THE FLEET DIESEL SPECIALIST TEAM

BY

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Introduction

The Fleet Diesel Specialist Team has now been in existence for 5 years. Perhaps it is therefore appropriate to state why the Team was formed and how it has developed, and to give an indication of its role.

With the ever-increasing number of gas turbine ships and a reduction in the number of steam ships, the Fleet population of diesel engines and the resulting total number of diesel running hours have increased dramatically over the past decade. An inevitable increase in major defects became apparent, together with a perhaps most surprising apparent lack of expertise by diesel maintainers in major warships. As a direct result of these shortcomings the Fleet Diesel Specialist Team was formed in January 1981 using existing personnel from C-in-C Fleet's diesel equipment section.

The Team and its Work

The diesel team consists of a lieutenant-commander, a warrant officer MEA(M), 2 charge chief MEA(M)s, and 3 chief petty officer MEA(M)s. Their responsibilities are shown in FIG. 1.

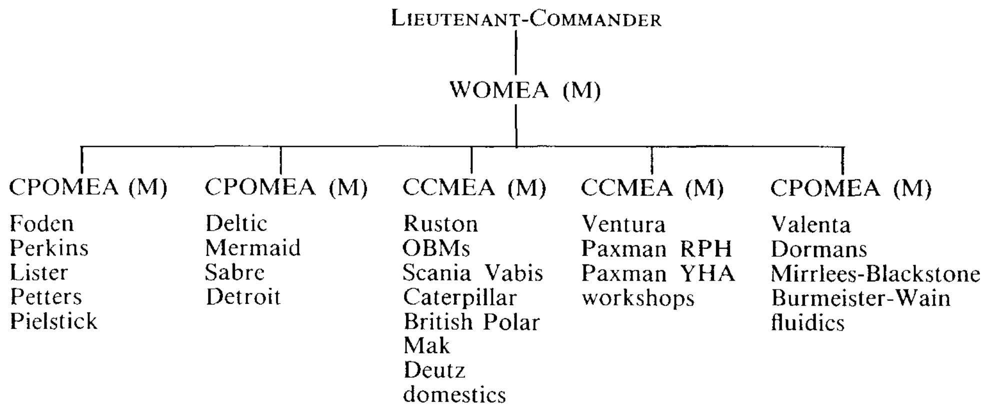

FIG. 1—THE FLEET DIESEL SPECIALIST TEAM

All members of the team have completed the diesel Adqual Course, and have also had practical diesel experience at sea. However, because of the wide range of diesel engines in use in the Fleet they may not necessarily be experienced on the specific equipment for which they are given responsibility. In order to overcome any such lack of experience, detailed specialist training is carried out as necessary at the engine manufacturers, and in certain cases arrangements are made for time to be spent at sea so that an understanding of particular engine operating procedures may be obtained.

The objectives of the team are:

(*a*) To act as monitors of operating, maintenance and setting-to-work procedures in use within the Fleet.

(*b*) To investigate ways of improving major maintenance procedures with a view to reducing overhaul time.

(*c*) To ensure that written operating and maintenance instructions issued to the Fleet are accurate, up-to-date, and sufficiently promulgated.

(*d*) To ensure training deficiencies are fed back to training establishments.

(*e*) To staff and comment on diesel engine main propulsion full power trial reports.

(*f*) To monitor, on a random basis, diesel generator monthly high load trials sheets.

The team covers over 600 diesel engines of about 25 different sorts. These engines achieve annual total running hours estimated to be some 750 000. A breakdown of the Fleet's present engine population is in TABLE I.

The area of greatest attention has been the Paxman Ventura and Valenta engines because this is where the engine population explosion has mainly occurred.

TABLE I—*Population of Diesel Engines in the Surface Fleet*

Engine	*Number*	*Service*	*Ship/Class*
VALENTA	24	Generator	CVS
VENTURA	166	Generator	T42, T22, T21, GMD, *Bristol*, LEANDER, ROTHESAY, *Abdiel*, survey
VENTURA	22	Propulsion	Survey Patrol Craft
PAXMAN 12YH	22	Generator	LEANDER (Batch 2) LPD
PAXMAN (other)	37	Generator	various
RUSTON	31	Propulsion	SOV, OPV, MCMV *Wakeful*
RUSTON	7	Generator	
DELTIC (18-7A, 9-59K 9-55B)	86	Propulsion and pulse generator	TON HUNT
PERKINS	48	Active rudder and generator	TON Fleet Tenders
FODEN	78	Active rudder and generator	TON HUNT
MIRRLEES BLACKSTONE	20	Propulsion	Survey
MIRRLEES BLACKSTONE	16	Generator	Survey
DORMAN	17	Generator	MCMV HK Patrol
PIELSTICK	10	Propulsion	HK Patrol
BURMEISTER & WAIN	1	Propulsion	*Endurance*
BURMEISTER & WAIN	5	Generator	*Endurance*
DEUTZ	3	Generator	FIPV
POLAR	4	Propulsion	FIPV
CATERPILLAR	6	Generator and propulsion	FIPV
FIAT	2	Generator	FIPV
MAK	2	Propulsion	FIPV

Activities

Ship Visits

(*a*) To discuss current problems with ships' and squadron staff and advise if necessary.

(*b*) To examine major failures, often in conjunction with the manufacturers' representatives, in order to obtain initial assessment as to the cause of failure.

(*c*) To assist ships' staff in setting-to-work and defect diagnosis. This is usually initiated either by ships' staff or the local CSO(E) staff.

Visits to Area CSO(E)s and CFMs

To discuss current problems with local staffs and to advise on actions being taken to overcome any shortcomings in material, design, operating procedures, logistic support, and maintenance standards.

Technical Liaison Meetings

These meetings are held for 14 different engine types and are attended also by representatives of MOD, the engine manufacturers, etc. They are regarded as being of crucial importance because all problem areas of design, procurement, and Fleet feedback are discussed. The resulting action grid acts as a regular bring-up system for forms S2022 requiring action by MOD. A précis of these action grids is issued to the Fleet on form S2022a.

Form S2022

Some 600 forms S2022 on diesel engines are received each year. With the introduction of the Technical Liaison (TL) Meetings, a revised procedure was created for dealing with diesel engine S2022s (see Fig. 2). This significantly speeds up the process of getting positive replies to ships. If a report requiring immediate investigation is received, it is actioned without waiting for the next scheduled TLM.

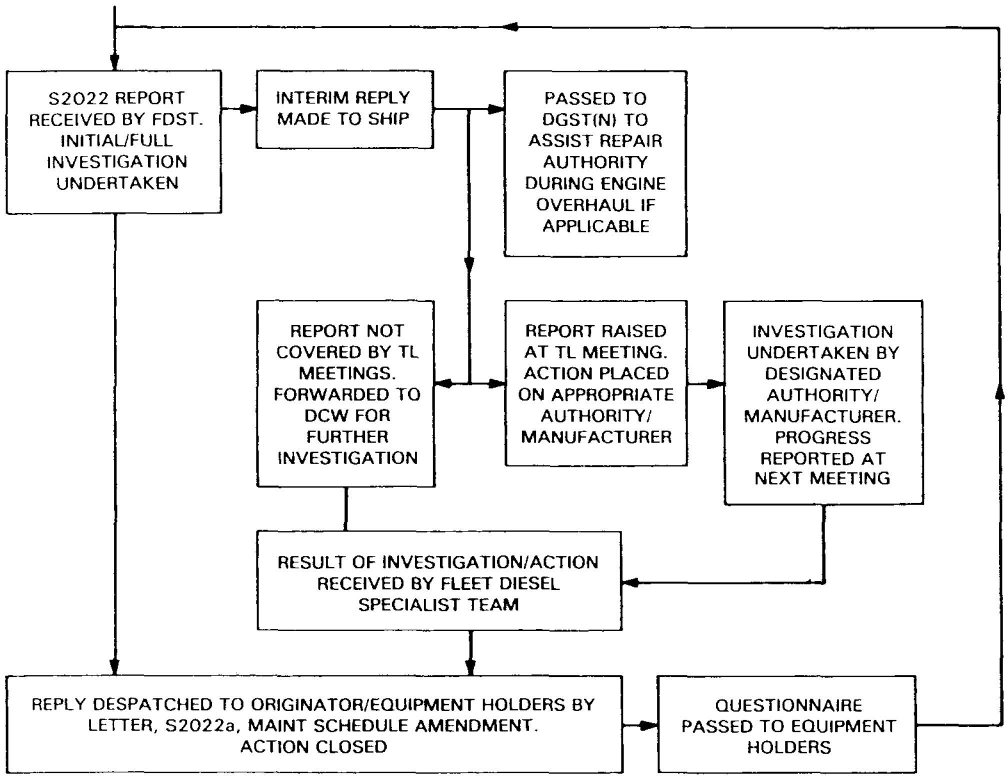

Fig. 2—Procedure for dealing with S2022s on diesels

Maintenance Schedules

The content of the existing maintenance procedures are generally satisfactory, but whenever reports are received which indicate a possible maintenance shortcoming they are investigated and any appropriate amendment action is taken. The Type 22 and CVS engine change procedures are being validated so that they can be included in the maintenance schedule. The change procedure is available for Type 42s and this can be adapted for use in a Type 22 should it be needed before the evaluation is complete.

Every opportunity is taken to extend the existing planned maintenance periodicities and to this end there are currently 10 Ventura generator engines which have been extended from 6000 to 7500 hours before top overhaul, and 12 000 to 15 000 hours before major overhaul. It will however take some time before the outcome of this Minor Trial is known (gas turbine ships average 2000 hours per engine per year). There is also a variety of engine types continually being given life extensions either for operational reasons or due to specific engine shortages.

Training Feedback

Regular meetings take place with the diesel section at H.M.S. *Sultan,* to discuss specific training shortcomings experienced in the Fleet. A representative from the Fleet Diesel Specialist Team gives a presentation to every diesel Adqual course; all diesel and maintenance shortcomings are discussed together with the actions being taken to improve the overall engine reliability.

Full Power Trial Reports

Full Power Trial reports (S346b) for all diesel engine propelled surface vessels (other than those administered by CMCM/CFP) are examined in detail and appropriate comments are recorded on the report, which is then returned to the ship for any action necessary.

Reports of Machinery Breakdown

FEO 0318 reports covering major failures for all diesel engines in surface ships are examined in order to identify any procedural, design or material deficiencies. Any relevant information or follow-up action is then promulgated to the various ships and authorities concerned.

Information Service

The team is continually called upon to provide information, by telephone requests from ships' staff, Area CSO(E)s, CMCM/CFP, CFM, MOD, and occasionally from engine manufacturers. This is strongly encouraged.

Minor Trials

The following Minor Trials have been approved and are being carried out:

Valenta:	Oil mist coalescer for crankcase breather
Ventura:	Extension of running hours
Ruston 12 RKC:	Modified SA-105 turbo blower
Ventura:	Exhaust temperature limits (Type 21, Type 22, Type 42 only)
Deltic 9.59K:	Engine air start valve
Deltic 9.59K:	Exhaust water carry over
Deltic 9.59K:	Exhaust system modifications
Foden FD12:	Salt water cooling system modifications

Diesel Engine Problems

Ventura Engines

(*a*) *Exhaust temperature scatter.* As a result of the difficulties being experienced maintaining satisfactory exhaust temperature scatter in certain engine applications, agreement has been reached to introduce an improved exhaust temperature monitoring system for a trial period in Type 21, Type 22 and Type 42 ships. It is anticipated this will reduce dramatically the effort and frustration of ships' staff whilst at the same time safeguarding the engines.

(*b*) *Fuel injection pump reliability.* Many instances have been reported of new and overhauled injection fuel pumps being outside the calibration specification when received from stores. As a result Paxman are currently checking all the calibration and test equipment held by the repair authorities against a master injection fuel pump.

(*c*) *Torsional vibration dampers.* A number of instances have been reported of the torsional vibration damper (TVD) being outside specification when checked by the Fleet Vibration Analysis Team before top overhauls or at the pre-refit vibration analysis inspection. These defects are attributed to a gradual deterioration of the lead bronze bearing material and the ageing of the silicon damper fluid. The effects of the TVD deterioration during its life have only recently been highlighted with the introduction of an improved damper test procedure using the Scientific Atlanter Analyser and proximity pick-up probe. It is therefore important that all TVDs are tested in accordance with the maintenance schedule before top overhauls.

All replacement dampers are being fitted with PTFE bearings, which should reduce the number of failures.

(*d*) *Oil leaks.* As a result of an excellent Fleet response to a form S2022(a) concerning engine leaks the following improvements are being made:

(*i*) All drive end Seloc washers are being replaced by Dowty seals at major overhaul, or whenever repairs are required in service.

(*ii*) The main bearing lateral bolts are being redesigned to incorporate a sealing cap. A recent trial using a proprietary Loctite has not been successful.

(*iii*) Modification action is being taken to introduce a fire-retardant flexible pipe in the lubricating oil supply to the injection fuel pumps to overcome fretting of the seals by engine vibration.

(*e*) *Water leaks.* The introduction of MOD 259 to fit a silicone sealing ring between the cylinder liner top flange and the crankcase, together with the discontinued use of Hylomar jointing compound on the cylinder head transfer ferrules, have significantly reduced the numbers of liner/head water leaks. In order further to reduce the possibility of liner leaks it is important that whenever cylinder heads are removed liner clamps are fitted to avoid the risk of the liner being disturbed.

(*f*) *Secondary balance weights.* These balance weights are fitted to the 8-cylinder Ventura, in which several failures of the free end balance weight have occurred during the life span of ROTHESAY and LEANDER Class ships. These failures were caused by a design shortcoming. An improved secondary balance assembly is now available for fitting to all engines which will continue in service into the 1990s. An installation programme will be issued in conjunction with MOD.

Valenta Engines

(*a*) *Inlet manifold and head fouling.* This has been attributed primarily to oil and carbon carry-over in the exhaust gas blowing back into the inlet manifold due to a combination of low load operation and oil passing the top oil control ring at the point of valve overlap. Trials are being carried out at Paxman Diesels with a reduced overlap camshaft and matching blower configuration. If these are successful, the first engine incorporating this modification will be installed in H.M.S. *Illustrious* shortly. It is expected that this will reduce the inlet manifold and head fouling significantly and, subject to a satisfactory trial period, this modification will be incorporated in all engines in the Fleet at major overhaul.

(*b*) *Piston failures.* There have been a few piston failures attributed to inadequate oil cushion rings. As a result improved oil cushion rings are being fitted at line overhaul (Mod E10). To prevent further in-service failures all unmodified engines are to have this modification incorporated at their next top overhaul.

(*c*) *Crankcase breather.* The emissions from the crankcase breather system have proven to be unacceptable, being a health risk and fire hazard. Trials of a Vokes coalescer filter to clean up the crankcase breather system have been completed at RAE Pyestock and the first in-service unit is to be fitted early this year.

Perkins T6.354 60 kW Generator Sets

Exhaust system failures. The fitting of Perkins T6.354 60 kW generator sets installed in certain MCM/CFP ships as a direct replacement for Foden units has resulted in failure of the existing installed aluminium exhaust system because of the higher exhaust gas temperature of the Perkins 4-stroke engine. A & A action has been taken to replace the aluminium exhaust systems with mild steel.

Foden FD12 Generator Sets

(*a*) *Lubricating oil coolers.* As a result of an unacceptable number of oil cooler tube failures Rolls-Royce Motors are urgently investigating an improved cooler design.

(*b*) *Crankshaft failures.* An improved Sersulf treated crankshaft is now being incorporated in all overhauled and new build engines. This, together with the requirement to prime the engines hourly when standby and immediately before starting, should reduce the number of failures.

(*c*) *Automatic air-operated pre-lub pump.* Approval has been given for the introduction of an engine air-operated pre-lub pump.

Miscellaneous

(*a*) *Demanding replacement engines.* Signal demands are required in accordance with BR 2000(27) for the supply of all diesel engines, and every effort should be made to give as much notice as possible (preferably 6 months), particularly for planned changes. This is to assist with the medium-term planning requirements; the long-term requirements are derived from ships 6 monthly engine usage reports. To establish requirements for major warship generator engines the usage is calculated for COGOG ships at 2000 hours per engine per year and for steam ships at 1000 hours per engine per year. It can be seen therefore that it is essential for ships to specify their actual engine requirements early, particularly if MEOs have 'preferred' engines to enable major work to be carried out at planned dockyard periods and are therefore increasing engine hours to suit these requirements.

(*b*) *Returning engines.* Unbelievable problems continue to be experienced getting many engines back into the repair cycle within a reasonable time. Engines are often left on the dockside for a number of weeks unpreserved and uncovered, completely open to the elements. This leads to unauthorized removal of components and serious deterioration of the engine, so increasing the overhaul cost of the engine considerably. MEOs are reminded of the requirement to complete the Certificate of Conformity in accordance with BR 2000(27) and to ensure the engine is correctly preserved, fully blanked, and returned to PSTO(N) as soon as possible after it has been removed from the ship. Failure to do this aggravates the supply situation of engines in short supply and dramatically increases the final cost of repair and (where long lead items have been removed) the repair time.

Engine Failures Caused by Poor Watchkeeping or Maintenance

The following major failures occurring during the past two and a half years can be wholly or partially attributed to inadequate standards of maintenance or watchkeeping by uniformed personnel:

(*a*) Piston seizure due to incorrect fuel pump spill timing (two). Both engines replaced.

(*b*) Connecting rod failure due to earlier damage to con. rods whilst rectifying cylinder liner leaks (two). Both engines replaced.

(*c*) Fuel pump flexible drive failures due to incorrect assembly and alignment of fuel pumps (nine).

(*d*) Piston failure due to break-up of valve seat. Low exhaust temperature had not been identified as a potential problem (one).

(*e*) Piston crown detonation damage due to defective injector and incorrect fuel pump timing (three).

(*f*) Piston ring failure due to inadequate oil band because of the incorrect assembly of oil control rings (one).

Conclusions

The overall material state and reliability of diesel engines in the Fleet is good. Remarkably few failures occur when the total number of diesel engines at sea, often operating under extreme conditions, is considered. Nevertheless, certain areas are causing unacceptably high maintenance effort. It is believed that these have now all been recognized and positive action is being taken to alleviate them.

Every effort is continually made to impress upon MEOs, squadron staff, and senior ratings the need to ensure that good watchkeeping and maintenance standards are maintained.

The Fleet Diesel Specialist Team is now fully established. It has an important part to contribute to the satisfactory operation of diesel engines and the maintenance of engineering standards within the Fleet.
