'AFTER A YEAR AT SEA....'

BY

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After a year at sea we have:

Learnt a great deal;
Made mistakes;
Seen the world.

This article started as two letters in response to the Editor's invitation to discuss 'notes from sea'. Although not in the usual 'notes from sea' form, it contains notes, anecdotes and user experience of GMD machinery as well as some interesting incidents which come to mind after a year at sea in H.M.S. *Hampshire*.

The statistics are that we have been flashed up for 65 per cent of the year; have travelled about 265 degrees round the surface of the earth at speeds rarely lower than 15 knots, and sometimes as high as 26 (on passage); reached a height of 600 feet above sea level (this is claimed as a record for GMDs but we do not consider it feasible to develop the G.6 as an aircraft gas turbine for future Jumbo Jets); and crossed the Atlantic both ways with one of our main feed pumps on the upper deck. Half of the time we burnt FFO in the boilers and recently have been trying out dieso. Despite the fact that we left riots behind us in Hongkong and Detroit, here are a few 'notes from sea'—not to mention the Great Lakes where we distilled fresh water for three weeks.

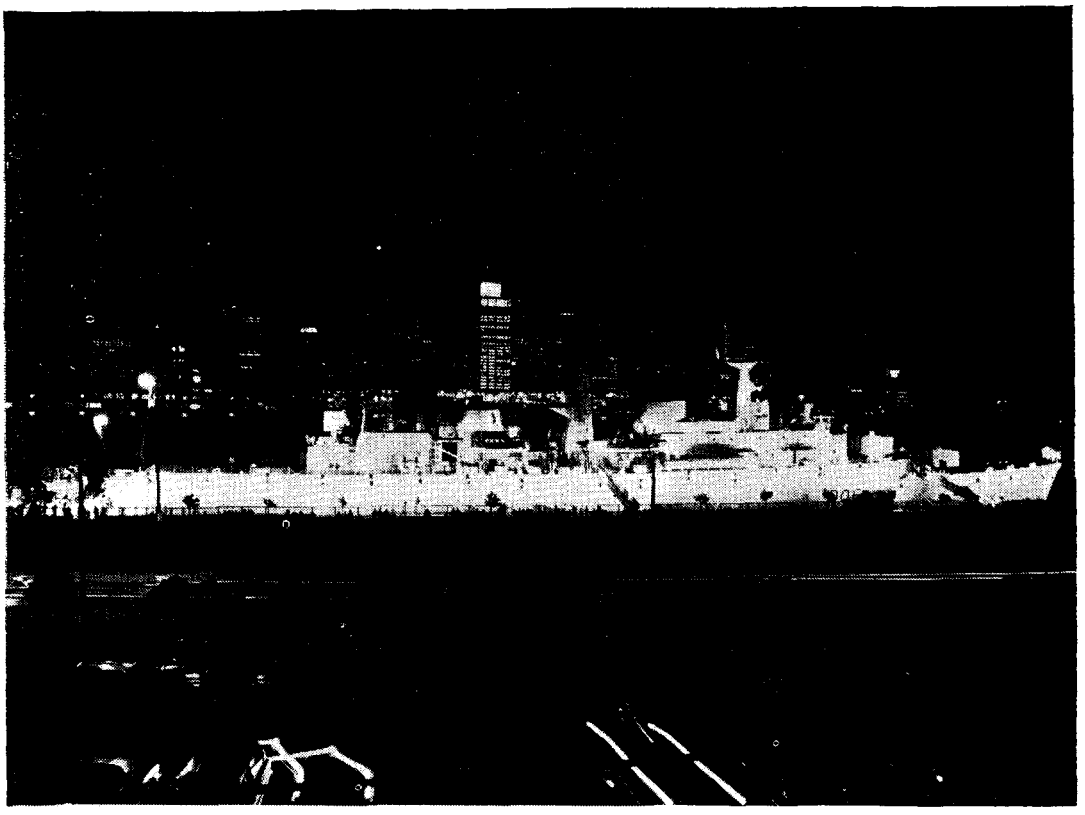

FIG. 1—H.M.S. 'HAMPSHIRE' FLOODLIT AT WINDSOR, ONTARIO, 1,500 MILES FROM THE SEA—DETROIT IN THE BACKGROUND (JUNE, 1967)

Main Boilers

During the time that FFO was being burnt, we found the best routine for soot blowing to be: economizers every six hours and the whole boiler every 24 hours. Improvements in the boiler condition were very satisfying and the Commander and Commander (WE) both commented on the marked reduction of soot on the upper deck and the 965 aerial respectively.

Controls and Instruments

Such was the faith in the installed automatic control systems that the designers did not consider it necessary to provide any means of testing and calibrating components under reasonable and clean conditions.

Through the kindness of the Weapons Department, the port electrical annexe (2K port) has been converted into a control instrument workshop, without prejudice to the existing electrics. These test facilities now enable us to 'set up' Bailey pressure transmitters, computing relays and the like, calibrate pressure and vacuum gauges, repair and refit Telektron motors and valve positioners and carry out other miscellaneous repair work essential to the successful operation of a machinery plant of this size away from base facilities for long periods of time.

A more sophisticated apparatus would be four pressure-electrical transducers to enable dynamic tuning of the auto systems to be carried out using the existing pen recorders in the ship. It is hoped to develop a pneumatic signal generator by adapting a Bailey computing relay into a flip-flop relay, but this is a long-term project.

The section is manned on a permanent basis by two artificers who have done the Calibrating Course at H.M.S. *Sultan*, assisted by a POM(E) or LM(E) and an SSM(E).

The effectiveness of this organization is shown by the very marked improvement in the performance of the control systems.

Departmental Comment

Investigations into the use of pen recorders for dynamic tuning are already being made. It is envisaged that this technique would be used for pre-refit trials and post-refit setting to work. They would also be used during the commission for fault finding and confirmation of system performance.

An A and A to provide a Controls Workshop is being prepared.

Servo Air Systems

One of the problems in the early stages of the Far East leg of the GSC was excessive moisture in the control systems. This moisture collected after a few days' steaming in the air motors driving the spill valves and in the G.6 throttle motors. A full-scale drive on refitting the Norgren primary air filters did not improve the situation. Eventually the trouble was traced to cracked aftercooler castings on the servo air compressor separator receiver vessel. As a temporary measure these were treated with Araldite and the system became comparatively water free; it is always left running, even when the main boilers are shut down. A proposal has been forwarded to raise the intakes of the servo air compressors out of the 100 per cent humid atmosphere of the steam turbine room and, to a lesser extent, in the gearing room, into the passage above.

The isolation of the systems, with respect to shut-down machinery spaces, is worth consideration. Hot, humid air pumped into a cool compartment will naturally condense and fill up air motors and valve positioners. The G.6 throttles are very prone to this and, incidentally, so was the shut-down boiler room in the two-unit *Tiger* Class ships. The fitting of small-bore drain cocks on the lowest point of each manifold supplying servo air to a group of 'boxes', and leaving them cracked open when the controlled machinery or boiler is shut down, would seem to be the answer to this problem.

Departmental Comment

A and A 461, issued in March, 1967, will extend the servo air compressor intake pipes outside the machinery spaces to alleviate the humidity problem. Action has already been taken to cure this trouble in the *Tiger* Class.

Evaporators

The scaling up of the evaporator shells and elements seems to occur rather more than would be hoped in this modern era. In order to try to reduce the long-term effect, the 'shocking' routine was kept at 12 hours while the descale was reduced from 72 to 50 hours. Not a great deal of benefit was gained.

While in Australia we were in great need of Condenflu. None was available so, going shopping, we came across some really good stuff called 'Alclean SR' made by ICI. This is a powder descaling acid which is made up into solution before use as required. It comes in 56-pound drums and would therefore appear suitable for stowage on board.

Departmental Comment

Hydrosulphamic acid, which is used by the U.S. Navy and is available here as a DCL powder, or Atlas H400 are approved alternatives to Condenflu. However, they are much more expensive and so Condenflu will continue to be supplied by D. of S. for descaling. Technically, Condenflu is, if anything, superior as a descaler but is not so easy to handle and is much more corrosive in contact with ferrous metals.

Fresh Water

Now that we have come home to roost it can be revealed that we took the prudent precaution of cleaning out *P* ballast tank and filling it with a 70-ton emergency reserve. Happily we never had to use it.

Fresh water consumption in the tropics was generally of the order of 60 to 70 tons per day. It varied according to:

(*a*) The productivity of the Chinese laundry crew—and their prices
(*b*) The cleanliness of the air-conditioning unit filters and the efficiency of the plant
(*c*) Whether the boiler box doors were left open (sucking in cold air)
(*d*) Whether the galley staff forgot to close the hatch on to the flight deck (letting in hot air)
(*e*) The number of make-and-mends.

The combination of the last four functions generally caused overheated (and under-occupied) bodies to try to cool off under the shower!

Evaporator Pumps

The recommendation to fit Crane's SS3 packing (p. 143 of Vol. 17, No. 1 of the *Journal*) is fully endorsed after a year's experience. Considerable difficulty was experienced in obtaining the packing originally but, eventually, enquiries by the technical department of SPDC, Singapore, revealed that both sizes were available on demand from SPDC (UK), though not in the preformed rings as stated in the original S.2022a.

Cooling Water Supply to Steam and Gas Turbo Alternators

The Departmental Comments on p. 144 of Vol. 17, No. 1, regarding the provision of alternative cooling for the 1,000 kW (and 500 kW) machines are not very reassuring. Embarrassing situations have been experienced during the last year's operations, the highlights in particular being:

(*i*) A 24-hour attack by jellyfish (the tough insoluble type) during a visit to Penang with FO2FEF embarked
(*ii*) An ingestion of large quantities of dead fish, six inches long, in the middle of the 'Flight of Three Locks' in the Welland Canal which, had the last generator stopped, would have brought the ship to a halt, with expensive consequences. The situation was saved by the fact that two firemain hose connections were fitted to the water side of the starboard STA condenser, which were sufficient to keep the machine going with a load of about 300 kW while the remaining machines were cleared. (The 750 kW air cooled GTA had shed a compressor blade at this time.)

Although firemain is fitted to the 500 kW machine circulating water system, there is no means of isolating the sea suction strainer for cleaning without shutting down. Duplex filters are fitted to both lubricating oil and fuel systems; why not duplicate the sea suction strainers?

One point of interest is that it is possible to put auxiliary circulating water on the main condensers and propel the ship in steam drive at slow speed (40 rpm) in tropical waters with the main inlets shut and main circulators stopped. Hongkong Harbour is so contaminated with polythene that gas turbine drive was always used to prevent blockage of the main condensers, but the generator problem still remained.

Departmental Comment

In the light of *Hampshire's* experience with firemain supply to the steam turbo alternator condensers, this will be re-investigated to see if a suitable

modification using firemain connections on the condenser inlet end cover can be proposed.

Since it is intended to replace these Allen GTAs at the long refit, no improvements in the existing salt water arrangements are contemplated.

Allen 500 kW Gas Turbo Alternator

These machines gave good and reliable service once they had been started, but starting is the secret. Here it is worth having by one a complete set of Monthly Reports on the test running of the depot spare at the Naval Marine Wing of the National Gas Turbine Establishment. Time and again we found that we were following, almost verbatim, pages out of these reports when trying to diagnose a fault or get the machines started; we even preceeded one report by a month! These reports were distributed without demand to all Allen fitted ships at the time the trials were in progress.

The air start valves frequently stuck and had to be prised up. This process invites dirt into the system when the top union is unscrewed to insert a bolt. This trouble also happened at Pyestock and, as far as is known, there is no real cure.

The inlet demister filters are of a type that entrap water easily, having no drainage, and an unexpected wave led to the burning and corrosion of one HP turbine. The only cure we found was to run the machine on the lee side when heavy seas were running or, better still, not to run them at all. In tropical rainstorms we asked the Officer of the Watch to ring the gas turbine control room and warn the watchkeeper of an oncoming downpour. By watching the exhaust temperatures and suitably cleaning the compressors when they rose, trouble was averted.

One successful experiment was the fitting of a 0–300 lb/sq in. pressure gauge with a shut-off cock in the fuel system to diagnose starting faults quickly and facilitate setting the starting fuel relief. Fitting an inlet and exhaust manometer also revealed interesting defects.

Unfortunately these machines were used as the stand-by generators for entering and leaving harbour, RAS activities, etc., consequently they were always being started and stopped, running only for an hour or two at a time, which could lead to burnt-out H.P. turbines. We now aim to run one or two of these machines continuously.

Departmental Comment

Although not specifically stated, it is considered that the scupper arrangement in the County Class adjacent to the intakes aggravates the ingress of water. Modifications to these arrangements are being considered. These will be incorporated if value can be obtained from the remaining lifetime of the installation.

The G.6

In order to achieve a reliable, trouble-free starting and operation of the G.6, it has been found essential to stick to a rigid discipline during the starting routine. No matter how familiar watchkeepers have become, when relying on memory they can forget some small but important point. The Chief ERA of the Watch takes charge following the completion of the check list and orders each item of the final starting routine from the check list—the operator repeating the instruction and then carrying it out. In this way, it has been possible to achieve a first-time start failure probability of one in about thirty for each engine, with diagnosis of faults in most cases of failure.

Very little maintenance has been needed on the G.6 with the exception that the fuel valve restrictor filters have to be cleaned frequently to preserve correct idling speeds and acceleration rates.

Starting failures due to ignition failure were virtually eliminated by changing the igniters after six starts. In addition, a watchkeeper is stationed to observe the build up of HP fuel pressure during starting. It has been found that ignition will not take place if this pressure is much below normal which may be due to a defective fuel pump or dirt on the fuel pump pressure relief valve; dirt can sometimes be disturbed by giving a sharp knock with a mallet.

An isolated and unusual fault occurred in the port outer engine. The engine was started and ignition occurred normally at approximately 700 rpm. The gas generator speed, however, steadied out at 2,700 rpm, well below its normal idling speed. It was noted that No. 3 combustion chamber T-max gauge was at zero while the remainder indicated 750 degrees C. Concluding that the burner had failed to ignite, the engine was stopped and a full examination of the burner carried out. It was found to be in good order with a clean filter. Having carried out a flushing routine a good restart was made with perfect ignition on all chambers and the defect did not occur again.

The G.6 has become 'man's best friend'. Its highest commendation, perhaps, was given by a high ranking Canadian naval officer who, having viewed 'both ends' of the ship, asked: 'Why did you bother to install steam when you have this?' There is, of course, an answer but it takes a long time.

Departmental Comment

This isolated fault would appear to be a case of failure of the flame to propagate to No. 3 chamber. The G.6 has never suffered from ths problem. Further instances should be reported by S.2022.

Port Main Gearbox

The ship sailed home on what was to have been a six-week sunshine passage at ten knots. Having settled down nicely to this routine, four days out of Singapore we received a 'come home quick and go to Canada' signal; the gas end promptly scrambled at 0230, the second boiler was flashed (a more lengthy process even with the Y.102a), and back we went to our normal cruising speed of about 20 knots.

After leaving Aden, where all incoming food, parcels and spare gear was frisked for plastic bombs, a loud knocking was heard coming from the port gearbox. On passage up the Red Sea, exhaustive research was carried out and we discovered that this noise could be eliminated by unclutching the HP steam manual clutch. The inspection cover of the main turning gear clutch was lifted after arrival at Port Suez and on unclutching the turning gear, the outer ring was seen to sag, thus confirming our suspicions that the pinion jack-shaft support bearing had failed. The subsequent metallurgist's report stated that the bearing 'had probably been overloaded in service, resulting in fatigue cracking and surface detachment of the whitemetal'. He concluded that 'the failure was attributed to operating conditions where the possibility of 'flexing' in the bearing housing was present'.

Departmental Comment

We do not think that the bearing housing is relevant to this problem.

There is a torsional vibration problem due to the large mass at the end of the jack-shaft. The reason for the large proportions at this end is that it was originally intended to fit an SSS clutch.

In the boxes from certain manufacturers the fit of the splines has not been good, consequently there has been serious fretting and a complex vibration pattern has emerged and this has resulted in fatigue of the bearings.

A redesign, using a 'Skefco' coupling instead of a spline, is under way at the A.E.I.

Conclusions

Despite the fact that we are the poor relation in this otherwise luxurious liner, it is fair to say that there has never been a dull moment. Our motto has been: 'If you can't take a joke, you shouldn't have joined'.

Personally, we must express our sincere thanks to many people widely dispersed; in particular to Miss Joan Hampshire at the SPDC (UK) for, more often than not, sending the right piece to the right corner of the globe (we know SPDC is human in this case!); to the many splendid and long suffering people in Singapore Dockyard, who kept us going; and lastly to our Lord and Masters for selecting us to burn dieso in our ship's boilers until Kingdom, or crisis, Come. Can we persuade the aviators to convert their Wessex to do likewise and provide fuel for another day's steaming?—we have had our eyes on their Avcat more than once!