# Ordnance, munitions and explosives services

FRAZER-NASH CONSULTANCY

SYSTEMS AND ENGINEERING TECHNOLOGY

# Frazer-Nash Consultancy

**Frazer-Nash is a leading systems and engineering technology company. Our consultants are applying their expertise and know-how to develop, enhance and protect our clients' critical assets, systems and processes.**

Working in the UK and internationally, we're making a real difference to the work of the armed forces, defence ministries and the defence supply chain.

We know that the changing defence environment presents a range of challenges for all stakeholders in the sector. Our Systems Approach, combined with our people's expertise, helps you meet your challenges head-on.

We provide a range of world-class engineering services in the specialist field of ordnance, munitions and explosives (OME). From modelling of fluid interaction, to blast assessment, human factors and hazard assessment, our highly skilled and experienced engineers understand the complex nature of their work, and deliver the very best in technical know-how and customer service.

## Our clients

Clients who benefit from our unique expertise and know-how include:

- AWE Aldermaston
- Babcock
- BAE Systems
- Chemring Group
- Cranfield University
- Defence Ordnance Safety Group (DOSG)
- Defence Science and Technology Laboratory (Dstl)
- Department for Transport
- Explosives storage and transport committee (ESTC)
- In-Service Submarines Project Team
- Lloyd's Register
- Ministry of Defence Saudi Armed Forces Project
- Police forces
- QinetiQ
- Ultra Electronics
- Weapons Operating Centre
- Weapon Science and Technology Centre

## We have provided support to:

- Tomahawk land attack system
- Harpoon missile system
- Sting Ray torpedo
- Spearfish torpedo
- Common Anti-Air Modular Missile
- Land Ceptor
- Sea Ceptor
- Sea Fox
- Brimstone
- Paveway
- Phalanx
- Naval medium calibre guns
- Goalkeeper
- Sea Viper
- Storm Shadow missile system
- Strategic weapon system
- OME/platform integration (sea, land, air)
- SS Montgomery (munitions sensitivity assessment)

# Our experience

## Noise and vibration assessment

Frazer-Nash specialises in solving complex noise and vibration problems across a range of industries. Recent projects include:

- Assessment of noise exposure of personnel to blast and weapons discharge.
- Noise audit and mitigation on naval vessels.
- Noise measurement and assessment of rotary and fixed wing aircraft.
- Noise and vibration audit of tracked and wheeled armoured fighting vehicles.

## Safety and environmental case development

Frazer-Nash provides safety and environmental management advice to multiple OME projects to ensure that accurate risk assessments are developed. Ranging from pyrotechnics through to complex weapon systems, we develop safety and environmental management plans, reports, hazard logs and assessments to support all phases of the equipment life cycle.

We also regularly undertake the role of Independent Safety and Environmental Auditor to provide impartial and pragmatic advice to customers.

## Infrastructure blast threat analysis

Our experts undertake detailed modelling of the propagation of blast pressure; from the detonation of an explosive charge, to the prediction of the propagation of the pressure front and the blast response of structures. We work with a range of clients to model blast effects and recommend measures to reduce the likelihood of damage to buildings and other infrastructure. We have a detailed understanding of the mechanisms involved in causing blast injury and can use our in-house software package FNFrag to assess the threat from fragments to a building's occupants.

## Blast loading on bridges

Frazer-Nash modelled the blast pressure loading on bridges caused by local weapon detonation, to support the assessment of the response of reinforced concrete bridge decks to blast loading.

The study included assessment of both direct hits and the detonation of weapons that missed the target and were embedded in the surrounding environment, including concrete, soil and water.

## Weapon effects modelling

Frazer-Nash is continuing the development of PALETTE; a versatile software suite, comprising a number of vulnerability and lethality modules. These provide a comprehensive modelling strategy for the response of fixed ground-based targets to air-launched weapons.

PALETTE provides an engineering-level modelling capability for the rapid assessment of highly-bespoke engagement scenarios, and is used in support of several programmes undertaken by the MOD and industry partners.

## FNGUN, internal ballistics modelling

FNGUN is a validated, easy-to-use, commercially available software suite for the analysis of internal ballistics. FNGUN is used by government and industrial R&D facilities worldwide, and has been successfully applied to gun systems ranging from small-calibre firearms, through mortars and grenade launchers, to howitzers and tank guns.

Frazer-Nash provides full training and support for FNGUN and offers consultancy services in internal ballistics analysis.

## UK Type 26 Combat Ship evidence-based decision making

Frazer-Nash is experienced in developing operational, logistical or cost-benefit mathematical models for a range of applications to support evidence-based decision making.

We developed a bespoke model for the UK Type 26 (T26) Global Combat Ship programme to optimise the future Support Solution for T26. Similar techniques could be applied to service and life extension programmes for OME.

## Missile launch system computational fluid dynamics (CFD)

To understand why the missile ejection speed was slightly below requirement, Frazer-Nash carried out an assessment of the gas path for a very high pressure (4000psi) pneumatic missile launch system on board an aircraft.

We were able to identify various losses throughout the system and validated our CFD models against physical test data from the client.

## Blast mitigation barriers

Working with the MOD's Defence Ordnance Safety Group, Frazer-Nash helped reduce the risks associated with armed aircraft in airfield operations.

Frazer-Nash developed a concept for providing blast mitigation under parked aircraft. We worked closely with the customer throughout the development process: from initial specifications, through selection and testing of armour materials, to the production of manufactured prototypes.

## Laser-guided bomb system thermal modelling

To meet environmental safety criteria, Frazer-Nash conducted an assessment of the heat transfer from various levels of diurnal insulation into the explosive fill of a laser-guided bomb system.

The assessment took into account solar radiation, effective background radiation temperature and the effects of wind speed on convective heat transfer away from the casing.

*"Frazer-Nash is a world leader in blast modelling. Our experts undertake detailed modelling of the propagation of blast pressure; from the detonation of an explosive charge, to the prediction of the propagation of the pressure front and the blast response of structures."*

*"Our people continually challenge established practices and achieve continuous and cost-effective improvements for our clients."*

# Our people and their expertise

The people in our business set us apart in the industry and are recognised internationally for their professionalism and range of capabilities. Some focus on core engineering disciplines, whilst other engineers are experts in noise and vibration or understand the unique characteristics of energetic materials.

All our people are highly experienced. And because of their diverse backgrounds – which include operators, regulators and industry experts – they understand the challenges faced by our clients and the industry in which they operate.

## Assurance

- Dangerous substances and explosive atmospheres regulations (DSEAR)
- OME/platform integration – air, sea, land
- Hazard identification, analysis and risk assessment
- Human factors
- Probabilistic safety assessment
- Fire safety assessment
- Safety and environmental case development
- Environmental assessment
- Integrated munition health management (IMHM)

## Systems and enterprise engineering

- Through-life system requirements
- Project and programme management
- Supply chain management
- Operations and improvement
- Strategy for competitive advantage
- Commercialisation of new technology
- Integrated engineering
- Resilience and security

## Simulation and electrical

- Fast-running operational analysis tools
- Modelling explosive threat scenarios
- Interfacing models with war gaming tools
- Cost benefit analysis
- Evidence-based decision making
- Software development

## Structures, dynamics and fluids

- Complex modelling of blast, fragmentation, ballistics
- Human injury effects
- Computational fluid dynamics
- Fire and explosion survivability assessment
- Finite element analysis of structures
- Effects of projectiles on armour
- Fluid and structural interaction
- Design and manufacture of barriers
- Weapon effectiveness

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FRAZER-NASH
CONSULTANCY

**To find out more about our work**
**and how we can add value to your business,**
**email defenceweapons@fnc.co.uk or visit our website:**

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