

# Vulnerability Design Course

Survivability Consulting Ltd & Thornton Tomasetti Defence Ltd, endorsed by UK MOD's Naval Authority Group

The ability of a ship to sustain battle damage and continue its operations can provide a battle-winning edge. This course will give an insight into the techniques developed by the UK over several decades to reduce naval vulnerability. It develops the attendee to practitioner level to enable informed decision making. The course provides a unique opportunity to learn from experts with decades of experience in naval vulnerability as well as a forum to network with MOD and industry staff in the field.

## Who is this course for ?

- Ship & System Designers
- MOD & Industry Project Staff
- Navy Personnel
- Procurement Staff
- Engineers and Scientists
- Classification Societies



**Location:** SCL, Dunfermline, Scotland

**Cost:** £1500 plus VAT

**Dates:** 7-9 September 2021 (Fully Booked)

8-10 February 2022 (Places Available)

**SCL** **Thornton Tomasetti**  
Defence Ltd

## Attending this course will develop an understanding of:

- Modern naval threats: anti-ship missiles, mines, torpedoes, bombs, bullets, shaped charges, shells and asymmetric attacks
- Primary weapon effects: penetration, blast, fragmentation, shock, whipping, bubble jetting
- Secondary weapon effects: flooding, fire, smoke & residual strength
- Lessons from real life battle damage incidents (e.g. HMS Sheffield)
- How to specify and measure vulnerability requirements
- Mitigation measures that can be designed-in or retro-fitted
- Vulnerability assessment through the design cycle
- The relationship between magazine safety and survivability
- How recent RN procurements have approached vulnerability
- MOD's Duty of Care during wartime & Combat Safety Summaries
- Software tools to support low vulnerability design

## Alternative courses can be arranged for non-UK nationals



Naval Authority

For enquiries please contact Paul Horstmann 01383 257032,  
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Limited number of UK MOD places available by contacting  
DES NAG VR1 on 030 679 35064

# Vulnerability Design Course

## Tuesday

- 09:00 Welcome & Introductions  
Course Objectives
- 09:30 NAG Introduction  
Vulnerability & Combat Safety
- 10:00 **Case Study: HMS Sheffield**  
What happened & how it could be changed
- 10:30 Break
- 10:45 Threat Evolution
- 11:00 Above Water Threat Basket  
Missiles, bombs, shells and rockets
- 11:30 Above Water Primary Weapon Effects  
Kinetic Energy & Ballistic Protection
- 12:00 **Exercise: HMS Xanadu**
- 12:30 Lunch
- 13:30 Above Water Primary Weapon Effects  
Blast Theory  
Simple Analysis  
Complex Analysis  
Modelling
- 14:30 **Case Studies: USS Stark & INS Hanit**
- 15:00 Break
- 15:15 Blast Protection Measures
- 16:00 Susceptibility Overview  
Signature (RCS, IR, Noise, Magnetic)  
Hard kill & soft kill
- 16:30 **Case Study: SS Atlantic Conveyor**
- 17:00 Close of Day One

## Wednesday

- 09:00 Underwater Threat Basket  
Mines, torpedoes & depth charges
- 09:30 Underwater Primary Weapon Effects  
Shock  
Whipping
- 10:15 **Case Study: USS Princeton**
- 10:30 Break
- 10:45 Underwater Shock Qualification  
Shock Analysis, Testing  
Shock Mounts
- 11:30 Fleet Applications (T26 & Pragmatic)
- 11:45 Human Vulnerability to UNDEX
- 12:00 **Exercise: HMS Xanadu**
- 12:30 Lunch
- 13:30 Secondary Weapon Effects & Recoverability  
Fire, Smoke, Flooding, Residual Strength  
DC & FF
- 14:00 **Case Study: USS Samuel B Roberts**
- 14:35 Escape and Evacuation (inc. after damage)  
Maritime Exodus
- 15:00 Break
- 15:15 **Case Study: ROKS Cheonan**
- 15:30 RN & RFA Fleet Vulnerability Summary  
Design lessons
- 16:15 Reduced Vulnerability Submarines  
& Lethality against Submarines
- 17:00 Close of Day Two
- 19:00 Evening Meal (sponsored by SCL)

## Thursday

- 09:00 **Case Study: USS Cole**
- 09:20 Asymmetric Threat Basket  
FACs, FIACs & WBIEDs
- 10:00 Vulnerability Assessment Techniques  
Vulnerability Reduction Strategy  
Modelling
- 10:30 Break
- 10:45 **Case Study: HMS Hood / Antelope**
- 11:00 Magazines  
Risk & Consequences
- 11:40 Procurement Lessons  
Requirements
- 12:10 Lloyd's Rules Military Notations
- 12:30 Lunch
- 13:30 Combat Safety Summaries  
Duty of Care during wartime
- 14:00 **Case Study: HSV Swift**
- 14:15 Lethality  
Threat platforms, Weapon Design  
Criticality Assessments
- 15:00 Break
- 15:15 System Design (from concept to build)  
Systems, equipment and services
- 15:55 **Case Study: HMS Glamorgan**
- 16:15 Course Summary
- 16:30 **HMS Xanadu Results**
- 17:00 End of Course