Safety/Risk Engineering, Naval Engineering, Technical Regulation, Acquisition Support

AMOG is a leading global solutions provider to the defence, maritime construction, energy, transport and resource industries and have been solving complex engineering problems for over 27 years. Our engineers have worked with submarines, naval ships, landing craft, aircraft, defence vehicles and land-based assets. We are familiar with and can operate within the standards specified by Defence.

AMOG can provide through life and acquisition support services in Safety/Risk Engineering, Naval Engineering and Technical Regulation. AMOG's Melbourne office is DISP Accredited and can handle classified material up to and including SECRET.

AMOG has proven capabilities in the following defence-related areas:

- Seaworthiness and Assurance Engineering
- Systems Engineering
- System Safety Engineering and Safety Case Development
- Safety & Risk Assessments
- Human Factors Engineering
- Integrated Logistic Support Analysis (ILS)
- Reliability Availability Maintainability (RAM)
- Reliability Centred Maintenance (RCM)
- Risk Based Inspections (RBI)
- Software Safety & Assurance (SIL Assessment)
- System Safety Engineering Training Courses and Workshops
- Advanced Hydrodynamics and Hydrostatics
- Naval Architecture
- Computational Fluid Dynamics (CFD)
- Fire & Blast Modelling
- Advanced Structural Analysis & Design (incl composites)
- Analysis and Mitigation of Corrosion

We have a proven track record of providing support to clients across the Defence Sector including; the Royal Australian Navy (RAN), Australian Regular Army (ARA), Royal Australian Air Force (RAAF) and CASG. In addition, we have worked with and for major Defence Prime Contractors, including:

Raytheon, THALES, BAE SYSTEMS, BOEING, ROHDE&SCHWARZ, AUSTRALIAN AEROSPACE EUROCOPTER, AN EADS COMPANY, GIBBS & COX Maritime Solutions, SAAB, AUSTRALIAN MARINE COMPLEX, ADI, CAE, ASC, ECA GROUP, Tenix, AUSTAL, DCNS, Australian Government Department of Defence Capability Acquisition and Sustainment Group, indra, UGL, LOCKHEED MARTIN, Navantia, New Zealand MINISTRY OF DEFENCE Manatū Kaupapa Waonga

AMOG provides highly qualified and experienced engineers, utilising leading edge technology, all operating within an externally accredited AS/NZS ISO 9001 Quality Management Framework. AMOG is also externally accredited to AS/NZS 14001, OHSAS 18001 and AS/NZS 4801 standards.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

www.amog.consulting

BAE Systems

HOBART Class Destroyers

Sydney & Melbourne

Reliability & Safety Engineering

AMOG has supported BAE on a number of projects related to the HOBART Class Destroyer (DDG) over the 2020-2022 period. These have included Probabilistic Risk Assessments, Reliability Studies on critical ship systems, and support for the safety case remediation effort (such as drafting Operational Safety Risk Assessments, and also conducting a System Safety Program audit in the form of a Safety Compliance Assessment).

The Probabilistic Risk Assessments focused on 10 key hazardous scenario categories on the vessel (e.g. Fire, Flooding, Electrical exposure, Inadvertent detonation, Exposure to RF radiation, etc.). AMOG built large fault and event trees based on review of key ship systems and safety argument reports, and conducted a quantitative numerical analysis to estimate frequency of initiating events and the subsequent probabilities of the various potential safety outcomes aligned to the Defence Harmonised Risk Matrix. The results provide a quantitative basis for the level of numerical risk associated with these key mishaps.

The reliability studies constitute ongoing work with BAE to build a Decision Support Environment (DSE) for the DDG. AMOG has built detailed numerical reliability models of ship critical systems (such as the propulsion system, the power generation system, ship control system, HVAC, etc.) in the form of reliability block diagrams with associated failure data and maintenance tasking to simulate a variety of scenarios and determine the reliability performance of the systems through a typical duty cycle of the DDG. This work can be used to inform decision makers on the outcomes of potential changes to operational and maintenance plans (such as increasing days at sea, specific deployments, maintenance tasking optimisation, skipping upkeep periods, etc.), and their overall effect on safety and capability performance.

CASG

SEA1180

Melbourne & Canberra

Systems Safety Engineering Management

AMOG is currently supporting CASG on the acquisition of the ARAFURA Offshore Patrol Vessels, specifically the safety program. AMOG is providing the System Safety Manager for the program, who is managing and leading all safety activities on the project. In addition to this, AMOG is also providing other resources to conduct safety studies (such as Fire Safety Studies, risk assessments of Government Furnished Equipment, compliance assessments, etc.).

Australian Government

Department of Defence

CASG

SEA3033

Canberra and Melbourne

Systems Safety Engineering Management

AMOG is currently supporting CASG in the acquisition of the new Pacific Support Vessel (PSV) for RAN. This COTS acquisition project will fulfil a role in RANs support fleet. AMOG is providing Systems Safety Engineering expertise building a safety and seaworthiness case for the PSV. The project requires AMOG to conduct hazard identification and risk assessments, and develop ship documentation. AMOG is also providing on-site support, assessing and verifying the ships functional performance and safety critical systems. In this role AMOG provides excellent value to the CoA bringing together years of systems safety experience, with operational knowledge and expertise in maritime systems and naval architecture.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

Royal Australian Navy

Australia

Guidance Document

DENG Logistics Library

AMOG was engaged by the Royal Australian Navy (RAN) to draft a guide for the conduct of technical fact finds and technical investigations. The aim was to provide a concise guide that could assist with incident investigations; for both accidents where an item of equipment was damaged or misused, and where items of equipment or components noticeably performed above expectations.

The final document incorporated:

- Processes for framing and initialising the investigations
- Conducting technical investigations
- Incident and investigation classification
- Gathering and preserving data (including documents)
- Assessment
- Root Cause Analysis (RCA) and methodologies
- Reporting and follow up procedures
- Real worked examples

The final guide was delivered to the RAN, forming a N44 series book within the DENG logistics library and to be used in conjunction with other Defence guidance.

Royal Australian Navy

COLLINS Class Submarine

Adelaide

Safety Cases

Effectiveness of Gas Injection Suppression in Cabinets (ASC Pty Ltd)

AMOG provided fire suppressant dispersion analyses and engineering advice.

This work provided a means to evaluate proposed improvements to the fire fighting systems aboard the COLLINS Class Submarines.

Previously, the crew were required to open electrical cabinets to fight fires affecting the equipment contained inside them. This method was prone to potential flare up of the fires and presented a significant hazard to personnel.

A proposed improvement to the process involved the incorporation of fire fighting injection sockets in order to facilitate greater effectiveness and safety when extinguishing fires within the electrical cabinets.

A series of detailed Computational Fluid Dynamics (CFD) analyses were undertaken by AMOG to determine the optimum location of injection sockets for the range of cabinet configurations. These analyses considered the time evolving dispersion of fire suppressant within the cabinets.

The numerical results were correlated with physical tests conducted for a simple test cabinet configuration and demonstrated the validity and usefulness of the numerical approach in these types of assessments.

CFD was an especially relevant tool for this task given the highly regulated environmental consequences for actual release of the fire suppressant in question.

Scope of work included:

- CAD geometry development
- CFD dispersion analyses
- Physical model validation
- Engineering recommendations with regard to optimal port locations

Royal Australian Navy

COLLINS Class Submarine

Adelaide

Hydrodynamics Modelling

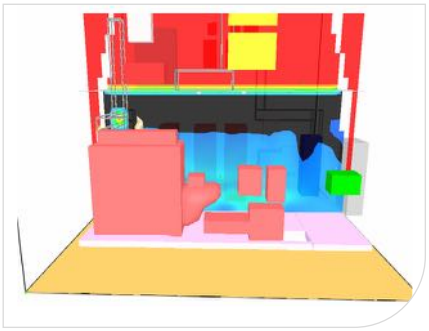
COLLINS Hover Mode

AMOG was engaged to develop a system of equations of motion suitable for modelling the zero forward speed near surface motions (Hover Mode) of a COLLINS Class submarine in an irregular sea. Methods of calculation of the first and second order wave forces were incorporated into the equations of motion, and a method of simulating an irregular sea wave elevation time history was provided.

Algorithms for implementation of the equations of motion and the wave load parameters were provided such that a numerical model of the Hover Mode dynamic response of the COLLINS Class submarine was able to be implemented in the ASC STSSF environment.

AMOG further supported the implementation of these equations of motion by performing an initial calibration of the hydrodynamic coefficients representing the COLLINS Class utilised in the two degree of freedom hover mode submarine model.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



Royal Australian Navy

COLLINS Class Submarine

Adelaide

Formal Safety Assessment

COLLINS Support - Return from Deep Diving Depth

A flood incident on HMAS *Dechaineux* occurred when the submarine was operating at maximum depth. This event revealed deficiencies in design for submarine recovery from flooding at maximum depth. It also illustrated some of the problems experienced on the COLLINS Class submarine due to differences in operational philosophy between the RAN and the Swedish Navy.

The RAN operates beyond the continental shelf in water beyond the crush depth of the submarine. Swedish Navy typically operates in shallower coastal waters, less than crush depth. As such, recovery from flooding events at maximum operating depth are much bigger concern for RAN as there is no possibility of rescue should the event occur when in deep water. Kockums were not able to provide the engineering justification for a prescriptive standard critical to the submarine safety case. There was also no strong, direct Navy to Navy links between RAN and RSwN to inform on this matter. Therefore this issue was a roadblock to resolving the problem until AMOG re-engineered the basis of the prescriptive standard from scratch (and developed this into a performance standard instead to a prescriptive standard).

AMOG was involved in resolving this problem right after the incident occurred through to delivery of the Formal Safety Assessment. AMOG was able to combine consequence modelling and reliability analysis with safety engineering to provide a quantitative risk assessment for the submarine recovery.

Royal Australian Navy

AWD Project

Adelaide

System Safety

System Safety Support (Raytheon; AWD Alliance; DMO; ASC)

AMOG was initially engaged to provide System Safety Services for the Evolved solution team. This included Safety Program scoping and planning, developing Safety Management Plans and conducting Preliminary Hazard List (PHL). Once the program was awarded to the existing solution, AMOG was engaged by Raytheon for further work and, over the course of three years, AMOG had Safety engineers working on-site in Adelaide AWD centre. AMOG worked on all aspects of the program including planning, safety data integrations, safety analysis, hazard log, developing safety deliverables and general safety management and provided general system safety specialist support to Raytheon Combat System Safety Manager on a permanent on-site basis.

External Communications Safety Program and Assessment (Rohde & Schwartz)

AMOG conducted a system safety program and a Safety Case Report (SCR) for the supply of a Radio External Comms System to the AWD platform, documenting the results of the safety compliance activities undertaken in accordance with MIL-STD-882C and DI-SAFT-80102B. AMOG also provided a Radio Product Group safety hazard analysis addressing hazards at the system level associated with the operational integration of the system into the AWD platform, as well as, a safety assessment for the differences between the CIS Integration Set and the Radio Product Group.

Suitability of Water Mist System (NOVA Defence)

Directorate of Navy Systems raised technical integrity risks associated with the HOBART Class AWD Platform, including the appropriateness of the proposed AWD Water Mist System. AMOG was engaged to conduct an independent review. Numerical modelling was conducted in Fire Dynamics Simulator (FDS) and introducing water droplets (specified size and number) tracked over time. We accounted for aerodynamic drag (transfers momentum from the droplets to the air) and evaporation including the associated thermal energy transfer.

Tenix Defence Marine Division

ANZAC Class Frigate ASMD

Melbourne

Naval Vessel Aft Mast Fire Modelling, Fire Risk Safety Assessment

FDS, Pyrosim

AMOG provided fire dispersion, consequence modelling and fire suppression system engineering services in support of a proposal to modify the aft mast structure on the ANZAC Class frigate to incorporate the CEAFAR radar as part of the Anti-Ship Missile Defence (ASMD) capability upgrade.

The proposal to modify the mast structure to the existing ship had myriad implications for risk assessment and safety systems.

AMOG provided a full cycle of analysis services to provide engineering guidance and recommendations to the ship builder so as to ensure full and optimal compliance with regard to fire risk and consequences.

A key aspect of the analysis cycle included detailed CFD simulations of fire and smoke propagation across a range of fire risk scenarios.

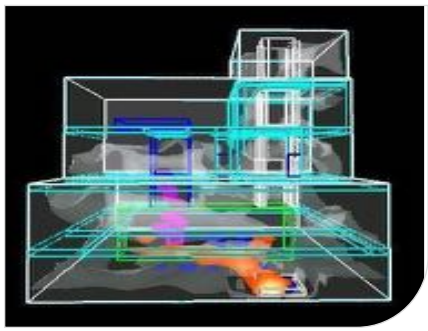
The detailed models encompassed consequences across heat, smoke, and visibility as assessed against applicable standards and tenability criteria.

The CFD analyses and associated engineering services resulted in firm recommendations with regard to fire suppression system requirements.

Scope of work included:

- Provision of expert advice on relevant regulations and requirements
- Assessment of fire risks and scenarios
- CFD modelling of fire development and propagation scenarios
- Engineering specifications of the recommended fire suppression system

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



Tenix Defence Marine Division

ANZAC Class Frigate

Melbourne

Machinery Space Fire Modelling, Fire Risk Safety Assessment, Egress Calculations

FDS, CFAST

AMOG was commissioned to undertake modelling of fire and smoke propagation in the machinery space of the ANZAC Class frigates to establish the tenability criteria for evacuation of the compartments and gain an understanding of time-dependent smoke spread phenomenon.

The credible fire scenarios identified for the Gas Turbine Space and Propulsion Diesel Space were fires resulting from ignition of diesel fuel spills and diesel leaks in the main machinery spaces, i.e. pool and jet fires.

Numerical models of the machinery space were constructed using two fire analysis packages, CFAST and FDS. The CFAST model was a two dimensional zone model which split the machinery space into an upper and lower layer. The FDS model was a detailed three dimensional representation of the machinery space that fully resolved the turbulent flow physics of the fire. The two model approach allowed rapid analyses to be conducted (CFAST) that were then verified against the more detailed (FDS) model.

On the basis of AMOG's analyses the client was able to determine that additional protective measures (i.e. escape trunking) were not required. In order to determine the adequacy of the fire safety controls, the egress times were calculated and compared to the point at which time untenable conditions were reached.

Scope of work included:

- Assessment of fire risks and scenarios
- CFD modelling of fire development and propagation scenarios
- Egress considerations assessment

ADI/Thales Australia

SEA 1390 FFG Upgrade

Sydney

System Safety Support to FFG Upgrade 2004-2008

As part of the FFG remediation program, AMOG was brought in to plan, execute and deliver the System Safety Program for the ADELAIDE Class FFG Upgrade program. This upgrade included improvements to capability and enhanced supportability in Anti-Ship Missile Defence (ASMD), On-board Training, Tactical Data Links, Torpedo Self-Defence, Mine Avoidance, Hull Mounted Sonar and environmental compliance and logistic support services through the upgraded Team Trainer (TT) and Operator Trainer (OT) facilities as well as the establishment of the Warfare System Support Centre (WSSC).

AMOG was contracted to provide the full suite of MIL-STD-882C safety deliverables as well as certification documents (prior certification arguments for VLS) and software assurance assessments against RTCA/DO-178B.

AMOG was involved in analysing these systems using various processes, tools and techniques as the situation required and in accordance with MIL-STD-882C. In general, they included techniques such as Failure Mode Analysis, Causal Analysis, SWIFT workshops, Sensitivity Analysis, Fault Trees, Event Trees, and State transition diagrams.

In supporting this program, AMOG allocated a full-time senior safety engineer on-site with Thales at Garden Island in Sydney, and had a team of safety engineers (up to 4 more) conducting analysis and developing reports.

AMOG supported this task for approximately 4 years through to a successful conclusion.

The Safety Program conducted on FFG-UP remains one of the most complete programs currently delivered to Navy.

Tenix Defence

RNZR - Project Protector

Williamstown, Victoria

System Safety Program

AMOG was engaged by Tenix Defence to support the System Safety Program (SSP) for the Royal New Zealand Navy's Project Protector. The purpose of this SSP was to ensure that the residual level of risk associated with the Project Protector Capability was reduced to As Low As Reasonably Practicable (ALARP) and included Ship to Shore safety programs for the Multi-Role Vessels (MRV), Offshore Patrol Vessels (OPV), Landing Craft, and Inshore Patrol Vessels (IPV).

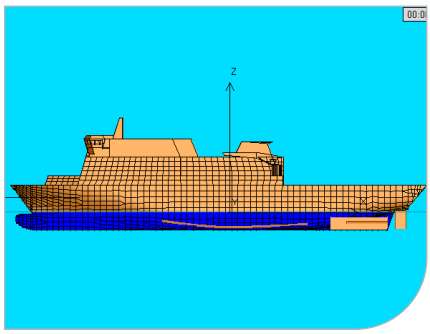
The safety program included the full suite of MIL-Std-882C deliverables, from preliminary hazard identification through to the final safety case, and all aspects of the Safety Management and SME support. Numerous analyses were performed, including Energy and Toxicity Matrices, Fault Tree and Event Tree analysis, Layers of Protection analysis, and System Safety Working Groups.

Hydrodynamic analyses were conducted to bound vessel motion and structural load inputs for the safety assessment. This included advanced numerical modelling of hydrostatic and hydrodynamic platform interactions. AMOG employed AQWA (an advanced three-dimensional time and frequency domain non-linear flow package) for the analysis of the hydrodynamic response of the MRV and Landing Craft.

As part of this program, AMOG also conducted a number of advanced Computational Fluid Dynamics (CFD) tasks, including the modelling of the Ship to Shore vessel mating with the MRV. This included modelling the movement of transferring vehicles and cargo through the various sea state conditions.

AMOG supported Tenix on this project for a number of years, with a mix of on-site and off-site analysis work.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



BAE Systems Australia

Project Protector MRV sea-keeping additional analysis

Australia

Sea-keeping

Subsequent to a hydrodynamic modelling of a Multi Role Vessel (MRV) and a Landing Craft Mechanised (LCM), AMOG was engaged by BAE Systems to conduct additional analyses for the MRV supplied to the New Zealand Ministry of Defence. Analyses were performed to investigate the likely sea-keeping behaviour of the MRV if a number of modifications to the configuration of the bilge keels, top weight ballast and liquid ballast were implemented. The aim was to improve the MRV's sea-keeping behaviour.

The scope included:

- 3D radiation diffraction analyses for each required combination of vessel forward speed and wave heading
- Time domain simulations of the MRV transiting through each of the specified sea states for each required combination of vessel forward speed and heading relative to the wave direction. The time-domain simulation accounted for the dominant non-linearities due to the submergence of the vessel hull at each time step, the time varying effects of the roll stability U-tank and the non-linear roll damping effect of the bilge keels.

Australian Aerospace

ARH and MRH

Queensland

Software Compliance

The requirements for Software Compliance Findings and Software Integrity Management was included into the Technical Airworthiness Management Manual (7001.053). Section 3.5.3 – Software Integrity Management, required that Software Configuration Item management of aviation software or aviation systems containing software be managed through an established Software Integrity Management System.

AMOG was contracted by Australian Aerospace to conduct a general compliance of the extant program against the intent of the new ADF Technical Airworthiness Regulations software requirements, specifically Section 3.5.3. of 7001.053.

LHDPO

Landing Helicopter Dock (LHD) Program

Canberra

Software Assurance Compliance Review

AMOG was engaged to investigate the Landing Helicopter Dock (LHD) program for compliance to modern Software Assurance standards. The task involved the investigation of critical software intensive systems of the LHD to determine the level of compliance to internationally recognised software assurance standards such as RTCA/DO-178B.

The task also included a high level gap analysis of the recovery activities necessary to compile a safety argument from the level of documentation and evidence available.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

DGTA

Unmanned Air Vehicle

Victoria

Safety Targets Development

AMOG was engaged to develop Safety Targets for CAT 2 UAS systems for DGTA. The task involved an industry wide literature review and interpretation against defence requirements. Safety Targets were developed for General Public (individual risk per mission, collective risk per annum), Mission Personnel (individual risk per mission, collective risk per annum) and PN curves for multiple fatalities.

A presentation of this project was delivered at the Defence/DMO Conference in Melbourne in 2012.

Rohde & Schwarz

Mobile Air Traffic Control Tower

New South Wales

Safety Assessments and Safety Case Development

AMOG was engaged to conduct Safety Assessments and develop a Safety Case Report for the design of a transportable air traffic control tower.

The task included the development of system safety program plans, conduct of system safety analysis, and the running of progressive system safety working groups. Identified safety controls and requirements were managed through to closure with the client. Hazard Logs where developed and maintained.

This task extended from acquisition through to in-service support.

This task was considered to be very similar to that required for ExTASS. It is a mobile unit with operation, assembly and transport hazards. The unit is C130J transportable.

Gibbs & Cox; Raytheon

Air Warfare Destroyer

South Australia

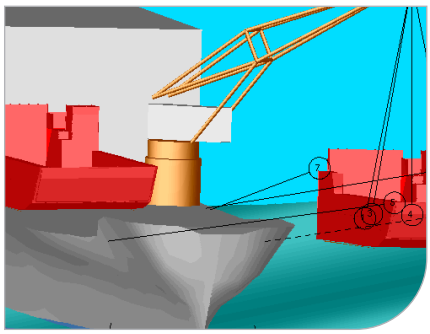
System Safety Support

AMOG was engaged to provide initial System Safety Services for the Evolved solution team. This included Safety Program scoping and planning, developing Safety Management Plans and conducting a Preliminary Hazard List (PHL).

Once the program was awarded to the Existing solution, AMOG was engaged to provide on-site System Safety Support to the Combat System supplier, Raytheon. During the course of three years, AMOG had Safety Engineers working on-site in the Adelaide AWD centre.

AMOG worked on all aspects of the program including planning, safety data integrations, safety analysis, hazard log, developing safety deliverables and general safety management.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



Defence Materiel Organisation

Landing Platform Amphibious (LPA) Ships

Canberra

Analysis of Lifting Operations

The Department of Defence was in the process of procuring watercraft to replace the LCM-8 craft that were in use with the Landing Platform Amphibious (LPA) ships (HMAS *Kanimbla* and HMAS *Manoora*). A critical aspect of the operation of the watercraft with the LPA was the deployment of the craft by the LPA's 70 tonne crane.

The Defence Materiel Organisation engaged AMOG to conduct numerical modelling of the lifting operations of the Watercraft onto and off the LPA foredeck. The analysis specifically addressed the clearance between the LPA and the Watercraft, the limiting sea state in which the lifting operations could be conducted, the ability of the watercraft to be controlled by handling lines during lifting operations, and the dynamic loads in the handling lines.

Tenix Defence

SEA 1654 – Auxiliary Oiler Replacement

Williamstown, Victoria

Delos System Safety Program

AMOG was engaged by Tenix Defence to conduct a safety assessment of the modification to MV *Delos*, a 37,000 tonne double-hulled oil tanker being converted to meet RAN requirements for underway replenishment. This included detailed analysis of complex integrated systems such as Aviation, RAS, Boats/Lifeboats, Accommodation, Containers, C4ISREW NDS DSE, Platform, Sewage Treatment Plant and the .50 Calibre Machine Gun.

AMOG developed safety assessments for all seven segments of the upgrade program whilst interfacing with the baseline certification of the vessel. These assessments where conducted in accordance with MIL-STD-882C.

As part of the safety assessment, AMOG conducted fire modelling of the accommodation section within the ship to gain an understanding of the time-dependent heat and smoke spread phenomenon and to investigate the time to reach untenable conditions. Modelling was conducted using the Fire Dynamics Simulator (FDS) software, a Computational Fluid Dynamics (CFD) software program that predicts the mass, momentum and heat transfer appropriate to low-speed fire-driven flows through physical geometric configurations.

Modelling was also conducted for the Aviation System analysis to determine the movement and possible impact of exhaust gases. Computer modelling as well as live scale model wind tunnel testing was conducted as part of this analysis to ensure helicopter operations and associated personnel were not adversely impacted in the planned helicopter deck configuration.

Hydrographic SPO

LEEUWIN Class

Queensland

Safety Case Support

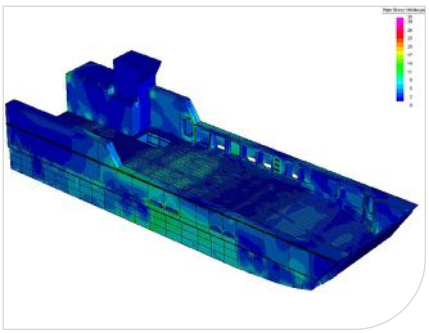
AMOG was engaged to conduct the first phase of the LEEUWIN Class Safety Case for HSPO.

This work included constructing the Safety Case Report (SCR) and developing high-level GSN models for the Safety argument.

The task included gathering previous work safety work and other artefacts and constructing an argument / evidence based SCR.

This task was one of the first Safety Cases constructed and approved by DGNCSA at a time when Navy Regulators were still trying to work out what they wanted in a Safety Case argument. This deliverable for this program was seen as a template for others to follow.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



ASC

COLLINS SEA 1429 – ADCAP CBASS HWT Project

South Australia

Safety Case Support

Project SEA 1429 was a multi-phase project that acquired a replacement Heavy Weight Torpedo (HWT) for the COLLINS Class Submarine. The new Mk 48 Advanced Capability (ADCAP) Common Broadband Advanced Sonar System (CBASS) HWT (Mk48 mod 7 HWT) replaced the Mk 48 Mod 4 torpedo previously in service with the RAN.

AMOG was engaged to conduct the System Safety Program for the platform integration issues associated with the introduction of the ADCAP torpedo to the COLLINS Class Submarines and the Submarine Training and Systems Centre (STSC) Weapons Handling and Discharge Training Rig (WHDTR).

In the course of this task AMOG developed safety deliverables in accordance with MIL-STD-882C including: SSPP, PHL, PHA, SRCA, SSHA, SHA, OSHA, HHA, TEHA, SCHR, and SV.

Tenix Defence

SEA 1348, Phase 3 ANZAC Ship Project Underwater and Surface War Fighting Upgrade Program

Williamstown, Victoria

ANZAC Ship Harpoon Missile Launch Capability Safety Case

The ANZAC Harpoon Missile Launch Capability (HMLC) project was supported by a comprehensive approach to assessing risk. AMOG's Safety Case provided evidence of the safety factors incorporated in the HMLC design for subsequent acceptance, deployment, support and disposal of the Capability.

The Safety Case was an element of Certification and provided evidence that the Provisional Acceptance into Naval Service was supported by a logical and structured assessment of the risks associated with all aspects of the capability.

DMO - LCM 2000

Aluminium Landing Craft

Sydney

Aluminium Vessel Hull Cracking Investigation

AMOG acted as the technical lead for the ongoing investigation of cracking damage in a class of small aluminium hull vessels. Hydrodynamic analysis to determine the dynamic wave pressure loads and the bow slamming loads in a number of key operating conditions was conducted, including extraction of the spatial variation of these forces to allow transfer of the loads to structural analysis.

Using these hydrodynamic forces, the structural response of the vessel was assessed. This structural analysis included linear static and transient analysis, which indicated that cracking observed in the vessels was likely a result of fatigue, induced by the combination of the longitudinal bending moments and the bow slamming forces due to the vessel hydrodynamic response.

Scope of work included:

- Use of a 3D Finite Element (FE) model to investigate areas of cracking and overall vessel bending characteristics
- Validation and application of load results from the vessel
- Hydrodynamic modelling and linear static analysis
- Checking of design to DNV standards
- Structural inspection and audit
- Strength and fatigue assessment
- Correlation of predicted damage against recorded defects

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

LandCorp (WA)

CUF Floating Dock

Western Australia

Dry Docking Facilities

AMOG conducted a concept level study of options for the expansion of the AMC Common User Facility (CUF) to service RAN ships and submarines. Evaluation of cost, schedule, risk and flexibility for thirteen options of the facility expansion. Construction methodologies, repair requirements, and launch and recovery operations of each option were assessed. Preferred options for the expansion were identified.

The recommended option for the facility expansion, installation of a floating dry dock, was adopted and developed into a concept design. AMOG was then engaged to conduct a review of the concept design. This study incorporated evaluation of the options for procurement and construction of the floating dock, including new build and refurbished floating docks, and local, overseas and mixed construction/ refurbishment options. Aspects including cost, schedule, risk and flexibility of each option were assessed.

In support of the development of the floating dock concept design, AMOG was commissioned to conduct a numerical analysis of a proposed mooring and manoeuvring arrangement for the floating dock. This study incorporated analysis of the spectral wind loadings due to the prevailing environmental conditions at the site, as well as hydrodynamic effects, in order to provide input into the feasibility of the proposed system as a means of adequately controlling the dock motions. The results of the study also provided valuable advice on the line loadings and the sizing requirements of such a mooring system.

In parallel with the analysis AMOG conducted a high level study to identify alternative manoeuvring and propulsion options for the floating dry dock.

Image courtesy of AMC CUF

AMC Management (WA) Pty Ltd

AMC CUF ANZAC Frigate Docking Study

Western Australia

Docking Study

AMOG was engaged to undertake the feasibility study of docking the ANZAC Class Frigates using the cradles built for docking the COLLINS Class Submarines on the Common User Facility's (CUF) Floating Dock.

The study involved:

- Checking the pressure on the hull during suing
- Checking the pressure on the hull and cradle when the hull is on the cradle
- Calculating the cradle loads
- Determining the bilge blocks required for seismic/hurricane forces and dead loads

United Group (UGL)

RAN ANZAC Frigates

Western Australia

Docking Cradles Detailed Design

The Common User Facility (CUF) at the Australian Marine Complex (AMC) had all of the basic infrastructure to dock ANZAC Class frigates, however had not yet been configured to provide this capability. AMOG had previously performed preliminary docking calculations to verify that it should be possible to dock the frigates using the existing CUF cradles. AMOG was engaged by United Group (UGL) to provide a detailed cradle design for docking the ANZAC Class Frigates at the CUF.

Part of this project also included the delivery of a new bilge block design, specifically for docking ANZAC Class frigates. To achieve acceptable structural integrity at the interface between the bilge block and the cradle, minor modifications to the cradle design were required, with the incorporation of a pedestal support for the ends of the cradle.

The design of the bilge blocks incorporated features to allow for two docking positions of the ANZAC Class Frigates on the docking cradles.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

United Group (UGL)

RAN ANZAC Frigates

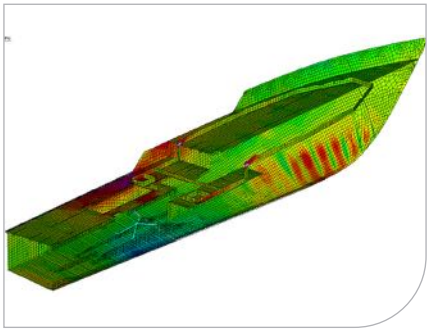
Western Australia

Docking Calculations

AMOG was engaged by United Group (UGL) to produce docking and undocking calculations of RAN ANZAC Class frigate at the Common User Facility (CUF) in the floating dock. This was performed for several docking/undocking evolutions.

The work involved the determination of a suitable trim condition of the floating dock, and condition of the ship by altering the ship's variable loads to ensure:

- Maximum allowable loads on the cradle were not exceeded
- Allowable pressures on the hull structure were not exceeded
- Adequate stability of the ship was maintained during the docking/ undocking process



Australian Customs Service

BAY Class Patrol Boats

Australia

Hull Fatigue Assessment

AMOG was engaged to perform an assessment of the fatigue life of the BAY Class Patrol Boats owned and operated by the Australian Customs Service. The Australian Customs Service was considering extending the service of the boats by another 10 years, as such they needed to be assured that the structure would be adequate for the service.

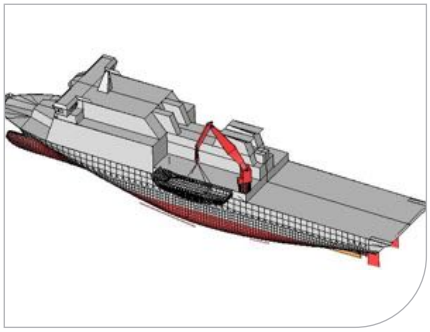
The scope of work involved the hydrodynamic analysis of the boat over a range of sea conditions representative of the boats' operations around Australia. From the hydrodynamic analysis, a set of pressure distributions over the hull were derived representing the various sea conditions. These pressure distributions were then applied to a finite element model of the hull to ascertain the cyclic stress ranges.

Using the operational profile of the vessel, a fatigue life of the hull was calculated and areas of the structure where fatigue failures where likely were identified. The fatigue analysis was validated against the known fatigue failures to date and a reasonable correlation was found.

Based upon the results of the analysis recommendations were put forward for which areas of the hull structure should be cropped and renewed as part of a life of type extension.

Scope of work included:

- Development of hull structural finite element model
- Development of hydrodynamic loads model
- Prediction of sea state stress cycles
- Fatigue life prediction
- Correlation of predicted damage against results of structural inspection
- Determination of fatigue monitoring regime (location and interval)



Tenix Defence Pty Ltd

HMNZS *Canterbury*

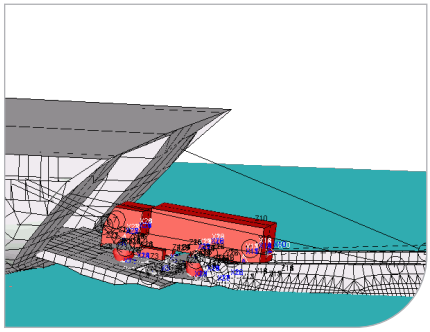
Australia

LCM Deployment and Recovery operations

AMOG was engaged to carry out a formal safety assessment of the personnel and vehicle Ship To Ship (STS) transfer aspects of the operation of the RNZN Multi Role Vessel (MRV) HMNZS *Canterbury*.

A series of time domain numerical simulations of the deployment and recovery of the LCM from the deck of the MRV using the MRVs articulated crane were undertaken to support the safety assessment. The limits of the volume swept by the suspended landing craft as it was lifted from the deck and lowered over the side were determined, together with expected sling and handling rope tensions.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



Tenix Defence Pty Ltd

HMNZS *Canterbury*

Australia

Ship Hydrodynamic Studies

AMOG was engaged by Tenix to provide to provide hydrodynamic analysis on the MRV-LCM transfer operations and to provide seakeeping simulations in higher sea states to provide some form of validation of the Seakeeping Assessment using a more simplified method than had previously been deployed.

The MRV-LCM transfer operations were analysed to assess the availability of vehicle and troop transfer at the top of sea state 3. The analysis was performed in two parts; initially the ramp to ramp angles were checked over a series of wave periods to assess the up-time availability, this was followed up with a dynamic analysis where a vehicle transfer was simulated across the ramps.

In addition, time domain simulations were performed in higher sea states (SS 7 and 9) to validate the initial frequency domain seakeeping predictions.

Based upon the analysis, a recommendation was put forward as to how to maximise operating envelope for the MRV-LCM Transfer Operations.

Defence - DMO - HSPO

LEEUWIN Class Hydrographic Vessel

Australia

Seakeeping Assessment

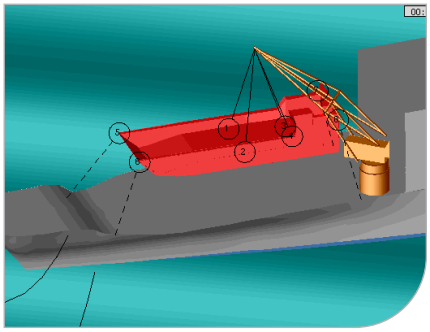
AMOG was engaged to undertake a study into concerns with the seakeeping of the LEEUWIN Class Hydrographic Survey (HS) Vessels.

The study consisted of a desktop review of the documentation, interviews with the crew to identify specific concerns, followed up with numerical simulations.

The numerical simulations compared the base ship to the base ship fitted with a range (15) of commercially available roll reduction measures/devices to ascertain the effectiveness of each of the stabilising systems to reduce the motions to a more comfortable level.

As part of the study, a screening process was applied to rate the measures/devices' suitability for the application. The screening process included weighting the various ship impacts (weight, structural changes, electrical loading, etc.) and total costs (equipment, engineering and installation).

From this process, recommendations were put forward as to the best solution to reduce the roll motions of the ships.



Defence Materiel Organisation

Landing Platform Amphibious (LPA) ships

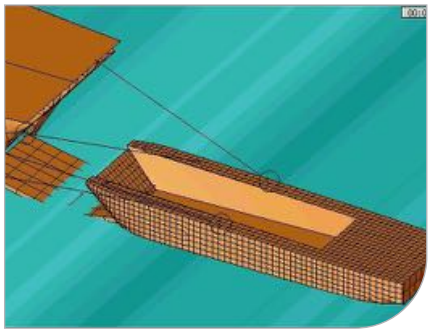
Australia

Analysis of Lifting operations

The Defence Materiel Organisation engaged AMOG to conduct numerical modelling of the lifting operations of the Watercraft onto and off the LPA foredeck. The analysis specifically addressed the clearance between the LPA and the Watercraft, the limiting sea state in which the lifting operations could be conducted, the ability of the Watercraft to be controlled by handling lines during lifting operations and the dynamic loads in the handling lines.

A detailed analysis of the deployment and recovery of the Watercraft from the foredeck of the LPA was conducted, for three specific cases. These analyses took into consideration the influence of the LPA motions (in response to the sea state) on the Watercraft, the influence of the suspended Watercraft on the LPA motions, and the use of handling lines to control the Watercraft.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



ADI Limited

LCM Watercraft and Landing Platform Amphibious (LPA)

Australia

Ship Hydrodynamic Studies

AMOG was engaged by ADI Limited to conduct ship hydrodynamic studies for LCM and LPA craft.

The scope of the Watercraft hydrodynamic assessment addressed the following aspects:

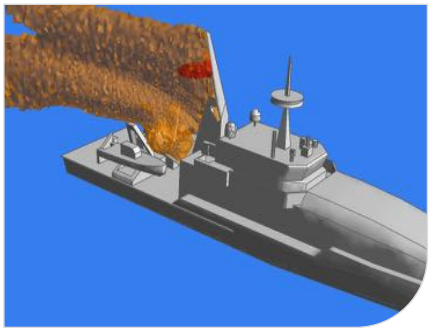
- The ability of the Watercraft and intermediate pontoon to support the loads imparted by the sea state and vehicle movements
- The influence of variations in mooring line characteristics on the response of the pontoon and Watercraft
- The relative angles between the LPA, pontoon, Watercraft, and associated ramps, in respect to the ability of vehicles to be transferred
- The loads acting on the Watercraft and LPA ramps and hinges

A hydrodynamic analysis of the Watercraft and intermediate Pontoon was performed at the top of Sea State 2 using a Pierson-Moskowitz wave spectrum. Advanced modelling techniques were used, taking into consideration:

- Wave height reduction behind the LPA stern
- Wave direction relative to the LPA
- Distribution of vehicles on the Watercraft

Calibration of the numerical modelling was provided through analysis of the existing LCM-8 craft. Animations of the predicted vessel motions were presented for review by current LCM-8 operators, and feedback provided indicated that the predicted motions were very similar to that experienced in reality.

On the basis of AMOG's analysis the Watercraft and Pontoon designs were modified so as to provide reduced loads and improved vessel response.



Patrol Boat Systems Program Office

ARMIDALE Class Patrol Boats

Darwin

Exhaust Plume Analysis, Wind Tunnel Validation, Sea Trial Measurements

ANSYS-CFX, Wind Tunnel Validation

AMOG provided integrated near field exhaust plume dispersion analysis services.

The ACPB fleet was relatively new and was owned and operated by a range of organisational stake-holders. AMOG was commissioned to investigate and analyse the dispersion of toxic gases over a range of operational conditions.

A large series of CFD analyses were carried out to characterize near-field exhaust plume dispersion scenarios in and about working areas and HVAC intakes.

A supplementary wind tunnel model study was undertaken in addition to in-situ gas concentration measurements made aboard during a sea trial. These results were used in the validation process for the CFD model.

AMOG provided expert advice with regard to the applicable tenability standards and used these standards as a basis for subsequent evaluations. The CFD analysis also facilitated comparative evaluation for a range of proposed modifications to the patrol boat configuration to mitigate against highlighted exhaust gas issues.

Scope of work included:

- Expert advice regarding applicable toxic gas tenability criteria
- CFD exhaust gas dispersion simulations
- Physical model wind tunnel simulations
- In-situ full scale field measurements
- Cross method validation
- Naval architecture configuration recommendations

Tenix Defence

MV *Delos* Conversion Helicopter Deck Operability Assessment

Melbourne

Wind Tunnel Modelling, Flight Operations Assessment

AMOG was engaged by Tenix Defence to perform a preliminary assessment of the operability conditions of the helicopter deck for the conversion of the MV *Delos* to HMAS *Sirius*.

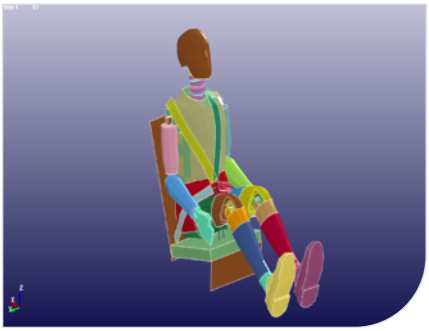
The flight deck operability assessment considered both the turbulence levels over the helicopter deck, due to airflow over the ship superstructure, and any potential thermal gradients over the flight deck due to recirculation of hot exhaust gases from the main exhaust stack. Each of these parameters had the potential to influence the flight conditions for safe helicopter operations.

The study was based on measurements of wind velocity and tracer gas concentrations produced from wind tunnel experiments. The wind tunnel experiments were conducted using the large environmental wind tunnel at Monash University in Clayton, Victoria, using a 1:100 scale model of the final vessel configuration. Steady and fluctuating wind speed over the helicopter deck, and along prospective approach and departure flight paths, were measured for a range of relative wind speeds and relative headings, for background turbulence conditions reflective of both calm and rough seas. Concentrations of tracer gas discharged from the exhaust stack were also measured, as a representation of the exhaust gas dispersion.

AMOG provided further interpretation of the wind tunnel measurements with respect of the flight deck operability under the range of conditions. In the absence of qualitative military standards, the United Kingdom Civil Aviation Administration guidance for offshore helicopter operations, CAP 437, was used as criteria to make a preliminary assessment of the limits of safe operability of the helicopter deck. Based on this criteria, radar plots of the preliminary operability limit were developed.

These plots, along with interpretive description of the conditions and limits of turbulence and thermal gradient over the flight deck and along prospective flight paths, were provided for use as guidance to pilots for the conduct of the first of class flight trials.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



DMO / LEA

M113 and ASLAV Vehicle Mine Blast Simulation

Australia

Model Development and Correlation

AMOG's scope of work included:

- Development of a dynamic model of the M113-A1 for underbelly and track mine blasts
- Correlation of vehicle and dummy performance to measured mine blast data
- Development of a model to represent M113-AS4 variant
- Development of a further model to simulate and assess enhancements to improve mine blast performance of vehicle
- Development of a dynamic model of the ASLAV Type 1 and 2 for underbelly and wheel mine blasts

Department of Defence

Mulwala Munitions Manufacturing Facility

New South Wales

MHF Due Diligence

The Defence Mulwala Facility (DMF) was owned by the Commonwealth and operated by Thales under the Mulwala Agreement (MA). Thales operated the Mulwala Facility to provide propellants and high explosives subject to the Agreement. This agreement obliged the Commonwealth to provide funds for the maintenance of buildings, plant, machinery and capability at the facility.

AMOG was engaged to provide a due diligence assessment of the Thales Proposal for MHF licensing of the facility.

Thales

Benalla Munitions Manufacturing Facility

Victoria

MHF Safety Report

The Thales Australia Benalla facility was officially opened on 9 August 1996, located near Benalla in north-east Victoria. The facility manufactured ammunition ranging from small calibre rifle ammunition through to naval shells, and a range of other military ordnance.

AMOG was engaged by Thales Australia to provide an assessment of the safety report for the Major Hazard Facility (MHF) at Benalla and provide an executive summary that was compliant with Regulation 9.18 (3) of the Commonwealth Occupational Health and Safety (Safety Standards) Regulations 1994 (the Regulations).

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

GHD

RAAF Williamtown Corrosion Control Facility

New South Wales

Hazardous Area Classification

GHD contracted AMOG to perform a third party review of a Hazardous Area Classification (HAC) that was conducted against AS/NZS 60079.10.1:2009 Explosive Atmospheres Part 10.1: Classification of areas – Explosive gas atmospheres.

The HAC was performed for RAAF Williamtown Corrosion Control Facility. AMOG's review assessed the applicability of the employed methodology, inputs, assumptions and conclusions drawn from the assessment of releases of flammable gases within enclosed ventilated spaces.

Comcare

Defence Radiation Facilities

Victoria and South Australia

Potential Major Hazard Facilities (PMHFs)

The Department of Defence had three prescribed radiation facilities, Bandiana, Edinburgh and Woomera that were to store radioactive waste material. The Department of Defence notified Comcare of these three sites being Potential Major Hazard Facilities (PMHFs).

In the capacity of a Specialist Advisor, AMOG was engaged to provide evidence to Comcare to support a decision on whether to classify these PMHF sites as Major Hazard Facilities (MHFs). In support of this, site visits were conducted at Bandiana, Edinburgh and Woomera to gather information on the types of holdings and the associated activities impacting the facilities.

Comcare

Explosive Storage Facilities – Port Wakefield Proof and Experimental Establishment

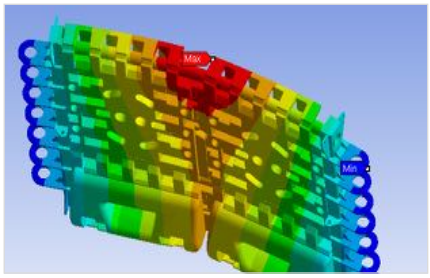
South Australia

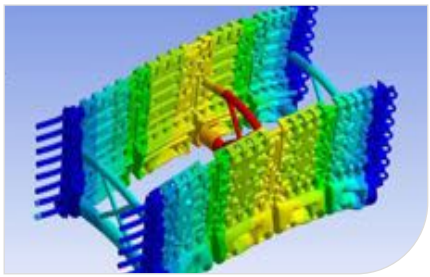
Potential Major Hazard Facilities (PMHFs)

The Department of Defence had a Proof and Experimental Establishment at Port Wakefield (P&EE PW) in South Australia that was used to store explosives. P&EE PW was classified as a Major Hazard Facility (MHF) under regulation 9.07 of the Occupational Health and Safety (Safety Standards) Regulations 1994, as the notified quantities of stored explosive material exceeded the threshold quantities specified in Schedule 9 Part 2.

In the capacity of a Specialist Advisor, AMOG was engaged to provide advice to Comcare to support a decision on whether to revoke classification of P&EE (PW) as an MHF. In support of this task a site audit of the P&EE (PW) was performed and a subsequent assessment report developed for Comcare for their evaluation of the site.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting





Thales Australia Limited

MHF Re-license - Explosive Ordnance (EO) Depots

Australia

Safety Case Assessment

On behalf of the Australian Defence Force, Thales operated 15 explosive ordinance depots throughout Australia. The quantity of holdings were such that each of these sites was classified as a Major Hazard Facility (MHF) under the Commonwealth Work Health and Safety legislation. Comcare was the regulator for Commonwealth MHF and AMOG was on the Comcare panel for approved assessors for MHFs.

To support the MHF licensing, AMOG was engaged by Thales Australia Limited to provide an assessment of the Safety Reports for the MHFs at the 15 EO depots across Australia, and provide an executive summary compliant with Regulation 9.18 (3) of the Commonwealth Occupational Health and Safety (Safety Standards) Regulations 1994.

To support the re-licensing of the MHFs, AMOG was engaged by Thales to provide an assessment of the Safety Cases against the requirements of Chapter 9 of the Commonwealth Work Health and Safety Regulations 2011, for the MHFs at the 15 EO depots across Australia.

AMOG conducted an assessment of the activities and documentation associated with the MHF, including an assessment of the Thales Safety Management System. The AMOG assessment was captured in an Executive Summary that addressed the following matters related to the MHF operator's duties:

- Identifying all hazards that could result in a major incident
- Conducting a safety assessment
- Implementing risk control measures
- Emergency planning
- Establishing and implementing an effective safety management system
- Reviewing risk management (including the safety assessment, emergency plan and safety management system) and the Safety Case
- Providing safety information for visitors
- Providing safety information for local community and authorities
- Implementing safety role for workers
- Consultation and communication with workers
- Security of the MHF

The sites in this study included: Jennings, Twofold Bay, Myambat, Williamtown, Albatross, Amberley, Garbutt,, Stirling, Edinburgh, Fort Direction, Mt Stuart, Darwin, Orchard Hills, Point Wilson, and Mangalore.

HALO

Marine Security Barrier

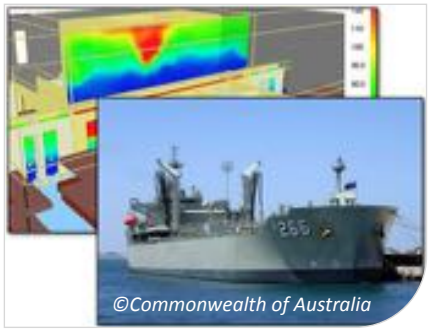
USA

Structural Design

AMOG's scope of work included:

- Detailed design of marine barrier
- Development of finite element model
- Detailed panel design and modelling
- Multiple load scenarios assessed
- Model coupling between detailed finite element structural model and hydrodynamic wave model
- Numerical high-impact load testing
- Design development

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting



BAE SYSTEMS

HMAS *Sirius*

Melbourne, Australia

Fire Safety Assessment for Accommodation Spaces

BAE SYSTEMS were responsible for the conversion of the commercial oil tanker MV *Delos* into the RAN Military Oiler HMAS *Sirius*. The conversion required a detailed safety assessment of the physical modifications and change of vessel use.

AMOG was tasked with providing the complete safety assessment for the conversion. Part of this safety assessment involved fire risk in various compartments, the most critical being the accommodation sections and machinery spaces.

AMOG modelled the worst-case design fires within the compartments, and determined the time until untenable conditions were reached. AMOG then assessed the time likely to be required by personnel to escape these compartments, used this information to create a risk 'bow-tie' model, and determined the level of safety risk as a 'Hazard Risk Index'.

The assessment identified additional, necessary safety controls, and allowed BAE SYSTEMS to claim the level of safety risk 'As Low As Reasonably Practicable' (ALARP).

ALSPO RAAF

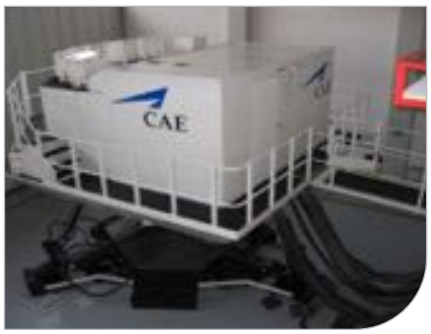
C130 H and J – Fire Suppressant Foam

New South Wales

Safety Assessment

AMOG conducted a System Safety Analysis of the C-130H and C-130J aircraft Explosion Suppressant Foam (ESF) installations. A System Functional Hazard Analysis (SFHA) and System Safety Assessment (SSA) was conducted in accordance with ARP4754/61. The output of this assessment was documented in a Safety Case Report (SCR).

This task required the generation of an ESF Hazard Log which could be imported into the ALSPO in-service Hazard Log.



DSTO

Evaluation of the Land Motion Platform

Australia

Safety Case Assessment

AMOG was engaged by CAE to be the Evaluator (ISA) of the Experimental Vehicle Simulator for DSTO in accordance with the requirements of DEF(AUST)5679.

This activity included the evaluation of the Safety Case and all major deliverables required by DEF(AUST)5679, including hazard analysis, architectural and design analysis documents.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

TFSPO

Model Regulations Gap Analysis

New South Wales

Work Health and Safety (WHS) Legislative Compliance

AMOG conducted a gap analysis of the TFSPO OHS management system with respect to the requirements under the new WHS legislation. Additionally, a review of TFSPO contractor and the TFSPO Contract Manager OHS obligations was conducted with respect to the management of Commonwealth contracts.

The task had two main elements:

- Review of the TFSPO OHS management systems and identification of required changes necessary for TFSPO to ensure compliance against new model WHS legislative requirements
- Review of the TFSPO OHS contract management framework and identification of required changes necessary for TFSPO to meet new model WHS legislative contracting requirements arising from, amongst others, goods and services, and engineering activities in support of TFSPO aircraft fleets.

AMSPO

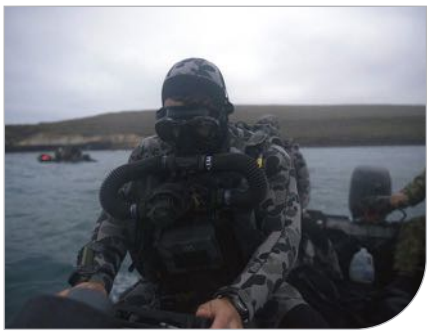
WHS-OPS

Australia

Risk Assessments

Engaged by AMSPO, AMOG's scope was to consider whether Work Health and Safety (WHS) issues in Configuration Item (CI) design had been a requirement of AAP 7001.053 Technical Airworthiness Management Manual (TAREG 3.4.1.c.) and its corresponding guidance chapter (Section 3 Chapter 18) for a number of years. With the release of WHS Act 2011 (Commonwealth), AAP 7001.053 had been accepted as the manner in which Defence aviation-related organisations meet their WHS obligations for design changes on CIs, for which the organisation is the Single Service Logistics Manager.

AMOG was engaged to conduct risk assessments on 179 CIs in accordance with the guidance provided in the Chief Engineer Directive 03/2013. This task included judgements of complexity, FHAs, and development and delivery of safety training to AMSPO staff.



COLSPO

Rechargeable Air Breathing Apparatus Safety Assessment

Australia

Safety Assessment

The Special Air Service Regiment (SASR) was the counter-terrorism response unit for domestic and international maritime security. Along with the existing SASR underwater breathing apparatus, a requirement had arisen for a miniature Self Contained Underwater Breathing Apparatus (SCUBA) set with submerged recharging capability. As a result of this requirement the Divex Rechargeable Air Breathing Apparatus (RABA) was selected for procurement.

AMOG was engaged to develop the Safety Assessment of the residual safety related risk associated with the Divex RABA and details the control measures implemented to minimise this risk.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

A more comprehensive list of AMOG defence clients and projects (alphabetical order):

- AMC Management / LandCorp: Examined the offload of a COLLINS Class submarine and ANZAC Class frigate.
- AMC: Safety Case for the docking and transfer system at the Common User Facility site.
- AMECRC, Transfield Defence Systems, Naval Projects and Support Division and Michael Rikard-Bell and Associates: Participation in the AMECRC High Speed Displacement Hull Form series model test program.
- AMC CUF: ANZAC Class cradle construction, Frigate docking study, modified mooring analysis, floating dry dock study, dock and transfer safety assessment, lift and transport system safety assessment and manoeuvring and modelling study.
- ANZAC SPO: Established the complete Safety Case for the ANZAC Class frigate, consolidating the 10 vessels (and different configurations) and using this framework to establish an online Hazard Log.
- ASC: Return to DOD Safety Assessment.
- ASC: Coordinated all logistics and the management and development of the Submarine Safety Engineering Forum program to assist the Australian Submarine community.
- Australian Submarine Corporation: Developed a Safety Assessment Report for the introduction of the MK-48 Mod 7 Torpedo into the COLLINS Class Submarine.
- ASC: Quantitative analysis of the recovery capabilities of the COLLINS Class Submarine.
- Atlantic & Peninsula Australia: HMAS Choules Exhaust Gas Assessment (CFD)
- Atlantic & Peninsula Australia: SEA3030 HMAS Choules Safety Support for Configuration Change
- Australian Submarine Corporation: Special forces modifications to COLLINS Class submarine.
- BAE Systems: DDG Human Factors Study
- BAE Systems: Fixed Firefighting System (FFFS) Upgrade Feasibility Study for Hydrographic Vessel
- CAE Professional Services: Evaluator (ISA) of the Experimental Vehicle Simulator for DSTO in accordance with the Australian Defence legislative requirements.
- CASG: AOR Certification Manager
- CASG: Principal Engineering and Specialist Systems Safety Support for SEA1654 Project
- CASG: SEA1445 Safety Case Development Support
- Defence DGTA: Review of C130J Safety and Certification Deliverables; the development of airworthiness advice to DGTA for airworthiness boards, and the general provision of expert safety and certification expertise to the acquisition SPO.
- Defence Maritime Services: Development of the System Safety Program Plan for the ARMIDALE Class Patrol Boat System Safety Program.
- Defence Materiel Organisation: Developed management system for capability acquisition health, safety and environment risks.
- Defence Materiel Organisation: Involved in the management of the acquisition of the LESCUT MR(A) acoustic torpedo decoy.
- Defence Materiel Organisation: Produced a framework for the development of a Safety Case for the upgraded ADELAIDE Class Frigate, including integration of MIL-STD-882C safety program tasks into a modern performance based Safety Case framework associated with the operational functions of the Upgraded FFG's.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

- Defence SRSPO: Provision of System and Software Safety expertise for the F111 BUP program, including the interpretation of DO-178B to a legacy development; the conduct of annual audits and assessments; the review of safety and certification deliverables and approval of the software program.
- DGTA: Developed Safety Targets for CAT 2 UAS systems for DGTA. The task involved an industry wide literature review and interpretation against defence requirements.
- Directorate General Technical Airworthiness: Developed Safety Targets CAT 2 Unmanned Air Vehicles.
- Engineering Education Australia: Delivered 5-day System Safety Engineering Master Class training course, which included Defence personnel.
- Fincantieri: Identification of the WHSE Aspects of the SEA5000 Tender Contract.
- Gibbs & Cox Australia: Air Warfare Destroyer system safety training.
- HSPO: LEEUWIN Class Safety Case for HSPO. The deliverable for this program was seen as a template for others to follow.
- Indra: LAND154 Ph2 Weapons Technical Intelligence Level 2 Laboratory System Safety Program.
- Landcorp Common User Facility: Set up and conducted a system safety program for the lift and transit of large maritime platforms (i.e. Ships and submarines) by floating dock and then a trailer system.
- Leighton Contractors: Provide specialist advice on Explosive Ordnance, System Safety Engineering and Major Hazard Facilities for the Point Wilson Wharf upgrade program.
- LHD: Software Assurance compliance review to investigate the Landing Helicopter Dock (LHD) program for compliance to modern Software Assurance standards.
- Navantia
- Naval Group (DCNS)
- Naval Ship Management Australia (NSM): ANZAC Class Docking Calculations
- Patrol Boat Systems Program Office: ACPB Air Quality Measurement
- Raytheon Australia: Developed and conducted the System Safety Program for the Air Warfare Destroyer project including the development of requirements for subcontractor safety programs.
- Raytheon Australia: Training – System Safety Engineering.
- Raytheon: System safety program and the development of a System Safety Program Plan and supporting documentation for the Air Warfare Destroyer Project including software safety, hardware safety, integration of risk control measures into system design, management of system safety.
- Rhode & Schwarz: TAOT
- Royal Australian Navy: Identification and assessment of the toxic effects of the by-products of halogenated fire suppressants (i.e. Halon, FM-200, NAF-S-III, etc.) post deployment of such agents on a fire.
- Royal Australian Navy: Conducted a risk based review of the stowage and handling of unleaded petrol on board RAN vessels.
- Royal Australian Navy: Developed a Formal Safety Assessment for fire risk on the RAN Amphibious Landing Platforms.
- Royal Australian Navy: Developed a management information system for technical training faculty.
- Royal Australian Navy: Developed a restructuring plan for Navy engineering training authority.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

- Royal Australian Navy: Developed site occupational health and safety management system for the Royal Australian Navy's Technical Training Faculty at HMAS Cerberus.
- Royal Australian Navy: Developed site plant and equipment management system Royal Australian Navy's Technical Training Faculty at HMAS Cerberus.
- Royal Australian Navy: Development of a Safety Case Report for the Royal Australian Navy's ANZAC Class Frigates.
- Royal Australian Navy: Fire safety assessment of ANZAC Class frigate main machinery spaces.
- Royal Australian Navy: Member of Commonwealth ADELAIDE Class Frigate Upgrade Team.
- Royal Australian Navy: Review and updated position statements for technical training faculty.
- Royal Australian Navy PBSPO: ARMIDALE Patrol Boat Safety Case refresh.
- Royal Australian Navy: CAPE Class Patrol Boat Safety Case.
- Royal Australian Navy: HUON Class MHC Safety Case refresh.
- Royal Australian Navy PBSPO: ARIMIDALE Patrol Boat RHIB Safety Case.
- Royal Australian Navy: Technical review of replacement sonar dome for suitability.
- Royal Australian Navy: KANIMBLA Class LPA: Risk Treatment Program, Fire Risk Studies for HMAS MANOORA and HMAS KANIMBLA, Review of Engineering Documents, Analysis of LPA Watercraft Lifting Operations.
- Royal New Zealand Navy: Project Protector System Safety Program – Ship to Shore, Whole of Ship Safety Program, MRV-LCM Interaction Study, ILS Support.
- Tenix Defence Marine Division: Provided Naval Architecture support to the ANZAC Ship project in areas such as weight control and sea trials conduct and analysis.
- Tenix Defence Marine Division: Provided Naval Architecture support to the JP2048 Phase 1 project for the refit and conversion work on HMAS MANOORA and HMAS KANIMBLA at Forgacs Dockyard in Newcastle.
- Tenix Defence Pty Ltd Marine Division: Responsible for ANZAC project performance to budget and schedule, and compliance of the delivered ship's with technical specifications. Involved in the successful instigation, negotiation and operation of the ANZAC Class Alliance Contract between Tenix defence, SAAB and Commonwealth of Australia for the ongoing support of the ANZAC Class of ship's post delivery.
- Tenix Defence, Strategy and Development: Involved in Tenix bid for SEA 1444, RAN Replacement Patrol Boat Project.
- Tenix Defence: Analysis of the Replenishment at Sea (RAS) System planned for installation into the NUSHIP Sirius and the development of the safety case to support the activity.
- Tenix Defence: ANZAC anti ship missile defence system safety program.
- Tenix Defence: Conducted a System Safety Program and developed a Formal Safety Assessment for the integration of the Thales Underwater Systems Petrel Mine and Obstacle Avoidance Sonar into the ANZAC Frigate.
- Tenix Defence: Coordination of the conduct of scale model wind tunnel testing of HMAS Sirius, using the wind tunnel facilities at Monash University, Clayton.
- Tenix Defence: Developed a Formal Safety Assessment for the trial fit of a prototype CEA-Far phased array radar system to the ANZAC Class Frigate.
- Tenix Defence: Developed a procedure for a Rough Order of Magnitude (ROM) costing for a project safety program.
- Tenix Defence: Developed the System Safety Program Plan for the ASSC Relocation project.
- Tenix Defence: Development of a Safety Case for the ANZAC Frigate Harpoon Missile Launch Capability.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting

- Tenix Defence: Reviewed existing safety analysis conducted on the ANZAC Frigate Combat System for suitability to act as the basis for the Safety Case for the MK-3E Software upgrade program safety case.
- Thales Australia: OneSky COTS Software Assurance Assessment
- Thales Australia: Provided services to Thales Australia Limited in relation to an assessment of the safety report for several explosive ordnance (EO) storage facilities operated by Thales Australia Limited EO Services.
- Thales Australia: Risk Assessment for carriage of ULP on Minehunter Ships.
- Thales Australia: SEA1778 Project Safety Manager
- Thales Underwater Systems: Conducted a safety assessment of the upgrade to the COLLINS Class Submarine SCYLLA Sonar System.
- Thales Underwater Systems: Training – Safety and Risk Management briefing for senior leadership team.
- United Group (UGL): Produced docking and undocking calculations of RAN ANZAC Class frigate at the Common User Facility (CUF) in the floating dock. This has been performed for several docking/undocking evolutions.
- United Group: Produced production drawings for the fabrication of bilge blocks for the use in dry-docking of the RAN ANZAC Class frigates. Design work included any required modifications to the existing Common User Facility (CUF) cradles.

If you require a more detailed capability document and information on our project experience, please email us: info@amog.consulting