

BOOK REVIEWS

BROOK, Peter. *Warships for Export, Armstrong Warships 1867-1927*. World Ship Society, Gravesend, 1999. 243 pages, 252 illustrations. ISBN 0 905617 89 4 Price £19 (members), £28 (non-members) + £3 postage.
(reviewed by EUR ING David K. BROWN RCNC.)

This book describes the 159 warships built by Armstrong's Tyne shipyard. It opens with a short history of the company and the personalities involved. There was a very close link between the Admiralty and the company; the naval architects PERRET, WHITE and WATTS left the Admiralty to work for the company, the latter two returning, whilst d'EYNCOURT joined the Admiralty from the company. George RENDEL, a company engineer, became Civil Lord of the Admiralty. A rather surprising point is that Armstrongs did not build machinery for its ships until after World War I.

The bulk of the book then describes each ship individually. Using company records there is a background to the design objectives, mention of special features and a brief account of the ship's service career. Where possible, sketches are included of alternative designs offered to the customer. Armstrong's were best known for fast light cruisers with exceptionally heavy armament, e.g. *Esmeralda* of 2950 tons mounted two 10 inch and six 6 inch. The big guns were difficult to work in such a small ship and replaced later in her career. The numerous photographs are well selected and clearly reproduced.

There is an 8 page annex on Armstrong guns, followed by 4½ pages listing the sources used. It is a most interesting book containing much material that has not previously been readily available. Those interested in older ships will spend a very long while browsing through the book.

BROWN, D. K. *The Grand Fleet - Warship design and development 1906-1922*. Chatham Publishing, London, 1999. 208 pages, 200 illustrations. ISBN 1 861 76 099 X. Price £35.

(reviewed by J.F.P. EDDISON RCNC)

This book follows on from the author's earlier work *Warrior to Dreadnought*, which examined the development of the capital ship from the Ironclad to the all big-gun battleship. It describes how the *Dreadnought* initiative led, in the brief period before the First World War, to the creation of a whole fleet of heavily armed and armoured battleships, how these ships performed in battle, and how the lessons of battle were carried forward after the war, up to the signing of the Washington Treaty.

Nor does the author restrict himself to capital ships, but covers the development and use of the whole supporting cast of naval vessels, including a wide range of wartime, and short-lived, expedients.

Like its predecessor, this book is minutely researched and clearly written, with extensive references (some newly found) and copious footnotes, and is supported by explanations and discussions of the sometimes obscure technical terms. The author has again dipped into his extensive collection of contemporary photographs to show the main features described, and sketches and graphs of technical points back these up. Appendices provide more detailed discussion of specialist aspects, accessible to both the general reader and the expert. For example, penalty clauses on performance are not new.

David BROWN has the happy knack of being able to present complex subjects simply, while not disguising their complexity. He provides a fascinating insight into design rationale, and into the accompanying technical developments of machinery, guns and armour.

The author sets the scene with a short introduction, summarizing the political, financial and technological climate at the start of the period, before describing some of the technical developments which contributed to the rapidly expanding shipbuilding programme leading up to war.

The development of the design of each major ship type is described and illustrated. Although the threat was perceived to come from Germany, the technical details were often vague and inaccurate, so there was constant refinement and effectively multiple prototypes, as a design was built and taken to sea, and then modified in the light of further information or of its performance. The expanding build programme, and very short design and build times, allowed what was a truly evolutionary progression to be condensed into a remarkably short period, a tribute to those involved, and to the flexibility of the bureaucracy (or lack of it).

The discussion of each theme is enlivened by brief biographies of the key players, and by accounts of the thinking of the Naval Staff and the Design Department, which shed light on the pressures involved and the compromises reached. The strong influence of ADMIRAL FISHER is evident throughout; his relations with Contracts staff are revealing! There are examples of particular hobby horses being injected into the design process, not always with a sound basis, and with consequent adverse effects on the overall result, and these illustrate the complex nature of the process and the scope for details to impose major limitations.

There are also some interesting comparisons with foreign designs, largely German and American, but the emphasis is on the development of the British designs. This the author describes with his customary technical skill and insight, showing how the various aspects of a design are dovetailed together, and how individual changes have repercussions through the whole.

An aspect of particular interest is the development of the battlescruiser, which the author groups initially with cruisers, demonstrating their original pedigree as fast, heavily armed, but comparatively lightly armoured ships. However, they are soon seen as fast battleships, although more expensive, sacrificing protection for speed, and arguably less effective. The section on the *Hood* is a must, showing how her design was frequently modified, based on wartime experience, even after ordering, and how the changes affected time, cost and performance, leading overall to a dramatic weight increase. We are promised a further book discussing the design aspects of her loss.

However, in a modern context, the sections on submarines and naval aviation are at least as interesting. An enormous amount of development work was carried out into naval aviation, in a very short time, and was put into practice, so that by 1918 the UK was operating recognisable carriers. It had gone a long way towards recognizing and dealing with the fundamental problems of this type of ship. Although there were still technological barriers, the conceptual and practical foundations were in place for the carrier designs of today, and the RN's initiative was widely copied.

Submarines too developed rapidly from the 1901 HOLLANDS, and were built in large numbers, being quick, cheap and simple (and expendable?). The design problems had not been fully solved, particularly the key ones of strength, control and watertightness, so the design process was empirical and conservative. The large numbers built allowed considerable experimentation, and rapid progress was made, including an early form of underwater telephone.

The author's exposition of the remarkably rapid progress in these two key areas for the future is an excellent introduction to the design problems met and solved under the stimulus of wartime pressures.

Wartime experience of all types of warship is analysed in depth from a design standpoint, for example the losses/damage at Jutland, and the design consequences for new designs are discussed. The effect of the higher operational tempo and harder working is drawn out, showing up design weaknesses that peacetime did not. These were not all operational; poor seakeeping, on all sizes of ship, was a major limitation that is fully discussed.

This section is not confined to major warships, but has an extensive review of all the minor and temporary warships built or bought in during the war. There are fascinating descriptions of minesweepers (interestingly coming out at about the size of the HUNTS), motor gunboats, monitors, Q ships etc. Though not described in depth, the requirement, design options and eventual solutions are clearly laid out.

The book closes with a review of British achievements in naval construction before and during the war, and claims, with justification, that these were considerable, in terms of designs developed, ships built and performance achieved. The Royal Navy was left with technology leads in many areas, which however were not matched by its ships, which in many cases were worn out and obsolescent. The author promises us another book to explore what happened.

The book is largely one for the specialist, mainly but not exclusively the naval architect, describing the ship design process as a whole, and discussing the key **technical** features and compromises which led to one solution rather than another. However, the author supports this debate with valuable insights into the strategic and political background underpinning it, not least the financial constraints which are so crucial to a successful design, or to one that is less so.

These factors will (your reviewer suggests) make this book a fascinating read for the wider audience of those interested in naval history.

HAMER, David. *Bombers versus Battleships*. Conway Maritime Press, London, 1999. 414 pages, 52 illustrations, 39 maps. ISBN 0 85177 771 6. Price £19.99. (reviewed by EUR ING David K. BROWN, RCNC).

The book is a narrative account of air-sea actions, which are well selected, exciting and generally accurate. The first chapter is a brief account of developments up to the end of World War I. This gives a muddled account of the development of the *Argus* failing to recognise that she was the only operational aircraft carrier—anywhere—when the war ended and was working up a squadron of Sopwith CUCKOO torpedo bombers to attack the High Seas Fleet in their anchorage. The second chapter deals with inter-war developments, mainly in aircraft carrier.

The next 17 chapters cover actions such as Taranto, *Bismarck*, Pearl Harbour, Ceylon, Midway etc, through to Okinawa. These are all well described and very readable. I found Pearl Harbour and the attack on Ceylon particularly interesting. The maps are well drawn and relevant—though I am surprised that Addu Atoll is not shown on the Indian Ocean map on page 154. The photographs are generally well known but excusable since there is little choice.

All authors make slips (me too) and reviewers turn a blind eye to a few but this book has far too many. They are mainly trivial e.g.:

- *Hermes* was not built on a HAWKINS class hull
- *Prinz Eugen* was 14680 tons not 10000
- *Repulse* mounted eight 4 inch when she was sunk and so on.

More serious, there is no mention of the numerous full-scale trials and shore tests carried out by the RN and RAF between the wars on the protection of battleships against bombs and torpedoes. These culminated in the giant pontoon Job 74 with a full-scale replica of *King George V* protection on one side and that of *Ark Royal* on the other. These trials formed the background to a parliamentary committee in 1936 on the vulnerability of capital ships to air attack. Their final conclusion was that the views of the air enthusiasts were that the UK should stop building battleships,

“If their theories turn out well founded, we have wasted money; if ill founded, we would, in putting them to the test, have lost the Empire”.

There should also be discussion of the belief of the Board under CUNNINGHAM in 1944-45 that the battleship was the heart of the fleet, which led to post war battleship studies of up to 70,000 tons!

It is a good read and quite cheap by today's standards.

JOHNSTONE-BRYDEN, Richard. *HMS Ark Royal IV. Britain's Greatest Warship*. Sutton Publishing 1999. 262 pages. Lavishly illustrated with black and white photographs from many private previously unpublished collections. ISBN 0-7509-1798-9. Price £20

Forward by ADMIRAL OF THE FLEET SIR Michael POLLOCK GCB LVO DSC. (reviewed by Douglas MACDONALD)

As a first time author, Richard JOHNSTONE-BRYDEN tells the story of the Fourth *Ark Royal* from her 12 years under construction at the Cammell Laird Yard to her ultimate death by acetylene torch in Loch Ryan. When she eventually gets her first set of sea trials underway in June 1954, followed by initial flying trials involving SKYRAIDERS, AS GANNETS and SEA HAWKS in 1955, Richard calls upon the recollections and anecdotes of many who served in her to weave together the tale of what was undoubtedly Britain's mightiest

warship. From the many taped interviews it is just a pity that Richard could not have checked the surname spelling of some of the well known Fleet Air Arm characters he writes about. This is a minor criticism of what has been a painstakingly researched book, which will act as a definitive guide to this great ship for a long time to come. The days of the early big jets, VIXENS and SCIMITARS through the refits to operate eventually the most powerful aircraft of the 70's, the F4 PHANTOM and the BUCCANEER S2. The recollections of all who served in her are treated very sympathetically by Richard. The *Kotlin* 'incident', the filming of *Sailor*, the visits onboard by HM The Queen Mother, HRH the Prince of Wales' sortie in a BUCCANEER and the various runs ashore are all here. SIR Henry LEACH's lovely tale about the preparation for, and the visit to *Ark* in the Mediterranean shortly before she came home for the last time is worth the wait. This book is a good read and above all the reader very much gets the impression of the Happy Ship that she was. Lavishly enriched by action photographs from many private collections, if you ever served on the 'Mighty Ark' then you must own a copy. Even if you didn't this book is one for the serious student of the Royal Navy and its Fleet Air Arm.

KEMP, Paul. *Midget Submarines of the Second World War*. Chatham Publishing, London, 1999. 125 pages, 107 illustrations. ISBN 1 861 76 042 6. Price £30.

(reviewed by EUR ING David K. BROWN RCNC.)

This excellent book is another in Chatham's 'Shipshape' series. It describes both midget submarines and human torpedoes of all countries during and after the war. Italy is, rightly, given the credit for the first successful use of such craft when the dreadnought *Viribus Unitis* was sunk at Pola on 1 November 1918 by a human torpedo. A film of her sinking has been used in numerous cinematic and TV epics, wrongly described!

Further developments in Italy just before the war led to a two man torpedo which scored a number of successes, notably the sinking of the *Queen Elizabeth* and *Valiant* in Alexandria harbour and several at Gibraltar from a covert base in the tanker *Oltterra*. The Royal Navy copied the Italian design and had a few successes. Germany was late into the race and her hurriedly produced versions had few successes. They even used the WELMAN craft—the only unsuccessful British craft—captured at Bergen in 1943 as the basis for their BIBER design. Japan put a great deal of effort into the powerful KAITEN torpedo but without a great deal of success.

The Italians were the first to build midget submarines, which were used extensively. The armistice came just in time to halt a well-rehearsed attack on New York harbour. During the thirties the Japanese developed midget submarine which were intended to take part in a conventional surface action. Only just before Pearl Harbour was it agreed that these craft should be used to spearhead the attack. It seems that the failure of Japanese craft to achieve more was due to lack of training. The British X class were quite successful as boats and achieved some notable successes, in particular the attack which disabled the *Tirpitz*. It is a pity that their (unofficial) names are not listed. Once again, German designs were rushed and the crews ill trained. There is a brief mention of post war designs, developed either to place nuclear weapons or as covert swimmer transports. Strangely, there is no mention of Sweden whose navy bought HMS *Stickleback* in 1958 and operated her as the *Spiggen* until about 1970. Returned to this country, she is displayed at the Imperial War Museum, Duxford, together with an excellent display of X craft photos.

The photographs are a notable feature of the book. There are numerous shots taken inside the boats showing the appallingly cramped conditions. With the

usual official doctrine of the inappropriate, the later British craft were designed by R.N. NEWTON, 6ft 8in tall! There are large scale, pull-out plans of X5 and *Seehund*.

It is a most interesting book and very readable. The author argues powerfully that the successful craft were designed, built, trained and operated within the 'establishment'. Pirate navies failed both in material and personnel aspects—perhaps why there have been no terrorist midgets. The only British design from outside Bath was the WELMAN craft, a failure. Suicidal bravery was no substitute for training. KEMP concludes by warning that there is virtually no harbour defence expertise or equipment available today.

KEMP, Paul. *The Admiralty Regrets. British Warship Losses of the 20th Century*. Sutton Publishing 1999. 272 pages, 64 photographs. ISBN 0 7509 1567 6. Price £19.99

(reviewed by John SHEARS)

In his introduction the author explains that this is not a complete list and that he has not included the legion of auxiliary craft that have been lost. He also adds that due to a lack of complete records he has not been able to fill in all the details. Sometimes it is hard to understand why this information is not available. For instance:

- Why wasn't the name of the Captain of HMS *Speedy* known?
- If there were two survivors from *E22*, surely some one knows the total complement of an E boat and thus list the number of casualties.

Examples such as this occur through out the book.

The inside cover states that over 800 British warships (including those of the various Dominions and Commonwealth navies) have been lost. This book lists 747 of them, of which 22% are submarines. The Author's time researching his other titles concerning submarines is reflected in the photographs, of which 70% are connected with submarine losses. 18 ships' names appear twice with three (*Ardent*, *Gurkha* and *Phoenix*) having the dubious distinction of appearing three times. (*Thetis* would also have this dubious distinction if the 2nd *Thetis* hadn't been salvaged and renamed *Thunderbolt*).

The book also claims to trace the development of naval warfare etc. This it may do, but as it will not be read from cover to cover in one go, but will be used as a reference document, then these notes may tend to get lost. They are discovered if they are on the page of the ship the reader is investigating, and when found are well worth reading.

When reviewing such a book, the reviewer will tend to turn to a specific ship they either served on or knew someone who was on board. Therefore it was surprising not to find HMAS *Voyager* listed, in which this reviewer lost a member of his term and Eddy BROOKS, the Gunnery Officer who chased him around Dartmouth.

Any book on this subject can be easily criticised for either not containing all the information, or sometimes too much (i.e. why three pages on the loss of the *Hussar* and *Britomart*?). Despite these small niggles, the book is thoroughly recommended as both a reference book and as a reminder of the sacrifices made by our predecessors.

I am sure the FAA will have not forgotten that before the aircraft names became famous, there were ships already with the same name:

Swordfish—S class Submarine sunk 7 November 1940.

Vampire—V class destroyer sunk 9 April 1942.

Whirlwind—W class destroyer sunk 5 July 1940.

Finally, all those who navigate their yachts around our coastline beware of the loss of HMS *Effingham* and the use of a thick pencil!

KOOP, Gerhard; SCHMOLKE, Klaus-Peter. *Battleships of the Scharnhorst Class*. Greenhill books, London, 1999. 175 pages, 234 photographs, 19 line drawings. ISBN 1-85367-365-X. Price £25.
(reviewed by EUR ING David K. BROWN RCNC).

This is a companion volume to the authors' *Battleships of the Bismarck Class*, previously reviewed in Volume 38 No.1 pp.114 of the *Journal of Naval Engineering*, and has the same virtues and problems. The numerous photographs of the building and service life of these two ships paint a vivid picture, which is to be welcomed. The quality is generally high except for some of the action shots. There are quite a few interior shots.

Their actions are frequently described using log entries which, while atmospheric, are not easy to follow. The action of the German ships against *Renown* in April 1940 is of particular interest as the elderly British battlecruiser put them both to flight. This was largely due to the poor seakeeping of the Germans with both A turrets quickly out of action due to flooding. The authors offer a somewhat muddled explanation in terms of hull form. It is more likely that it was simply lack of freeboard; a rule of thumb used in British designs at the end of World War II was that freeboard should equal $1.1 \sqrt{\text{Length}}$ ft which would be 30 feet for these ships. Scaling from photographs, the freeboard as built was about 23 feet at sea. They were then rebuilt with a new, longer bow with increased sheer after which the freeboard was about 27-28 feet, still less than the guideline. (The photographs used are not entirely clear but these figures seem of the right order). Waves will always come aboard and more attention should have been paid to the watertightness of A turret.

The text is not very clear; e.g. there are a great number of 'facts' on the machinery but these are not related to performance. It seems that this high-pressure plant was unreliable. Though the armour thickness is given correctly, the fact that the belt was thicker than *Bismarck's* is not brought out. At the time the design was started, German warships were limited to 10,000 tons by the treaty of Versailles. Her displacement was given as 26,000 tons which was given a degree of legitimacy by the Anglo-German Treaty but their true standard displacement was 31,552 tons, a gross breach of the new treaty.

They had an active war and this well illustrated book will be of interest.

McCALLUM, Iain. *Blood Brothers, the life and times of Hiram and Hudson Maxim: Pioneers of modern warfare*. Chatham Publishing, London, 199. 200 pages, 33 photographs, 2 maps. ISBN 1 86176 096 5 Price £20
(reviewed by EUR ING David K. BROWN RCNC).

The MAXIM brothers were self made men from a humble background whose inventions span many fields of activity. They were rumbustious, even vulgar, but they had a talent for making things work. Hiram's work on machine guns is the best known of their inventions with guns of his design in use in several armies until well after World War II. Even the Royal Navy's multiple pom-pom was basically to Hiram's design. Both the Admiralty and the War Office are shown as interested and progressive in trials of the new weapons. Their reluctance to purchase in quantity seems well justified in the light of rapid developments in this field.

Both were active on propellants for guns and both warned of the danger of cordite as then made in the UK. Hudson was largely instrumental in persuading the USN to adopt nitro-cellulose, which probably kept that navy clear of the disastrous explosions, which afflicted ships using cordite. It was Hudson's activities in this work that led to the final split between the brothers as Hiram thought that Hudson had pirated his work.

Hiram's attempts to fly were unsuccessful but very brave and well conceived. He began serious work in 1889 with the development of a lightweight steam engine and boiler. Over the next few years he built a plane that, in final form, had a wing span of 104 feet and weighed 8000lbs with fuel, water and crew of two. It ran on rails for take off but a second set of rails was to prevent it from rising too far at first. In July 1894 it did take off and seems to have travelled about 600 feet before crashing. Though work continued for a time, it was proving costly and company support was withdrawn.

The book is well written, easy to read and, with numerous wives, mistresses etc., quite spicy!

PENN, Geoffrey. *Fisher, Churchill and the Dardanelles*. Leo Cooper, Barnsley, 1999. 288 pages, 38 photographs, 4 maps. ISBN 0 85052 646 9. Price £25. (reviewed by EUR ING David K. BROWN RCNC).

FISHER and CHURCHILL were both complex characters with immense drive and imagination. Initially, they had great mutual respect and worked well together. This book tells how their relationship soured. A major factor was CHURCHILL's repeated attempts to pre-empt operational matters, the prerogative of the First Sea Lord. There is also room for concern as to claims for the credit for ideas such as the introduction of oil fuel, the speed and 15inch armament of the *Queen Elizabeth* etc. When two creative characters are in dialogue it is often very difficult, even for the participants, to decide who thought of it first. In addition, the ultimate authority lay with CHURCHILL as First Lord. (CAPTAIN PENN outlines the importance of the change to oil fuel but does not give enough credit to the engineer officers who overcame great difficulties in giving the lead to the RN).

Both men were well aware of the value of selective truths in bolstering their case. FISHER wrote in *Naval Necessities*,

'I had an excellent secretary. When I asked him for the facts, he always asked me what I wanted to prove. There is no doubt that facts are most misleading.'

The author has done well in reproducing complete quotations rather than the edited versions used by the protagonists.

The Dardanelles campaign is sketched in as the cause of the final break between FISHER and CHURCHILL. The RN had ended the Crimean war with the finest coastal attack force in the world and for many years this was a major role. The Syrian operations, the Crimean war, the American Civil War and others showed that, contrary to the view often expressed, a battlefleet could overwhelm forts.¹ Material damage was usually slight but the morale effect of large numbers of heavy guns in rapid fire would lead to rapid capitulation. (This is quite the opposite of CARDEN's plan for the Dardanelles operation which envisaged a slow, methodical attack). However, a big exercise at Berehaven in 1885 showed the difficulty in passing a minefield protected by batteries. Later trials showed the difficulty in dealing with concealed guns and a pre war study into the Dardanelles showed that passage was almost impossible and that re-supply would be quite out of the question.

The author makes a case for FISHER's proposed Baltic operation. To my mind, this has the same objections as that of the Dardanelles. Both show the lack of a proper naval staff who would have shown the need for fast minesweepers, suitable aircraft, and an adequate provision of ammunition with proper fuses etc. and, in so doing, shown that neither attack was feasible. It is fairly clear that FISHER was a leading opponent of a staff and that one

¹ This argument is justified by the papers and discussion of the 'Ships versus Forts' Conference in 1995, organized jointly by the Society for Nautical Research and the Fortress Study Group.

reason for CHURCHILL's appointment was to establish such a staff. BERESFORD was an enthusiastic supporter of a staff and needs a better press. PENN, rightly, points out the difficulties of establishing a staff when there were no trained staff officers but this is no excuse for not making a start.

Although occasionally spoilt by some over-sweeping judgements, this book is an important contribution to the study of a very difficult era in the RN - but one in which much was achieved. The author gives the credit to FISHER and all of the blame to CHURCHILL; I would be more even handed.

PHILLIPSON David. *Roll on the Rodney* Sutton Publishing 1999. 152 pages. 6 illustrations. 25 photographs. ISBN 0 7509 19686X Price £16.99 (reviewed by Dennis ROGERS)

The author has aptly chosen *Roll on the Rodney* as the title. It sets the theme for this book, a collection of canvassed memoirs and authentic first hand accounts by fellow seamen, supported by the author's own experiences of life on the lower deck of the Royal Navy in the decade following the Second World War. The privations endured and tolerated during the war by men on the lower deck and their expectations of improvements in both living and conditions of service after the war ended, which for political and economic reasons was not forthcoming during the period covered. This led to a crisis in manning and retention of trained men following the discharge of Hostilities Only ratings.

The opening chapter repeats the assertion that in its essentials, the 150 years since NELSON had seen little change in the living conditions on the lower deck. Men still slept in hammocks but the number of available slinging billets was never sufficient, a condition exacerbated by the demands for space for new equipment. Living conditions were primitive and TB was endemic. That the sailor kept himself and his kit clean and tidley was a credit to his versatility and ingenuity.

Subsequent chapters look at food, clothing, pay, discipline, shore leave, relations with officers, all supported by anecdotes told with such an irreverent sense of humour, some of which brought tears to the eyes of this reviewer. Included are first hand accounts of such post war actions as the:

- Yangtze incident involving the *Amethyst*
- Mining by the Albanians of the *Volage* and *Saumarez* in the Corfu channel
- Disaster at Portland in 1949 when the *Illustrious* motor pinnace returning from Weymouth with liberty men, sank in rough weather in Portland harbour with consequent loss of life.

One small error in the final paragraph of page 107 where the author recounts sewing the badge of his newly qualified Radar Plot rate badge onto the left sleeve of his jumper. Non substantive rate badges are worn on the right sleeve.

The book ends with a glossary of naval terms used on the lower deck, taken from Rick JOLLY's book, *Jackspeak*.

An enjoyable read and an ideal complement to *The Royal Navy An illustrated Social History 1870-1982* by CAPTAIN John WELLS and *Social Change in the Royal Navy 1924-70 - The Life and Times of Admiral Sir Frank Twiss'* editor Chris Howard BAILEY, both available from Sutton Publishing.

Marine Accident Investigation Branch. *Report on the Underwater Survey of the Stern Trawler 'Gaul' and the Supporting Model Experiments*. Southampton, 1999. 222 pages, 58 photos, plans and maps. ISBN 1 85112 171 4 Price £20. (reviewed by EUR ING David K. BROWN, RCNC).

The *Gaul* was a 66 metre stern trawler built in 1972 by Brooke Marine (Lowestoft) as the *Ranger Castor*. She disappeared on 8 February 1974 in very severe weather about 60 miles off North Cape with the loss of all 36 crewmembers. There was no distress call. The formal enquiry was held in the autumn of that year hearing evidence from 60 witnesses. A former captain gave evidence that she was an excellent seaboat, supported by the behaviour of her sister ships one of which was used for trials. A lengthy series of model experiments were carried out by the National Maritime Institute, reported by MORRALL to RINA in 1980, which confirmed her stability and seaworthiness.

It was estimated that the significant wave height was 6.7m (22ft) at 1030 on the day of sinking, rising to 7.6m (25ft) by 1630. This implied that the highest waves expected in a three hour period would be 13.1m (43ft) and 14.6m (48ft) respectively though there was a 10% chance of waves up to 14.9m (49ft). The enquiry concluded that the *Gaul* had been lost as a result of severe wind and waves associated with flooding from some cause. Despite this finding, rumours persisted that she had been gathering intelligence and had been sunk or captured by the Soviet Union.

In August 1997 a team funded by British and Norwegian television companies found the wreck at a depth of about 280m and took a number of video images. These were shown in the UK in November 1997 and, as a result, MAIB were directed to carry out a detailed survey in the summer of 1998. To demonstrate that the survey was detailed and impartial, representatives of the *Gaul* families' association and a TV team joined the survey team.

The cable layer *Mansal 18* that had dynamic positioning carried out the survey. Three ROV were available. The equipment varied; there was a manipulator fitted with shears to cut away nets, with which the wreck was festooned, a hydraulic hammer to break portholes and a miniature camera that could enter the portholes. The objects were to inspect for damage, check the state of doors and hatches, and obtain as near 100% video coverage as possible and to look inside for any human remains.

The *Gaul* was heeled 35° to starboard and more or less on an even keel. Access to the port side was unobstructed but numerous nets curtained the starboard side. Visibility was poor which meant that many frames covered an area less than 2m square. These were then joined into a mosaic using a computer program on digital images. The miniature camera could be inserted about one metre into an opening through to picture the bridge console an extension was used.

A further set of model tests was carried out at Haslar. DR HOGBEN had advised that breaking waves up to 18.3m (60ft) were possible in a 3 hour period and, to reproduce such waves in the tank, a scale of 1/46 was selected. It was confirmed that *Gaul* was very seaworthy but a group of beam waves of 16m (52ft) height could knock her over to 90° and a 22m (72ft) wave could invert her.

Study of the images ruled out fire, collision, structural failure and enemy action. Flooding of the factory deck from ship's systems was also ruled out. Damage to both sides near the forepeak was thought to be due to implosion from water pressure. Damage to the port funnel was consistent with wave impact. Two doors and two hatches were found open and could have caused rapid flooding. There was no direct evidence as to how these became open.

In all probability someone trying to escape opened the engine room door. It is possible that the hatches came open with the ship upside down.

The available evidence of her course is not consistent with the impact of beam seas. But, in the weather conditions, it is quite possible that the bow was knocked or blown round and she was then impacted on the beam by a group of very large waves which would knock her over to 90° within 7 seconds. She would recover to 30° quite rapidly, 10 seconds—but a large amount of water would have entered the fish hatches and flooded the factory deck. This would leave the doors found open below water and the ship would sink by the stern within 10 minutes. All observed damage is consistent with this hypothetical course of events that will be considered by a re-convened formal enquiry.