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#### **NUCLEAR**



**OTHER** Industries





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## COMPANY PROFILE & CAPABILITY STATEMENT Overview of PMSC Limited



PMSC Limited is a wholly owned independent UK limited company and has been successfully expanding since its formation in February 1992.

We provide RAMS Consultancy and Management services to the Nuclear, Chemical, Oil and Gas, Defence and Railway industries, both within the United Kingdom and overseas.

Our philosophy is to provide original thinking to solve our client's problems in a technically competent and cost effective manner.

We believe that our track record and client list demonstrates our range of capabilities.

Our core business activities are as follows:

# RELIABILITY AVAILABILITY MAINTAINABILITY SAFETY

Within these business areas we provide reimbursable solutions with personnel integrated into client teams, alternatively we offer fixed price solutions with regular interfacing.

As an additional service we can also provide head hunting service for a fixed % of salary finders fee.



Company Introduction and Policy



PMSC Limited was formed in February 1992 by Paul Mann as a specialised RAMS consultancy providing services to the Nuclear, Oil and Gas, Chemical, Defence and Transportation industries. Our policy is to retain Systems Assurance (RAMS) as our core business, in order to maintain a high standard of competence in our chosen discipline.

Since our formation we have assisted a number of major corporations and have gained a track record in our specialist field. As a result of our in-house project work we have developed a suite of QA procedures, which allow our staff to manage projects effectively and retain the necessary records. Further details of our project control system are available on request.

In addition, we have, in response to the legislation placed on UK limited companies, developed our own Health & Safety Policy.

We hope that you find this information of interest and that PMSC may at some point in the future be of service to your organisation.



PMSC Limited has links with the following countries, and other locations, by agreement.

- UK & Europe
- Canada
- Japan
- Singapore
- Kuala Lumpur
- Hong Kong
- Australia
- Taiwan



#### **SAFETY** Services

# COMPANY PROFILE & CAPABILITY STATEMENT Safety Services

- Safety Case Preparation and Handbooks
- Safety Case Technical Co-ordination
- Hazards Identification including HAZOPs
- Hazards Analysis (including PHA)
- Production of Detailed Safety Related Schematics
- Safety Management Systems Audit/Review
- Safety Management Systems Handbooks
- Safety Assurance Reports and Plans
- Software Safety Assessment and Software Integrity Levels (SIL) Analysis
- Fault and Event Tree Construction and Analysis (using "state of the art" software)
- Escape, Evacuation and Rescue Analysis
- Human Reliability Analysis
- Environmental Impact Assessments
- Environmental Base Line Studies
- Independent Peer Review
- Common Cause Failure Analysis
- Risk Management
- Risk Acceptance Criteria
- Safety Training Courses
- Advice on the UK Construction Design and Management (CD&M) Regulations
- Planning Supervisor Function
- Health and Safety Plans





#### **RELIABILITY** Services

# COMPANY PROFILE & CAPABILITY STATEMENT Reliability Services

- RAMS Assurance Reports and Plans
- · Availability Analysis
- Reliability Predictions
- Maintainability Predictions
- Quantified Risk Assessment
- Failure Modes Effects & Criticality Analysis
- Reliability Centred Maintenance
- Montecarlo Simulation
- Spare Parts Provisioning
- Logistics Support Analysis
- Reliability Data Collection & Review
- Reliability Testing Plans
- · Reliability Growth Modelling Analysis
- Software Reliability Prediction
- · Statistical Analysis and Acceptance Testing
- Markovian Multiple State Modelling
- Producers Versus Buyers Risk Assessment





**MANAGEMENT** Services

### COMPANY PROFILE & CAPABILITY STATEMENT

**RAMS related Management Services** 

- Project Cost Control and Planning
- Project Management
- Preparation of Invitation to Tender Packages
- Production of Technical Scopes of Work
- Production of Standard Conditions of Contract
- Bid Evaluation Procedures
- Strategic Decisions Analysis
- Safety Case Strategic Advice
- Functional Specification Production
- Functional Analysis
- Organisational Management Advice
- Project Risk Assessments
- Expert Witness Services
- Organisation Building in Safety
- Safety Management Systems Audit and Review
- System Integration Function



**System Assurance Training Courses** 



PMSC Limited has developed a bespoke 3 day Systems Assurance Training Course which covers the following areas:

#### **DAY ONE GENERAL INTRODUCTION**

- Safety Management Principles
- Safety Management Standards
- Safety Management Concepts
- Concept of As Low As Reasonably Practicable, ALARP
- Origins of Systems Assurance
- Safety Case Philosophy

#### **DAY TWO** REVIEW OF STANDARDS

- Selected Standards to Suit Client Application
- Safety Risk Management
- Development and Allocation of Safety Requirements
- Safety Integrity Levels (SIL) Following IEC6 1508 as a guide
- Safety Programme Planning
- Verification and Validation

#### **DAY THREE** REVIEW OF SYSTEMS ASSURANCE METHODS

- Preliminary Hazards Analysis, PHA
- Hazards and Operability Studies, HAZOP
- Failure Modes and Effects Criticality Analysis, FMECA
- Fault Tree Analysis/Event Tree Analysis, FTA/ETA
- · Quantified Risk Analysis, QRA
- Human Reliability Analysis, HRA
- Common Cause Failure, CCF
- Cost Benefit Analysis, CBA

For further details of this course, (which can be run at our premises or the clients) please contact Paul Mann on +44(024) 7635 6388, or Roger Lounsbury in Canada on 001 613 584 1889.



Client Listing by Industry Type



PMSC has worked with several major "blue chip" companies, both in the UK and overseas. Some examples from the Nuclear, Oil & Gas and Railway industries are presented as follows:

#### PMSC Client Listing from The Nuclear Industry

- The Atomic Energy of Canada Limited
- Nuclear Electric plc
- Devenport Management Limited
- UK Health & Safety Executive (Her Majesty's Nuclear Installations Inspectorate)
- Allott & Lomax Consulting Engineers
- Thompsons Nuclear (part of Rolls Royce)
- Ministry of Defence, Rosyth
- GEC Alsthom Engineering Systems Limited
- Mott MacDonald Limited, Scotland
- Scottish Nuclear plc

#### PMSC Client Listing from The Oil & Gas and Chemical Industries

- Allot & Lomax for Allomax, UK
- ARCO, UK \*
- British Gas Exploration and Production, UK
- British Petroleum Chemicals, UK
- Conoco UK Limited \*
- Elf Petroleum Norge a/s, Norway \*
- Foster Wheeler Wood Group, UK
- INCO, UK
- Maersk, Denmark \*
- Marathon Oil (UK) \*
- PDO, Oman \*
- Qest Consulting, Australia
- Stratex Worley, Australia
- Stone & Webster, UK
- · Transco, UK





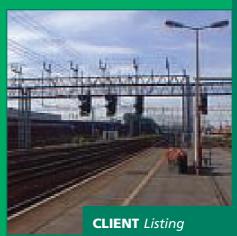
(\* Sub-contacts)

#### PMSC Client Listing from The Railway Industry

- Allot & Lomax Limited
- Blue Print Engineering Limited
- Bovis Construction Limited
- Bombardier Prorail, Kingston, Canada
- Ferson Contractors Limited
- GEC Metro-Cammel Limited
- Interfleet Technology
- Kier Construction Limited
- Kawasaki Heavy Industries, Japan
- Kawasaki, Itoshu, Toshiba Consortium
- · Laing Management Limited
- London Underground Limited
- Mitsubishi Heavy Industries, Japan
- Network Train Engineering Services
- NESIC, Singapore
- Owen Williams Railways (formerly British Rail Design Construct Unit)
- Powell Duffryn Rail Products \*
- Railtrack MPD South
- Railtrack MPD North West
- Railtrack MPD London North Eastern
- · Railtrack MPD East Anglia
- Railtrack WCML (Route Modernisation)
- Railtrack Thameslink 2000
- Rust Kennedy & Donkin
- Siemens, Erlangen, Germany
- Siemens, UK
- Southern Track Renewals Company
- Taylor Woodrow Management Limited
- Thomas Vale Construction Limited
- Toshiba, Tokyo
- Union Railways Limited
- Westinghouse Signals Limited











Some Example Projects from Industry



PMSC has undertaken a number of small and larger scale projects in a wide variety of industries. Some examples are presented below.

#### **NUCLEAR SAFETY RELATED PROJECTS**

#### Nuclear Electric plc

Preparation of the reliability analysis for the Heysham 2 Buffer Store.

#### Nuclear Electric plc

Probabilistic Safety Assessment of the Heysham 2 Carbon Dioxide Cooling System in support of the on load refuelling safety case.

#### • Her Majesty's Nuclear Installations Inspectorate

Peer review of the various THORP safety case submissions.

#### Atomic Energy of Canada Limited

HAZOPs and Safety submission for the MAPLEX project. Reliability and Maintainability calculations.

#### • Ministry of Defence, Rosyth

Preparation of an Invitation to Tender for the eventual Design and Build contract. Detailed technical specifications for the peer review contract for the safety case.

#### GEC Alsthom Engineering Limited

Safety Analysis for the Scottish Nuclear Cry Store proposed for both Torness and Hunterston. Event Tree construction and analysis for the work area 6, Vaults and Storage Tubes.

#### Thompsons Nuclear Engineering Limited

Preparation of safety case documentation for the fuel drying machine and associated interlocks for the SNL Dry Store.

#### • Her Majesty's Nuclear Installations Inspectorate

Provision of technical support in the independent review of dockyard safety cases including



a crane reliability analysis, review of several HAZOP reports and development of an independent Fault Tree model for Overside services.

#### **OIL & GAS AND CHEMICAL RELATED PROJECTS**

#### • Elf Petroleum Norge a/s \*

Review and audit of the corporate safety management system for the whole of EPN's operations in the North Sea.

#### Conoco UK Limited \*

Technical aspects of the peer review of the section 5s (control of major hazards) for safety cases.

#### Marathon Oil (UK)

Preparation of the safety case handbook for Brae A, Brae B and East Brae.

#### Foster Wheeler Wood Group

Brief scoping study for the Magnus Plateau extension safety case.

#### Allot & Lomax for Allomax

Preparation of a specification for a risk analysis framework for the West of Shetland field development.

#### • British Gas Exploration and Production

Preparation of a generic risk analysis template using Fault and Event Tree construction and the analysis tool Fault Tree Plus.

#### Stratex Worley Joint Venture

Preparation of a reliability model using the Reliability Availability Maintainability Package, and secondment of specialist personnel on a sub-contract basis.

#### Qest

Secondment of several safety personnel for Safety Case/Hazards Analysis study work. Major Study for ESSO in the Bass Straits.

#### Stone & Webster for Transco

General safety analysis support to northern gas compression stations, involving HAZOP support, QRA and reliability analysis.







#### • PDO, Oman \*

Provision of HAZOP chairman for hazards identification session associated with a Gas Treatment Facility for a new gas turbine power station.

#### PDO, Oman \*

Consequence calculations for jetfire, and dispersion calculations including the siting of the stack.

#### BP Chemicals \*

Development of a safety plan for a new build Ethylene Cracker.

#### Maersk, Denmark \*

Development of an update to the Maersk Exerter Safety Case - Mobile Drilling Rig.

#### ARCO, Aberdeen \*

Assistance in the development of a Safety Case Handbook for the workforce.

#### TRANSCO UK Limited

Provision of HAZOP Chairman and HAZOP Secretary for three HAZOPs in connection with a new Gas Compression Station.

#### TRANSCO UK Limited

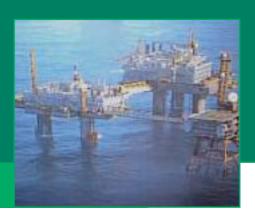
Full reliability analysis for a new Gas Compression Station. The analysis utilised an FMECA/Fault Tree approach and was numerically assessed by TRANSCO failure rate data.

#### • INCO, Swansea

Reliability Analysis of a Nickel Foam Plant using Fault Tree + for the development of a Fault Tree Analysis Model.

#### (\* Sub-Contracts)







#### **RAILWAY INFRASTRUCTURE RELATED PROJECTS**

#### • Taiwan Shinkansen Corporation

RAMS Advisors for a new build high speed railway system in Taiwan using EN50126 as a guiding standard

#### · Kawasaki Itochu Toshiba, Japan

RAMS/Systems Assurance bid preparation and support for the C830 Marine Line project in Singapore

#### Land Transport Authority (LTA), Singapore

Delivery of a tailor made Systems Assurance (RAMS) Training Course

#### Railtrack MPD South

Preparation of the Safety Analysis Report on Class 373/I Structural clearances for the routes between the Channel Tunnel and London.

#### • Jubilee Line Extension Project Team

Scoping study for London Underground Limited on the content of a railway safety case for application to the JLE.

#### Union Railways

Safety assistance on the Channel Tunnel High Speed Link.

#### Jubilee Line Extension Project Team

Updating of Quantified Risk Assessment for the existing Jubilee Line.

#### Westinghouse Signals

FMECA on the moving block signalling system for the Jubilee Line Extension.

#### Railtrack MPD South Zone

HAZOP on Ballast Gluing for the provision of lateral restraint.

#### Railtrack MPD North West

Production of Project Safety Case for the changes to the existing railway infrastructure to enable the operation of the EPS Class 373/2 vehicle in the North West Zone.

#### · Railtrack MPD London North Eastern

Production of Project Safety Case for the changes to the existing railways infrastructure for operation of the EPS Class 373/2 and the Networker Express Class 365/5 on the East Coast Main Line, and the route to Kings Lynn.

#### Railtrack MPD London North Eastern

Input to the HAZOP on generic activities in the following areas, P/Way, Civils, OHLE, Signalling and Telecoms works.



#### Southern Track Renewals Company

Safety Case auditing of approved sub-contractors.

#### · Railtrack MPD East Anglia

Production of a Simplified Project Safety Case structure for small projects.

#### Rust Kennedy & Donkin

Risk analysis of the task of temporary earth strap installation at Designated Earthing Points.

#### • Owen Williams Railway (Formerly BR DCU, Birmingham)

Project risk assessment for location of a crossover near stafford.

#### • Railtrack West Coast Main Line Route Modernisation, Birmingham

Assistance to Railtrack in the supply of Safety Risk Manager and Safety Manager Re-Signalling.

#### Interfleet Technology Limited, Derby

Assistance on the HAZOPs for HEX temporary station for the proposed Fast Train Service and the train care facility (depot) for HEX.

#### Ferson Contractors & Thomas Vale Construction

Assistance in the preparation of Contractors Safety Cases for construction contractors working for the **first** time on the UK railway.

#### • Railtrack Property Projects

Organisation and delivery of the 100 basic Principles training courses for engineering work on the UK railway.

#### Railtrack Thameslink 2000 Project Team

Project Management of the Reliability, Availability, Maintainability & Safety, RAMS.



#### **ROLLING STOCK RELATED PROJECTS**

- Siemens, Krefeld, Germay
   RAMS support to DESIRO (UK) Project.
- Siemens, Erlangen Germany
   RAMS support to Regional Railway North East HEX EMU derivative (Northern Spirit).
- Siemens, Erlangen Germany
   RAMS support to Heathrow Express project.
- Kawasaki Heavy Industries, Japan
   Total RAMS co-ordination associated with the C751B 6 car EMU for the Singapore Changi Extension.
- Kawasaki Heavy Industries, Japan
   RAMS advice to SPI900 project in Hong Kong, new build 12 car EMU for West Rail and East
   Rail including Quantified Risk Assessments and Operational Safety Reports.
- Interfleet Technology Limited
   Management review of the Safety & Reliability Plans submitted by Siemens, the designer of the Heathrow express EMUs.
- Interfleet Technology Limited
   Reliability apportionment study for the proposed Class 91 vibration detection system.







#### Interfleet Technology Limited

Development of a standard for the production of Project Safety Plans and asociated Risk Analysis.

#### GEC Alsthom Metro-Cammel

Organisation and recording of HAZOPs on various train systems on the Northern Line Rolling Stock project.

#### GEC Alsthom Metro-Cammel

Provision of Safety Case assistance on the Channel Tunnel Night Stock project.

#### Interfleet Technology Limited

Preparation of the Safety & Reliability section of a rolling stock fire protection system technical specifications.

#### Network Train Engineering Services

Reliability study on the Class 321 cab bodyside door pneumatic control system.

#### • Blue Print Engineering Services

HAZOP and full Quantified Risk Assessment on the LTF 25 Bogie wheelset on behalf of the designers Powell Duffryn.

#### · Bombardier, Canada

Supply of safety personnel for the rolling stock division.







**DATA** Source Library

### **COMPANY PROFILE &** *CAPABILITY STATEMENT*

Library of Standards & Data Sources

At PMSC Limited we have developed a library of documents relating to every aspect of the RAMS field. The purpose of this library is to provide a reference base that can be used for informational purposes during future projects. Every document in the library is logged into a comprehensive database to allow ease and speed of recovery. The library now boasts some one thousand entries that range from Availability Compliance to 'Waste Management, the BNFL Approach'. Perhaps the most important section of the library, however, is that which deals with the standards applicable to RAMS Assurance working. These standards and guidelines have been gathered together from the UK, USA and Europe. Some examples are quoted below for reference.

TOPIC AREA	INTERNATIONAL STANDARDS
Reliability Analysis (includes analysis and demonstration)	Euro Norm 50126 Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS).  MIL-STD-471a - Military Standard Maintainability Verification / Demonstration / Evaluation.  MIL-STD-2173: 'Reliability Centred Maintainance'.  MIL-HDBK-217F: 'Reliability Prediction of Electronic equipment'.  DEF STAN 00-40: 'Reliability and Maintainability Parts 1-8'.  DEF STAN 00-43: 'Reliability and Maintainability Assurance Activity'.  International Electrotechnical Commissions Standard - 60300 - Dependability Management'.  International Electrotechnical Commission Standard - 60571, Part 3 - Electronic Equipment Used on Rail Vehicles, Components, Programmable Electronic Equipment and Electronic System Reliability.  International Electrotechnical Commissions Standard 60605, Equipment Reliability Testing.  MIL-STD-785B: 'Reliability Program for Systems and equipment Development and Production.  MIL-STD-756: 'Reliability Modelling and Prediction.
FMECA	Military Standard 1629. IEC Publication 812 'Analysis Techniques for System Reliability - Procedure for Failure Mode and Effects Critically'.





**DATA** Source Library

### **COMPANY PROFILE &** *CAPABILITY STATEMENT*

Library of Standards & Data Sources

TOPIC AREA	INTERNATIONAL STANDARDS
HAZOP	IEC 61508 - Functional Safety-Related Systems Parts 1-7. MIL-STD-882B: 'System Safety Management'. prENV50126: 'Railway Applications - The Specification and Demonstration of Dependability, Reliability, Availability, Maintainability and Safety (RAMS)'. DEF STAN 00-58'Hazop Studies on Systems Containing Programmable Electronics'. "Hazop and Hazan" by T Kletz (UK) Institution of Chemical Engineers 3 <sup>rd</sup> Edition 1992. Railtrack Yellow Book (Issue 3).
FTA and ETA	NUREG-0492 'Fault Tree Handbook' D F Hassel, N H Roberts, W E Vesely, and F F Goldberg US Nuclear Regulatory Commission. Reliability and Risk Assessment by J D Andrews and T R Moss ISBN 0-470-23345-1 Chapter 7 Fault Tree Analysis Combined FTA/ETA modeling tool is Fault Tree +

In addition to standards PMSC Limited has several sources of failure rate data available for the quantification of RAMS analysis such as reliability prediction and Quantified Risk Assessment. Some examples are as follows:

DATA SOURCE	COMMENTS
OREDA 92	Mainly used in the offshore oil and gas sector for equipment reliability.
Mil Hdbk 217	Electronics reliability assessment.
IEEE-500	Mechanical and electrical component reliability database compendium.
NPRDS	Non Electronics Parts Reliability Database.
Mil Hdbk 472	Maintainability data handbook.
PMSC in house	Data base of man made accidents around the world since the 1700 hundreds (approx 2500 events logged.)
Railtrack Yellow Book	Railtrack Safety Management System.







Wherever you are, we can do!