UNIVERSITY COLLEGE LONDON ME POST-GRADUATE PROJECTS

Summaries of the projects in marine engineering on the 1989–90 MSc courses at University College London are given below. The full reports are held at the University and further information may be obtained from the Professor of Naval Architecture, Naval Architecture and Marine Engineering Office, Department of Mechanical Engineering, University College London, Torrington Place, London WC1E 7JE.

Investigation into the Use of Inlet Pre-whirl in a Turbocharger Radial Compressor
by D. R. Patrick, BEng, MSc, AMIMechE, RCNC

The overall performance of highly-rated turbocharged diesel engines can be compromised by the performance of the turbocharger. At low speed, the onset of compressor surge may be limiting, whilst at higher speeds, and powers, rotor speed and the resultant dynamic loading may be a constraint.

This report describes practical and theoretical work, carried out at MTU's research facility in Friedrichshaven, Germany, to investigate the broadening of a turbocharger's operating range through the use of pre-whirl in the compressor inlet flow.

The work was based upon an MTU ZR140 turbocharger. This component is similar to the ZR170 turbocharger fitted in a sequential turbocharging arrangement to the 16V396TB/84 engine—an engine which, whilst having a broad operating range, is affected by the turbocharger limitations described above.

It was demonstrated experimentally that pre-whirl could be used to increase the turbocharger's operating range—with positive pre-whirl producing a 'desirable' left and downward shift of the operating point on the compressor map—and that a given pressure ratio could be achieved with a lower volume flow rate, albeit at higher turbocharger speed.

In the course of the investigation a theoretical method was also developed for pressure loss prediction on the inlet side of the experimental test rig.

A Study into Firefighting Improvements for Small GRP Ships
by J. W. Johnson, BEng, MSc, RCNC

The vulnerability and susceptibility of warships to damage through fire is a function of many variables, including the size and method of construction of the ship. Several nations have adopted GRP construction for small warships, especially those used for mine-hunting, and ships of this size and method of construction require particular attention to their firefighting arrangements. This is now a matter of concern to Spain's national shipbuilder, Bazan, as it starts, shortly, construction of a new all-GRP minehunter for the Spanish Navy.

This study was undertaken at the technical design offices of Bazan, in Spain. It summarizes, initially, fire risks, methods of fire-detection and fire-fighting techniques, including human and organizational aspects. It then examines the shock and fire performance of GRP and recent fire incidents in ships. There then follows a review of future design improvements relevant to firefighting.

The report concludes with a 'ship study' which addresses, for a small GRP ship, vulnerability to enemy attack, firemain routeing, and the distribution

of fire-detection and firefighting equipment, with proposals for the nature of the damage control organization and communication arrangements.

Investigation into Mitigation of the Ignition Delay Effects of Diesel Fuel/ Water Emulsions
by S. C. Crabtree, BEng, MSc, RCNC

It has been established that the addition of water to diesel fuel (gas oil) can improve diesel engine fuel consumption and reduce the level of pollutants in the engine's exhaust gases. These benefits are, however, normally accompanied by an undesirable increase in ignition delay. This study investigated theoretically and experimentally the use of oxidizers and other additives (viz. ammonium perchlorate, ammonium nitrate and ammonium fluoride) in diesel fuel/water emulsions, to mitigate ignition delay effects.

The report presents, initially, a review of diesel engine combustion. Descriptions are then given of the nature and predicted effects of diesel fuel/water emulsions and the additives to be tested. Finally, the report describes experimental work, which was performed at the Royal Military College of Canada, to test the smoke point and ignition characteristics of a variety of diesel fuel/water emulsions and additives. The ignition tests were made using a single-stroke rapid compression machine to achieve controlled conditions for the measurement of ignition delay.

It was concluded from the experimental work that the addition of either oxidizers or fluorides to the water phase of diesel fuel/water emulsions reduced ignition delay, although the mechanism by which fluorides produced this result was not determined. There was evidence that the addition of oxidizers increased the tendency to soot but verification of this effect through engine testing is required.
