

RESILIENT SHIP DESIGN COURSE

PROTECTING AGAINST UNDERWATER AND ABOVE WATER THREATS



TNO innovation
for life

**17–20 SEPTEMBER,
2019
ROTTERDAM**

Although warships have several layers of defence, history has shown a multitude of incidents where these have all failed resulting in battle damage of the ship. Much can be done in the design of the ship to provide an adequate level of resilience against anti-ship missiles, UNDEX threats, shaped charges, gunfire or asymmetric threats. You can learn all about it in this course organised by TNO Defence Research from the Netherlands.

FOR WHOM?

- Navy personnel
- Survivability experts
- Shipyards
- Designers of naval vessels
- Naval ship manufacturing industry
- Managers of new naval projects
- Project engineers who prepare specifications of naval equipment and installations
- Engineers who monitor naval building or upgrade projects
- Technical procurement officers
- Classification societies

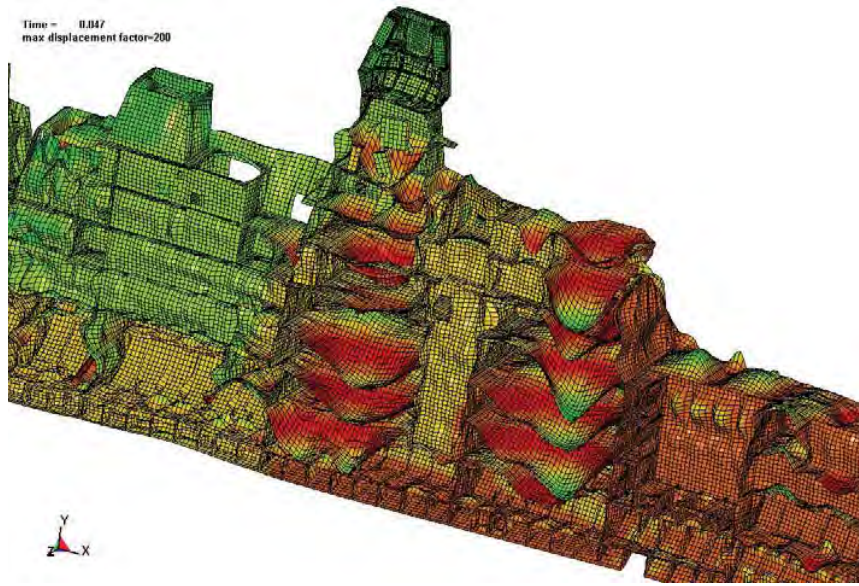
PURPOSE OF THE COURSE

The main purpose of the course is to understand the basics of designing against modern above water and underwater threats. Participants will

learn the principles of ship survivability, so that they are able to design themselves, to communicate with specialists, to tackle an underwater shock problem or to deal with above water threats. The knowledge can also be applied to upgrade ships for new threats.

FORMAT

This seventh edition of the course introduces case studies, linking theory to actual incidents. TNO welcomes internationally acclaimed guest speakers from NL MoD, Industry and Survivability Consulting Ltd in the UK.



Design against underwater shock

COURSE PROGRAMME

Threats

- Description of anti-ship missiles
- Grenades, shaped charges and bullets
- Close-in explosions like on USS Cole
- Mines and torpedoes

General ship survivability design

- Relevant aspects that determine survivability, design goals, guidelines, possibilities for vulnerability reduction
- From staff requirements to equipment shock specifications
- Integrating vulnerability reduction in ship design, practical issues and pitfalls

Underwater shock

- Phenomena and effects
- Mechanics of a single mass-spring-damper system
- Shock Response Spectrum
- Shock resistant designs
- Mechanics of a two mass-spring-damper system
- Introduction dynamic analysis methods
- Behaviour of springs
- Shock specifications
- Laboratory shock test methods

Blast response

- Basics of blast
- External blast
- Blast phenomena in a ship
- Governing loads on structural elements
- Response of the structure: SDOF under blast

- Approach for blast resistant design, structural details
- Simulation tools
- Composite materials

Ballistics

- Basic ballistics: failure mechanisms, penetration mechanics
- Fragments, bullets, shaped charges and countermeasures
- Fragment ejection from warhead
- Behind armour effects
- Test methods
- Protection solutions

Fire and countermeasures

- Hazard identification and design fires
- Modeling of fire
- Active and passive fire fighting
- Demo of Fire Dynamics Simulator

Damage control

- System lay-out and network analysis
- Autonomous recovery
- Reconfiguration and OODA-loop
- Recoverability
- Damage control optimisation
- Manning and resilience in operations

Practical elements

- Laboratory ballistics test demo
- Laboratory shock test demo
- Case studies of actual ship incidents
- Exercise in a workshop
- Software tools for blast, fragment protection and fire safety engineering

LECTURERS



VADM (ret.) Matthieu Borsboom

The keynote will be given by Vice Admiral (ret.) Matthieu Borsboom. He is a former Commander of the Royal Netherlands Navy and Director of the Defence Materiel Organisation.



Hans van Aanhold

Senior research scientist, with TNO since 1991. Performed and conducted projects related to underwater shock modelling and testing, vibrations and composite structures.



Erik Carton

Senior scientist ballistic protection and materials. Active in blast and impact phenomena, including explosive metal working. Generated energy-based engineering models for bullet interactions.



André van Erkel

Expert in ship vulnerability for 35 years. Focused on: structural modelling, blast modelling, explosive testing of ships and metal failure modelling. Developed blast resistant bulkheads and doors.



Kirk Green

Project manager with TNO since 2008. Point of contact for qualification and shock testing. Responsible for shock mount characterisation programs and consequences.



Paul Horstmann

Technical Director at Survivability Consulting Limited in the UK. 30 years of experience in ship vulnerability, working on projects such as Type 45, QEC and Type 26.



Johan Janssen

Coordinates research related to manning and automation for naval ships, including automation of the recoverability systems to maintain the ship's fight-through capability. With TNO since 1998.



Niek Leemkuil Environmental Engineer with Thales Naval since 2012. Studied Bsc. Applied Physics. Experienced in designing, analyzing and testing against shock and vibration.



Gert-Jan Meijer Senior business developer at TNO. Gert-Jan was project manager of a multi-year NE-US project on shock response of composite naval structures. He has taught structural dynamics at Delft University of Technology.



René van Meurs (MoD) Ship Vulnerability Reduction Officer. Manages R&D projects on warship vulnerability and supports the Netherlands' MoD Staff, Operational Command, DMO designers and project engineers on vulnerability. René is NE delegate for NATO ST/SCS.



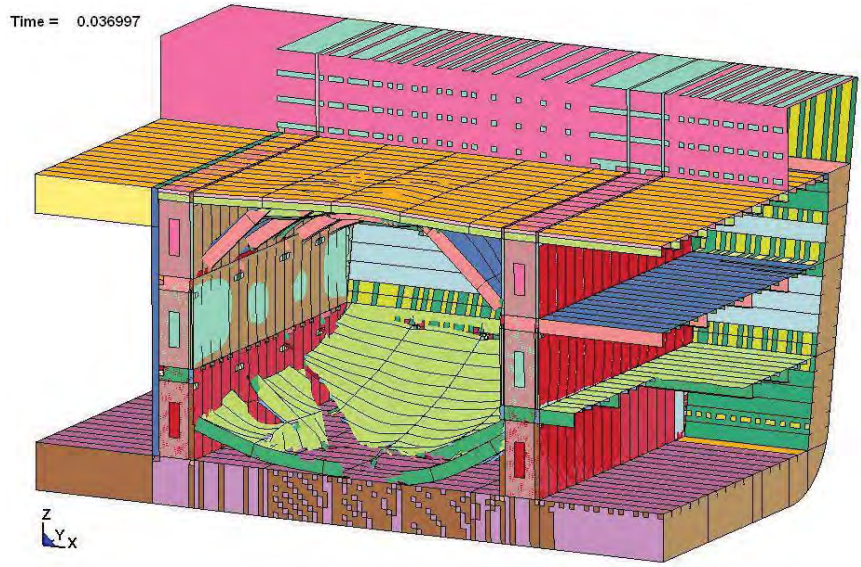
Wilfried Post Senior scientist. With TNO since 1995 studying human information processing and team performance under stress for the external and internal battle. Applied that knowledge in current RNLN vessels, in relation with reduced manning.



André Vaders (MoD) Senior Expert Structural Mechanics. Member of the NE-UK BNCP team for the aspects shock, vulnerability and structures. Member of the NE-GE Shock Expert Group.



Rogier van der Wal Senior scientist. Experienced in protection against fire and ballistics. Provided integral solutions for the Royal Netherlands Navy to maximise resilience of both the Joint Support Ship and Patrol Vessels.



Simulation of an internal explosion in a reinforced ammunition storage

TUESDAY INTRODUCTION AND SHOCK MECHANICS

- Keynote on ship survivability
- Resilience of ships
- Threats and weapon effects
- Introduction to underwater explosions
- Mechanics of a SDOF, 2DOF and MDOF systems
- Numerical analysis methods
- Case study AW attacks: HMS Sheffield (and HMS Glamorgan)

WEDNESDAY SHOCK RESISTANT DESIGN AND LABORATORY TOURS

- From staff requirements to shock specifications
- Shock resistant designs
- Modelling of shock mounts
- Shock specifications, laboratory tests and test methods
- Case study UW attacks: USS Princeton, USS Samuel B Roberts and ROKS Cheonan
- Shock laboratory tour and demonstration of shock test
- Laboratory for Ballistics Research tour and ballistic test

THURSDAY BLAST AND BALLISTICS

- Basics of blast
- Blast in ships
- Blast response of structures
- Blast resistant design
- Basic Ballistics
- Fragments, bullets, RPG's and countermeasures
- Case study Asymmetric attack: USS Cole, INS Hanit and HSV Swift
- Social event in the evening

FRIDAY DAMAGE CONTROL AND PLATFORM DESIGN

- Integrating vulnerability reduction in ship design
- Operational resilience in ship design
- Fire and countermeasures
- Systems analysis
- Recoverability
- Autonomous recovery
- Workshop

COURSE LEVEL AND LANGUAGE

The recommended level of education is a National Certificate or a Bachelor degree in Engineering, Physics, Science or Naval study. A basic understanding of mechanics and/or mechanical vibrations is recommended. The course will be given in English.

DATES AND VENUE

The Resilient Ship Design Course will take place from 17 to 20 September 2019. Venue is the Delta Hotel, room Triton, Maasboulevard 15 in Vlaardingen - close to Rotterdam. Ways to get to the venue and suggestions for nearby hotels are given on the course website.



The Delta hotel (photo from TripAdvisor)

COST

The costs are € 3200 excl. VAT. The price includes a hard copy and digital copy of the course proceedings, software tools, lunches and beverages and the diner on Thursday. There is an early bird discount of 10% for applications placed before the 31st of May 2019.

CANCELLATION

Cancellations received in writing less than six weeks before the event will be subject to an administration charge of € 500. Cancellations received after this time cannot be accepted and are subject to the full event fee. Delegates may be substituted. TNO preserves the right to cancel the course no later than six weeks before the start, in which case paid registration fees will be refunded.

REGISTRATION

You can register by sending an e-mail stating your name, company/organisation, VAT number and address to louise.michon@tno.nl. After reception of your registration, we will send you payment instructions. Your registration will be confirmed after reception of your payment.

“EXCEPTIONAL PRESENTATIONS”

“WELL WORTH THE MONEY”

"COMPLICATED SUBJECT, BUT VERY WELL PRESENTED"

“VERY WELL ORGANISED”

“[... THE DEMOS ARE] SO COOL!”

Comments on previous editions

TNO.NL

WEBSITE

www.tno.nl/resilientshipdesigncourse/

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