. However, taking off and landing was to prove a daunting experience for many MAC ship aircrews in the future with the realisation that special powers of airmanship were needed to handle aircraft in the short and narrow landing space required, coupled with a relatively slow speed of the ship.

The success of anti-submarine tactics used by MAC ships was built up around the capability of the Swordfish Mark II aircraft. It had a reliable Pegasus engine, was rigged in construction but had a weak undercarriage liable to collapse on a heavy landing. However, the slow speed of the aircraft and the all round vision from the open cockpit made it ideal for low flying patrols and searches whilst its offensive capability of 8 rocket projectiles or low depth charges made it a deadly adversary. The tactics used by

MAC ships were simple but effective with dawn and dusk patrols or searches being carried out usually under the 'reptile' air patrols (Atlantic convoy instructions). The use of these instructions meant that in an emergency, briefing could be cut to a minimum allowing the aircrew to become airborne as quickly as possible. Every observer had details of the code and could analyse the situation to take the necessary action required.

If a U-boat was sighted orders were to report the position and if possible use cover in the hope of making a surprise attack. If it crash dived, the pilot would attack at once hoping to use rockets or depth charges before the U-boat was fully submerged. In the event of the U-boat staying surfaced, an attack could be made but it was considered wiser to wait for support and then make a combined attack.

The aircrew flying the Swordfish MK2 completed 270 operational voyages, including 4177 operational sorties, (an average of 13 sorties to a crossing) and 9,016 flying hours. The effectiveness of MAC ship operations is shown by the fact that only 3 successful attacks were made on convoys escorted by MAC ships with the loss of five ships, one escort vessel and 4 merchantmen.

In fact, their real effectiveness was in preventing U-boats from approaching to within torpedo range of a convoy. The great majority of MAC ships sorties were totally uneventful which was monotonous and frustrating to aircrew. However, this did not mean that the flights achieved nothing. The very presence of supporting aircraft lifted the morale of all in a convoy. Of greater importance if there were U-boats preparing for attack they would be forced out of range. A U-boat in mid-Atlantic spent much time on the surface where the speed was greater but if forced to dive because of the approach of an aircraft her speed was drastically reduced and prevented her from chasing a convoy and making an attack. A U-boat could normally detect aircraft before herself being detected. So no patrol or search need ever have been fruitless.

There were many technical obstacles to be overcome if MAC ships were to operate effectively at sea, a fact compounded by the lack of previous experience in working a dual purpose aircraft carrier.

It was, however, obvious, to Naval Air Staff and Merchant Navy Officers alike that the

highest standards of both seamanship and airmanship would be essential. It was also realised that unless a spirit of co-operation and harmonious relationships could be established there was no hope for the role of MAC ships to be accomplished.

There were sound reasons for thinking that the latter might be the case. There had been no love lost between the Royal Navy and the Merchant Navy where separate background and culture had kept them apart and there was every reason for discord.

No discord ever appeared. From the start, relationships were excellent being fostered by the Commanding Officer of 836 Squadron who realised the importance of co-operation. The handling of an aircraft carrier for efficient flying operations demanded from the Merchant Navy deck officers the highest standards of seamanship whilst an equivalent level of airmanship was required by aircrew. The safety of the ship manoeuvring inside a convoy and the safety of an aircraft landing on depended on ability and skill. The standards achieved developed a feeling of mutual trust in the ability of each other leading to happy and harmonious relationships.

SUMMARY PERFORMANCE FIGURES FOR MAC SHIPS

MAY 1943 - MAY 1945

Number of Voyages by MAC Ships 25 th May 1943 - 8 th May 1945	= 324
Outward voyages ON/ONS Convoys	= 172
Inward voyages HX/SC Convoys	= <u>152</u>
Total	= 324 voyages
Number of non-operational voyages	= 38 outwards
Number of voyages as ferry carrier	= <u>16</u> return
Total	= 54
Total number of operational voyages	= 270
Number of air sorties carried out	= 4,177
Number of operational flying hours	= 9,016
Average flying hours per voyage	= 27
Highest number of hours flown UK - Halifax return voyage	
Number of sightings by aircraft	= 12
Number of attacks by aircraft	= 6
1 U-boat damaged and surrendered to escort vessel	
1 damaged by R/P attack	
1 French submarine sunk	
Number of return voyages as ferry carrier	= 16
Number of aircraft carried = 20 per voyage	= 320 aircraft
Used as escort oils	= 8 voyages

13. **SUGGESTIONS FOR FURTHER WORK**

This section was under discussion when the author died.

