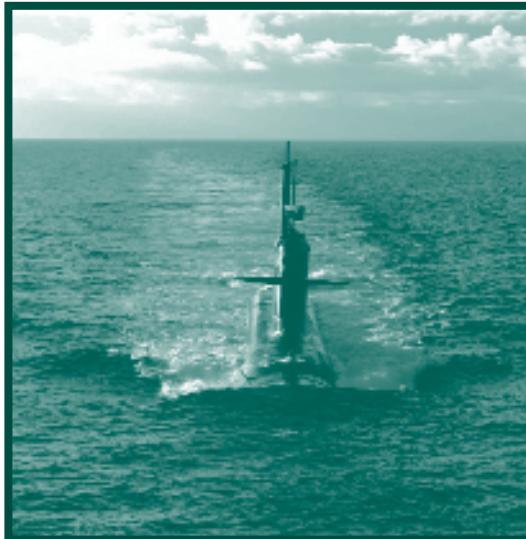
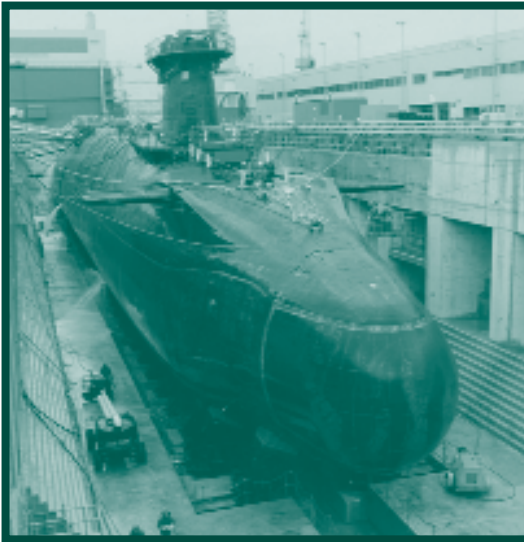


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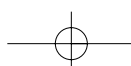
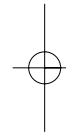
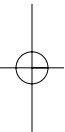


International Conference

## WARSHIP 2005-NAVAL SUBMARINES 8

22-23 JUNE 2005

JURYS GREAT RUSSELL STREET, LONDON, UK



## day 1

09.30 - 10.00 Registration &amp; Coffee

## Session 1 - New Technology in Submarine Design

10.00 - 10.35 **Marine Systems Development - A New Opportunity***Mark Tooth, MoD Abbey Wood, UK**Lt Cdr Matt Bolton and Lt Cdr Graham Ford Royal Navy, UK*

The design of nuclear submarine secondary systems has changed little since HMS DREADNOUGHT was commissioned in 1963. This paper will describe the approach to establishing a new development programme, its management, drivers and current content. It is broadly anticipated that the development programme will have a marked impact on submarine procurement and the paper will conclude with a view on the way in which marine engineering development may influence submarine design during the current build programme and beyond.

10.35 - 11.10 **Evolution from Periscopes to Optronic Mast Systems***Alan Stevenson, Thales Optronics Ltd, UK*

For over a century the submariner's view of the above water scene has been dominated by the periscope through an intimate, hands-on Man Machine Interface. The advent of non-penetrating technology in the shape of the optronic mast has required a considerable re-evaluation of the operational model. This paper will discuss and explore the technological, operational, manpower and support impact of moving from a traditional periscope to an optronic mast system with particular reference to the non-penetrating optronic masts for the Royal Navy's ASTUTE class submarine Visual System. The steps taken and lessons learned in this process will be presented.

11.10 - 11.45 **ZEBRA Battery - The Solution to Submarine Energy Storage***Dave Williamson, Rolls-Royce plc, UK**Lt Cdr Neil Benstead, Ministry of Defence, Marine Electrical Systems IPT, UK*

The ZEBRA battery represents one of the most advanced and safe alternatives to lead acid and can meet the power demands of a submarine. The paper will explore and discuss the benefits of ZEBRA over lead acid, which have prompted investment from the UK MoD. Higher energy density and the prospect of significantly reduced through life costs have resulted in a programme of development work funded by the UK's Submarine Marine Engineering Development Programme. This paper presents the work being done to make ZEBRA available for Naval applications and concludes with a view of energy storage for future submarines.

11.45 - 12.15 Coffee

## Session 2 - Submarine Safety, Escape &amp; Rescue

12.15 - 12.50 **United States Navy Submarine Safety (SUBSAFE) Program***CDR Stephen E. Iwanowicz, Mr. Matthew S. McBride, US Navy, USA*

The SUBSAFE Program was established to provide maximum reasonable assurance of submarine watertight integrity and ability to recover from a flooding casualty. Now over 41 years old, the SUBSAFE Program is a highly successful program of work discipline, material control, and associated formal documentation. The program has established submarine design requirements, SUBSAFE certification requirements for unrestricted operations at sea, and certification maintenance requirements along with supporting work control, program management, and audit processes. This paper presents the evolution, structure, and implementation of the SUBSAFE Program.

12.50 - 13.25 **Advancements in U.S. Submarine Escape***John T. Leadmon, Russell C. Hrabe, Brandon B. Shea, Michael D. Holmes and Joseph T. Arcano, Jr., Naval Sea Systems Command, USA*

This paper addresses advancements in submarine escape systems that allow for safe crew egress from periscope depth through 600 feet. The US Navy submarine escape system gives consideration to every aspect of survival from human physiology, through automation, escape and survivability procedures, to adverse casualty situations and distressed submarine positions of rest. This paper examines the advances in U.S. Naval Submarine escape, rescue and survivability being implemented today.

13.25 - 14.25 Lunch

14.25 - 15.00 **Assessing the Safety of Disabled Nuclear Propulsion Plants: Submarines HMS Tireless and RF Northern Fleet Kursk***John H Large, Large & Associates, UK*

In August of 2000, the Russian Federation Northern Fleet nuclear powered and nuclear weapons capable submarine Kursk, whilst at periscope depth in the Barents Sea, experienced a catastrophic explosion in her forward torpedo compartment, sinking with a total loss of the 119 crew members on board. Prior to commencing with and throughout the world-first salvage operations to recover the Kursk, the condition and potential failure modes of the nuclear propulsion plants had to be assessed by reliable and novel means, as did the hazards presented by the boat, its on board weaponry, and the rough-and-tumble of forces imposed by the salvage and lift operations. The paper discusses the approach to nuclear safety assessment, how the Kursk was raised and considers the potential effect on personnel safety and the environment should the assessments been at fault.

15.00 - 15.35 **NATO Submarine Rescue System - An Integrated Approach***Neville Yard, Rolls-Royce plc, UK*

Rolls-Royce are the Prime Contractor for the NSRS contract. The project is a collaborative venture between the governments of France, Norway and the United Kingdom to provide a fully integrated emergency response capability able to respond to a submarine sinking anywhere in the world within demanding target times. The presentation will describe Rolls-Royce's underlying philosophy behind the system architecture, the operating and management methodology that have been adopted and an overview of the component parts of the system.

15.35 - 16.05 Coffee

## Session 3 - Modelling as a Design Tool

16.05 - 16.40 **Electron Beam Welding***Phillip R Thompson, Weidlinger Associates Ltd, UK*

The use of electron beam (EB) welded fabrication for submarine hull valves is an exciting development offering the possibility of low defect, high integrity hull valve design at reduced cost compared with traditional cast valves. The cost of underwater shock testing every new variant of these valves could negate the through life cost. This paper describes how advanced finite element techniques, suitably validated, could accurately predict the failure modes under shock. Recent research topics which aim to develop a numerically robust valve modelling methodology are discussed and some of the key modelling issues such as validation, internal/external fluid modelling and stud fastener integrity are presented.

16.40 - 17.15 **Collapse Pressure of Watertight Bulkheads***Jack Reijmers, IV-Nevesbu, the Netherlands*

The design philosophy governing the use of watertight bulkheads in submarines differs greatly for that used in surface ships. With one compartment flooded the modern submarine is considered to be lost. To enable the crew to be rescued the bulkheads need to be strong enough to resist the design pressure only once. With conventional tools based on bending theory the bulkhead plating will be oversized. So to optimise the structural weight advanced tools are needed to reach beyond the elastic limit. This paper describes the analysis methods used to predict the behaviour of the bulkheads in this non-linear region.

17.15 - **General Discussion & Evening Reception**

# Naval Submarines 8

June 2005

## day 2

09.00 - 09.30 Registration & Coffee

### Session 4 - Operations

09.30 - 10.05 Development of an Onboard Submarine Stability Tool

*Darren Haynes, Sea Technology Group, UK.  
Ian Carter, GRC Ltd, UK*

Recent submarine incidents have shown the potential application of an onboard Submarine Stability tool for emergency response. Recently the Royal Navy began to use Seagoing Paramarine as an onboard Stability tool on all major Warships and Frigates. This paper describes the development of a Submarine version of the Seagoing Paramarine to address the different operator requirements between submarines and surface ships. In particular it presents the operator requirements, the work done to date and application of the tool by the Sea Technology Group, with technical and software aspects being provided by GRC Ltd.

10.05 - 10.40 Astute Class Submarine Movement Control - An Integrated Approach

*Simon Purvis and Neil Philip, BAE Systems Submarines, UK*

The Astute Class submarine incorporates a number of features within the manoeuvring and control systems, which are designed to improve manoeuvring performance, reliability and safety compared to previous classes of RN attack submarine. A modified approach to manoeuvring limitations was required by the adoption of split aft hydroplanes and the need to constrain autopilot demands to maintain the submarine within the Safe Manoeuvring Envelope. The paper presents the integrated approach to the 'movement function' adopted for Astute, and how this has influenced the design for performance, safety and support.

10.40 - 11.15 Industrial Challenges within Royal Navy Submarine in Service Support

*Mike Whalley, DML Devonport, UK*

Supporting a modern fleet of nuclear attack (SSN) and ballistic (SSBN) submarines poses many challenges to industry. This presentation aims to explore the key challenges and explain how both Industry and Ministry working in partnership are meeting them; the role and responsibility of Industry as Design Agent and the interface with the MoD Design Authority and also the influence of technical authority decisions on the remainder of the in service support activities. The paper concludes with a look at what the future could hold for industrial support to nuclear submarines and how might this change as new classes of submarine enter service.

11.15 - 11.45 Coffee

### Session 5 - Design & Construction

11.45 - 12.20 MARPOL Compliant Management of Solid Waste on Astute Class Submarines

*Kevin Young, BAE SYSTEMS Submarines, UK*

MARPOL and Contractual requirements for the disposal of solid waste streams on Astute Class Submarines mean that the vessel will not always be able to carry out overboard discharges, as is current practice on RN submarines. The only alternative to discharge is storage. In order to optimise the overall spatial design of the vessel the decision was made to provide facilities for storage only, not overboard discharge. The biggest hurdle has not been the equipment design or arrangement but the selling of this idea to the ultimate customer who will have to spend long periods of time living with the waste and the consequences.

12.20 - 12.55 Classification and Construction of Submarines in Accordance with Classification Societies' Standards

*Harald Pauli, Lorenz Petersen ; Germanischer Lloyd AG, Germany*

Germanischer Lloyd (GL) published "Rules for the Construction and Classification of Submersibles" many years ago. Recently GL issued the "Guidelines for the Use of Fuel Cells on Ships and Boats". Due to the fact that no other classification society has such an amount of experience with conventional submarines, GL has a unique position among classification societies. Classification of a submarine can give considerable benefit both to the Navy and to the shipyard. This paper discusses the benefits available to both parties.

12.55 - 13.30 ASTUTE Propulsor Technical Innovation Summary

*Peter Vinton, Rolls-Royce plc, UK  
Dr Martin West, Frazer-Nash Consultancy, UK*

The pump jet propulsor for the ASTUTE class of nuclear submarines has been designed and manufactured by an industrial team led by Rolls-Royce to meet a demanding set of requirements in terms of service performance, design justification and manufacturing programme. This paper illustrates the advantages gained by forming a team and describes a number of technical innovations. The paper also features a discussion of the issues and scope of the various modelling and analyses undertaken by Frazer-Nash Consultancy and describes how it has even been possible for some aspects of the design to be fully accepted by the modelling alone.

13.30 - 14.30 Lunch

### Session 6 - Trials and Experimental Analysis

14.30 - 15.05 Submarine Towing Trials

*J. Anderson and S. Watts, QinetiQ Haslar, UK  
E. Ofosu-Apeasah and N. Hills, UK MoD S&MO IPT, UK*

Recovery of a disabled submarine on the surface covers a wide range of actions, one of which may be an emergency tow. Issues that must be addressed are the capabilities of the towing vessel and the behaviour of the towed submarine in a variety of vessel conditions and sea states. S&MO and QinetiQ have completed a series of Submarine Class model towing trials in the Ship Tank at Haslar, and more recently in open water. The knowledge gained from such experiments (and other analytical techniques), is extremely useful to the S&MO IPT in their planning and towing of a submarine from sea into a safe port.

15.05 - 15.40 Submarine Trials and Experimentation - Dealing with Real-Life Data

*Jon Bayliss, QinetiQ, UK  
Author TBA, Sea Technology Group, UK*

A key factor to ensure safe operation is the ability to predict submarine manoeuvring trajectories. This allows computer simulation to be used to investigate safety critical operational aspects of manoeuvring, such as plane jams, without putting actual boats in danger. In order to perform validated computer simulation, submarine trials are necessary to provide actual boat, or model, data that must be correlated to simulated results. This paper details the need for submarine trials and gives some background on the planning that is performed for such trials, both model and full-scale. Methods to compare the simulation and post-processed trial data, to allow validation, are presented and benefits and shortfalls discussed. Examples are included in all cases to illustrate problems that can occur.

15.40 - 16.15 An Evaluation of the Merits of Non-Body of Revolution Submarine Hull Forms

*Jeffrey Pfister, Northrop Grumman Corporation, USA  
David Nagy, Naval Sea Systems Command, USA*

In early 2004, Naval Sea System Command commissioned Naval Surface Warfare Center and Northrop Grumman to investigate the merits of two non-body of revolution hull forms in four areas: payloads, structures, powering, and manoeuvrability. A body of revolution hull form was included in the study as a baseline. A traditional payload option and a modular payload option were developed for each of the three types of hull forms. This paper reviews the impacts of the payload and hull form combinations on the structural, powering, and manoeuvring aspects of the six concepts.

16.15 - General Discussion

International Conference  
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 22-23 JUNE 2005  
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**VENUE**

The Venue for "Warship 2005-Naval Submarines 8" is *Jurys Great Russell Street, London, UK*

**EVENING RECEPTION**

22 June 2005

Following the end of day one, delegates are invited to attend an evening reception at the conference venue.

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