

# COMBUSTION IN THE GUIDED MISSILE DESTROYERS

BY

LIEUTENANT-COMMANDER P. E. J. EVANS, R.N., C.ENG., M.I.MECH.E.  
A.M.B.I.M.

A one-day symposium was held at the Admiralty Marine Engineering Establishment, Haslar, on Wednesday, 21st October, 1970, to discuss the problems of combustion as experienced in the Guided Missile Destroyers. All GMDs were represented by their Marine Engineer Officers, and some Chief Petty Officers also attended, together with representatives of DGS, C-in-C WF Technical Staff and SMA. With some of the resident staff of AMEE, MCTT, MTU and CBIU, a total of 65 people were at the assembly.

To the majority of those present combustion was little or no problem a few years ago, simply a case of pumping FFO into the furnace and ensuring there

was sufficient air to prevent black smoke. Neither was there much of a problem if it failed to ignite at first when lighting up—another piece of burning oily rag would solve the problem, including burning off the puddle of FFO on the furnace floor! The explosive results achieved since the conversion to burning Dieso under our boilers however have highlighted a number of problems with the equipment presently in use. It was to explain the progress of investigations at AMEE, and to get up-to-date information on the experience of the ships MEOs, that led to the Symposium being held.

The discussions opened with a talk on the design particulars of boilers and the properties of the various fuels they may be required to burn. The effect of changing from one fuel to another is in fact minimal with the controls set up in the normal manner, as fuel flow and the combustion air requirement alter in such a way as to maintain reasonably efficient combustion. For maximum efficiency on FFO one should steam on the fringe of the 'black smoke line'. Unfortunately with Dieso black smoke is not the sensitive indicator of just too little air as with FFO. With Dieso burning black smoke indicates a serious shortage of air, a condition frequently accompanied by after-burning with all its inherent dangers.\* Without continuous reading exhaust gas analysis equipment it will remain necessary for ships to adjust their air bias to produce most economical steaming, as indicated by the minimum master signal which can be achieved for that particular steam offtake.

The subject of the next talk, 'lighting up and low power steaming problems in GMDs', was well understood by the assembly, though the 'proved reliability' of the Lucas torch igniter was a comment which found a number of disbelievers. The speaker was able too to inform the audience of the success of recent trials to overcome some of their problems, in particular the re-positioning of the torch igniter, giving improved ignition of the registers. Also a new pilot register has been designed which has a stable flame under all boiler steaming conditions. This is presently undergoing ship trials in H.M.S. *Norfolk* and about to be fitted in H.M.S. *Zulu*. Brief mention was also made of modifications being made to the registers of H.M.S. *Fearless*, similar equipment to that fitted in GMDs and Tribals, and which, on FFO, has always been subject to severe swirler fouling. The modifications give a stable flame at low powers, even with maximum RDL, and does not foul throughout the range of boiler output. These modifications could in due course be applied to all GMD, Tribal and Assault ships if proved entirely satisfactory.

The arrangements provided for sighting furnaces prior to flashing, and the methods and difficulties of operating the boiler front equipment were criticized. It was clear that the satisfactory completion of a number of projects at AMEE could solve several of the problems which the operators at present treat in their various ways. A clear furnace is no longer a certain indication of a safe furnace with Dieso burning due to possible absorption of the Dieso by the floor bricks, as glazing of the surface no longer occurs. To smell the furnace contents by the removal of a window might well be a safer method under the new circumstances, and AMEE will investigate the use of an explosimeter or 'standard nose' to this end.

Atomizers have always been treated as fuel flowmeters at sea for the purpose of establishing or checking, ship consumption curves. The audience was informed however that for this purpose the atomizer is of dubious value, except at full power. If the atomizers have been recently calibrated at AMEE\*\* and gauges checked, or trials gauges fitted, then at full power the fuel flow should be known within 1–2 per cent. Actual flow at other powers can vary differently

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\*DCI 1084/69 refers.

\*\*FTTI 19/71 refers.

for each atomizer, and on an atomizer within tolerance at maximum output has been measured at maximum turn down as much as 25 per cent greater than shown on the calibration curves as issued. (At maximum turn down the flow is seldom less than that shown on the curves, though a few brand new atomizers do have this feature, and at the mid-point the flow fluctuates between atomizers on either side of the curve). The introduction of a snap tank was suggested, but the complications of size and possible maloperation preclude this. The provision of fuel flowmeters is under active consideration but there are no manufacturers in the country prepared to quote to the accuracies required, because of the many uncontrolled variables, and the position cannot be said to be encouraging.

'There is nothing wrong with controls, except . . .', stated the next speaker. He then elaborated on the problems of clean air, correct calibration and maintenance, leaving no doubt in the minds of the majority that properly trained and knowledgeable operators and maintainers are essential for success. Mechanical problems in the systems should first be eliminated before looking for faults in, or adjusting, the controls themselves. Tuning in particular should never be attempted until all elements are free to move and have no lost motion. Sensitive gauges used for checking installed gauges should be treated with care and shut off except when a reading is being taken, as they will not retain their accuracy under the fluctuations experienced in normal operations.

Short comments by DGS and C-in-C WFTS representatives closed the talks, and the floor was then open to general discussion of subjects of interest to Marine Engineer Officers. The proceedings finally terminated at 1700, though a number of visitors remained to look over the facilities of the establishment.

A number of gaps remain in our knowledge of firing boilers with liquid fuels despite over 50 years' experience, and these gaps have been highlighted as a result of the change from FFO to Dieso burning. It is hoped that with closer contacts between AMEE and the Fleet, by holding more symposia and personal visits by ships officers, the problems remaining will become better understood, and thereby the gap closed more quickly in the future.