

# H.M. YACHT 'BRITANNIA'

## TWENTY YEARS ON

BY

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### Introduction

In July of this year, *Britannia* completed a nine month refit, the longest period that the Yacht has experienced in dockyard hands since commissioning in January 1954.

The main purpose was to modernize the Junior Yachtsmen's accommodation and bring it into line with current Fleet standards. At the same time, it was decided to replace the manually-operated telephone exchange by an automatic one integrated with a dictograph intercom system to meet direct key calling requirements.

Once the full extent of the time in hand was known, the opportunity was taken to seek approval to complete as many alterations and additions as possible, mainly on the radio and nav aids side, and to bring all planned maintenance up to date.

The refit has been referred to as the mid-life refit of the Yacht and there is no apparent technical evidence to suggest that *Britannia* cannot remain operational for another twenty years.

In Volume 7, No. 1 of the *Journal of Naval Engineering*, published in January, 1954, Commander J. W. Mott, *Britannia's* first Engineer Officer, wrote an article in which he described the machinery and equipment fitted. It is not the intention to repeat this information but to explain some of the problems that have been faced and the more important changes which have taken place.

In general, the machinery and equipment fitted is unsophisticated, robust, and reliable and, in addition, has ample access for maintenance and cleaning. These basic criteria, coupled with correct operating procedures, have enabled the Yacht to carry out her duties in a relatively trouble-free way.

By the start of the last refit, *Britannia* had spent a total of just under 35,000 hours underway and steamed over 462,000 miles.

### Upkeep Policy

The Yacht's original upkeep policy was based on a DED of six weeks and a refit of eight weeks in alternate years; in practice, the refit in every fourth year was extended to sixteen weeks, and on occasions longer, in order that a complete survey of the structure could be carried out in accordance with Lloyds requirements.

It has now been agreed that the survey should be carried out continuously at each DED and refit, and as a result a new three year refit cycle has been approved. The latter consists of a DED of seven weeks in the first and second years and a refit of fourteen weeks in the third.

*Britannia* has never been entitled to any official FMG support, nor has she ever been planned to undergo an AMP. However, a close liaison is kept with the Portsmouth FMG who have always been very helpful when asked for assistance and given it whenever possible, if at times only on a day-to-day basis.

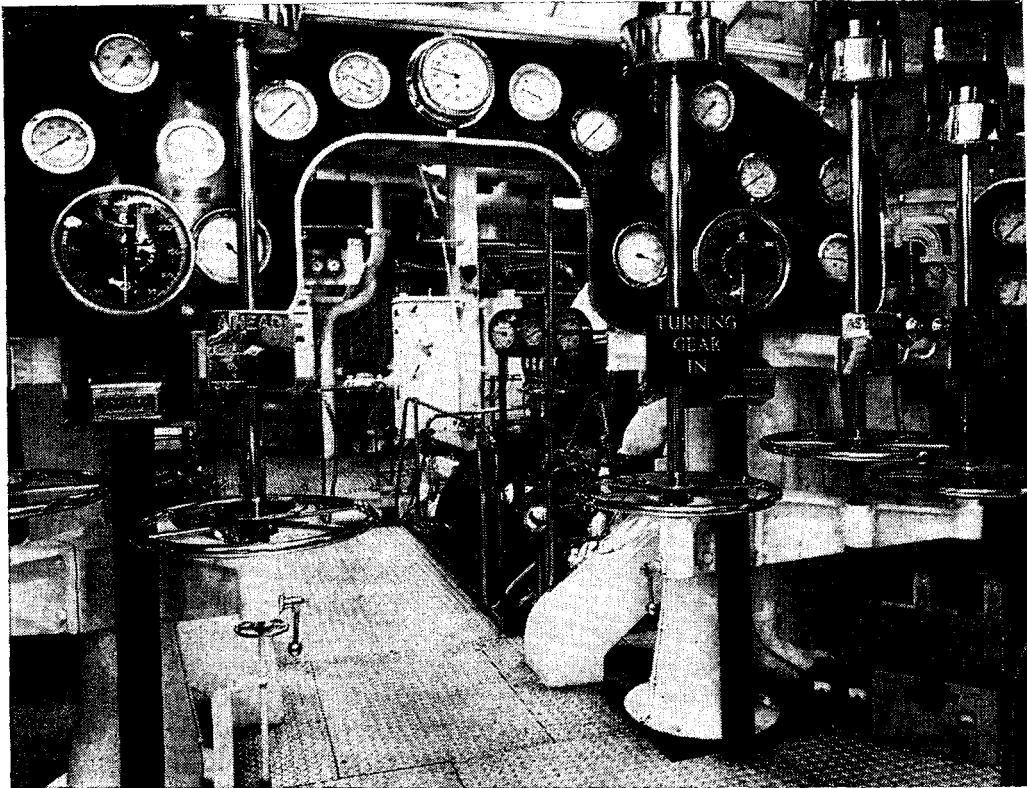


FIG. 1—THE ENGINE ROOM

### Main Engines, Shafting and Propellers

The performance of the main engines throughout has been good; there was for a long time a problem with high bearing temperatures, but this was resolved in 1969 by a combination of improved instrumentation, larger oil clearances and chamfering the butts.

The stern tubes, which were fitted with for'd and after bearings, also presented a problem in the early days with high temperatures being recorded. It must be noted that no A-brackets are fitted. The stern tubes were modified in 1956 by boring the for'd bearings oversize—the bushes were finally removed a year later—and fitting a water-cooled, packed inboard gland. A Cederval gland is fitted outboard and the whole stern tube is lubricated by a mixture of OM 750 and OC 160. There was, for some time, yet another problem with the leakage of lubricating oil inboard through the packed gland, but the logistics aspect of this was resolved by the fitting of a recovery system which has enabled the oil to be used again and again.

Vibration has always been a problem in the Yacht, particularly as the Royal Apartments are situated aft. Four-bladed propellers were originally fitted, and these were replaced, for trial, by five-bladed ones in 1961. The trial was not successful. Since then the speed range of 180 to 220 r.p.m., corresponding to  $14\frac{1}{2}$  to  $17\frac{1}{2}$  knots with a clean bottom, has always been avoided on Royal Duty. A trial conducted by Lloyds Register of Shipping was carried out last year and, after much deliberation of the results, it was decided that the fitting of new propellers was the only practical means of alleviating, as opposed to curing, the problem. However, the matter has been put into abeyance for the time being.

### Boilers

Poor combustion in both main boilers has been another problem which the Yacht has lived with from the start; it has also been the subject, from time to

time, of investigations by AMEE. A study on possible conversion to Dieso burning is currently in progress and the final outcome will depend as much on the total cost of such a project as on the ability to carry it out within a fourteen week refit.

A soot-collecting system, which was described in Commander Mott's article, is fitted in each boiler's uptake and generally functions very well, providing soot blowing is carried out regularly and external cleaning done thoroughly. Soot on the upper deck is never popular—in any ship.

Apart from tubes removed during wear and waste tests, both main boiler economizer elements were renewed in 1969 and the floor tubes during the last refit. Various auxiliary boiler economizer elements were renewed in 1967 and 1969.

### **Generators and Conversion Machinery**

Three 500 kW d.c. turbo-generators and one 270 kW d.c. Diesel generator give a reserve capacity of some 40 per cent. over maximum load conditions. The only foreseeable long term problem is that of certain spare gear, but this can be overcome by forward planning and by manufacturing items in the dockyard.

The requirements for a.c. have risen markedly in recent years and in particular as a result of the recent accommodation modernization. Two 82.5 kVA, 440 V, 3-phase, 60 Hz motor generators were fitted in the last refit to replace the original two 35 kVA, 230 V, single-phase, 50 Hz machines. The change in frequency necessitated modifications to various items of equipment.

There is only one shore supply connection box on the main switchboard and this is limited to 1000 amps. The average harbour load has risen in recent years and approval is being sought to increase the shore supply capacity and thereby avoid the possibility of running the diesel generator as a daily routine during working hours.

### **Distilling Plant**

Two single-shell distilling plants, ex H.M.S. *Queen Elizabeth*, are capable of producing a total output of about 150 tons per day, but here again there is a reserve capacity of at least 40 per cent. over maximum requirements. Demisters were fitted in the last refit, as were two new distiller condensers, and it is hoped that brine weirs may be added at a future date.

Feed water consumption at sea has remained fairly constant at 6 to 9 tons per day and the fresh water consumption, which has risen over the years, is averaging 70 tons per day on Royal Duty.

Blue water (see BR 3000, Article 2731) has caused embarrassment at times by staining baths and slightly colouring white clothing. The matter is under continual investigation onboard and the best remedy is to take on shore water whenever possible. Allowing scale to build up on the evaporator shell coils has been marginally successful, but a proposed solution, whereby the made water was pumped through marble chip containers, was not.

### **Air Conditioning**

Two vacuum refrigeration plants, each of one million Btu/hour capacity, were originally fitted and are still in use. They were designed to supply the Royal Apartments only, with one plant in use and the other stand-by. The chilled-water main supplied thirteen Thermostat Units, fitted with temperature and humidity controls, and these in turn provided trunked air to the various spaces.

In the 1964-5 refit, the chilled-water main from the stand-by plant was

extended for'd to supply a total of 88 chilled-water heat-exchangers fitted in messdecks, cabins, offices, etc. The heat-exchangers, in which were incorporated small d.c. fans, did not give a very satisfactory performance, they were noisy and provided a large maintenance load.

During the recent accommodation modernization, the system for'd was changed so that trunked cooled air is now supplied to all Yachtsmen's messes and dining halls from three large chilled-water heat-exchangers fitted in a fan space. Individual chilled-water heat-exchangers of various sizes, and fitted with a.c. fans, have replaced the old ones in officers' cabins, the wardroom and offices; there is still a noise problem with the larger of these units.

The vacuum refrigeration plants have, on the whole, given very satisfactory service. Unfortunately there is only one sea suction for the two plants, and in polluted harbours, polythene bags, seaweed, etc. can put both out of action. The original stand-by plant is capable of providing chilled water for'd and aft, but the other one can only supply the Royal Apartments.

### Laundry

The laundry, which is sometimes referred to as the Yacht's main armament, was work studied and as a result the whole layout was changed in 1961. There are some original equipments still fitted and these, together with some more modern ones, have always given excellent service.

### Boats and Davits

The Royal Barge was replaced in 1964 by a Camper-Nicholson 41-foot boat driven by two Foden FD6 MK VI engines. An air-cooling system for the cabin was fitted during the last refit; it consists of a Canpa air-conditioning unit supplied by a small Petter Diesel alternator.

The two motor boats, known onboard as Escorts, were replaced in 1970 by Vosper Thornycroft 34-foot boats powered by two Perkins P6 engines; the latter are also in use in the Fleet.

The davits for the Royal Barge and Escorts were renewed this year to increase their factor of safety.



FIG. 2—'BEFORE'—A BROADSIDE MESS



FIG. 3—'AFTER'—PART OF ONE OF THE NEW MESSES



FIG. 4—'AFTER'—JUNIOR YACHTSMEN'S DINING HALL

### **Accommodation and Complement**

Broadside messes and hammocks went out during the modernization and have been replaced by bunk accommodation and dining halls. FIGS. 2, 3, and 4 tell their own story. The project has been most successful and all credit for this must go to the Ship Department and Portsmouth Dockyard.

As a result of the modernization, the Junior Yachtsmen's complement has had to be reduced by some five per cent. and the pinch is being felt in all departments. In addition, the dining halls concept has meant an increase in communal duties.

### **Hull**

Cathodic protection, supplied by Morgan-Berkeley, was installed in 1967 and has been very successful.

A permanent elm fender, or rubbing strake, was fitted just below the waterline from 70 to 119 stations for the passage through the St. Lawrence Seaway in 1959 and has given sterling service, particularly in the Panama Canal.

### **Radio, Nav aids and Telephone**

The engineering department is also responsible for all WE matters. Apart from the standard communications equipment fitted in the Fleet, there is also an HF radio telephone link using a transmitter/receiver incorporated in Lincompex equipment which prevents speech fading and provides limited security.

The Nav aids now fitted include two type 975 radar, an FM 16 medium-frequency direction finder, a Decca QM 12, a Loran AN/UPM-12C and an echo sounder type 773EE.

The new Phillips telephone exchange and dictograph system was supplied by Telephone Rentals. The new exchange has four special facilities, mainly for use on certain numbers in the Royal Apartments; these facilities are: the ability to connect several extensions simultaneously for conference purposes, the ability to break in on an engaged number, the ability to visually identify certain numbers when dialling the exchange, and the ability to have direct access to a shore exchange in any part of the world. The new internal communications system has stopped the requirement for exchange watchkeepers at sea and has made four men available for other duties.

### **Hospital Ship Conversion**

*Britannia's* alternative role is that of a hospital ship. Before the start of the last refit, an exercise was carried out to convert the Royal Apartments into wards, etc. All furniture was removed and replaced by two-tier bunks, although no medical stores or personnel were embarked. The exercise, however, was completed well within the time allowed and proved that such a conversion is possible.

### **Redundant Machinery and Equipment**

Some of the machinery and equipment described in the original article has rarely, if ever, been used. This includes the Turbulo oily-bilge separator, the fresh-water distilling plant and the low water-level alarms fitted to each boiler.

The separator has been used on occasions as an additional storage for lubricating oil, but no date can be found when the fresh-water distilling plant was last in operation. The latter was designed for distilling shore water, if required for feed purposes, or redistilling contaminated water onboard; however, the large capacity of the main distilling plants has not made its use necessary.

The low water-level alarms fitted to each boiler were designed to automatically shut off the hot oil discharge to the burners and 'sound off' in the event of water-level becoming dangerously low. They have not been in use for many years.

### **Permanent Royal Yacht Service**

Two thirds of the Yachtsmen are in the Permanent Royal Yacht Service; the remainder, unless they successfully apply for a transfer and a vacancy exists, serve between two and two and a half years in the Ocean Complement before returning to General Service.

It may be of interest to know that, of those still serving onboard, one Yachtsman joined while the ship was building and six others joined on commissioning. Of the latter, one is a CMEM.

### **Conclusion**

It is hoped that this article has given a little insight into *Britannia's* current technical state. The reference to another paper written nearly twenty years ago was made without tongue in cheek, but it is asking for long memories of some and daring others to find a back copy. It has not been possible to include everything here; however, machinery, equipment and systems not mentioned, such as pumps, main refrigerators, stabilizers and steering gear have played their part well and performed very satisfactorily.

It must be remembered that although the Yacht participates when available in certain exercises, she exists in peace time entirely to meet the requirements of Her Majesty The Queen and the Royal Family and it is our duty to see that they are able to carry out their planned programme with the greatest degree of comfort and the least possible inconvenience.

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