

## **RESCUE SUBMERSIBLE DESIGN**

As a result of a long-standing relationship with one of the UK's leading suppliers of rescue submersibles, FCL have developed significant experience in the mechanical design of such vehicles. The most significant single project carried out involved the parallel development of two similar rescue submersibles for the Republic of Korea Navy and the Republic of Singapore Navy. These vehicles each featured a two compartment hull, separated by a full depth rated bulkhead, and comprised a command module to accommodate the pilot and co-pilot, and a rescue chamber which could accommodate up to sixteen evacuees and the rescue chamber operator. The rescue chamber incorporated an integral dry mating skirt to enable the transfer of submariners and rescues from distressed submarines. Although the two vessels shared many common features, different operational requirements dictated the provision of an additional rear hatch in the second vessel, necessitating the production of two complete sets of design documentation.



A further challenge presented by the work was the aggressive project schedule agreed with the two customers, which dictated that a 'concurrent engineering' approach be adopted, in which fabrication took place in parallel with the design process. With this in mind, FCL undertook the design work in three distinct phases: a first in which the principal scantling dimensions were set down permitting initial material ordering to take place, a second in which more detailed analysis was carried out of key design features to provide additional confidence in their adequacy prior to commencing manufacture, and a final phase involving formal substantiation of the complete design.

The number of distinct components making up the complete submersible (command module, dry mating skirt, rescue chamber, conning tower, battery pods, hatches, viewports and other penetrations) combined with the large number of potential load cases (including several loading scenarios incorporating combinations of internal and external pressure, launch and recovery loading, towing loading and various potential collision scenarios) made it impractical to consider all loading conditions during the initial phases of the work, and FCL therefore needed to rapidly identify the most significant scenarios for each area of the design to ensure that the required level of confidence could be provided in a timely fashion. Evidence of our success in this exercise was provided by the fact that no significant shortcomings were subsequently identified during the final detailed assessment of the design.

FCL's formal design substantiation reports were prepared in accordance with PD5500 and Lloyd's Register Rules and Regulations for the Construction and Classification of Submersibles and Underwater Systems, and were subsequently approved by Lloyd's Register with minimal comments.