DARD Consulting Limited

Duncan Dowling **Curriculum Vitae**

Systems, Safety and Software Engineer December 2024

Specialising in complex dependable systems

Summary

Duncan is a versatile and enthusiastic Chartered Engineer whose specialities include systems, safety and software engineering of complex software/data-intensive applications in highly regulated domains. He has over 20 years' experience in the UK and overseas on large and small projects - mainly in the Rail (ETCS in particular), Aerospace, and Defence sectors and, to a lesser extent, Nuclear. He is experienced in all lifecycle phases of specifying, delivering and assessing complex, critical, software/data-intensive systems.

Duncan thrives working on challenging projects, delivering value and engaging with people at all levels both inside and outside of the organisation. He is confident working either as team leader, team member or external consultant. Duncan is always looking to improve his performance and that of the people around him.

When not working, Duncan enjoys time with his family and enjoying the outdoors cycling, walking or running.

Personal

Security clearance: Lapsed

Full and clean driving licence

Email: duncan.dowling@dard.co.uk

Telephone: +44 (0)7779 281761

Location: Bath, United Kingdom, and willing to travel.

Summary of Skills and Interests

- Systems Engineering:
  - Requirements engineering, e.g. management, deriving/writing/reviewing, tracing/compliance analysis (e.g. showing satisfaction of parent requirements), use of DOORS (including automation using DXL).
  - MBSE, systems architecture, analysis, modelling and design (using Artisan/EA)
- Safety Engineering and Safety Management:
  - Safety Management and Planning
  - Hazard/risk identification, analysis, assessment and mitigation
  - Hazard Log design and management
  - Safety Case author (including use ASCE, and writing plugins)
  - Standards – Def Stan 00-56, IEC 50126/8/9, CSM, CCS TSI/NTSN (ETCS), ARP4754/4761
  - Independent safety assessment, assurance and auditing (ISA)
- Software Engineering:
  - Software requirements definition
  - Assurance against ED-109 / DO-178B
  - Software design and modelling – using, for example, UML, freemat
  - Development – Python, C, C++, PHP, SQL, XML

- Project Management and Team Leading:
    - Duncan has formed and led medium-sized engineering teams.
    - Duncan has been technical leader to small specialist teams on a range of projects.
    - Duncan obtained Project Management foundation level qualifications for Prince2 and APMP

Foreign Languages - intermediate French, rusty German, travel Chinese.

Other Interests - Travel, mountain biking, learning, hiking, running, different cultures, being challenged.

Education and Professional Affiliations

Chartered Engineer (MIET).

1992 BEng (1st Class honours) from Brunel University.

Employment history

2010 – Current Director and Principal Consultant with DARD Consulting Ltd.

1998 - 2010 Senior Systems Engineer with Altran Praxis (formerly Praxis Critical Systems).

1994 - 1996 Project Engineer with PVC Additives Limited (Hong Kong).

Index to Career History

	Aerospace	Railway	Other
Systems engineering	17, 19, 20, 24	1, 2, 4, 8, 9, 10, 11, 21, 26, 27, 28	5, 18
Safety engineering	13, 15, 19, 20, 24	3, 4, 6, 7, 8, 22, 26, 27	14, 16, 18, 23
Software engineering	12, 17, 19	1, 7, 9	

Detailed Career History

1. ETCS Key Management (Mar 2023 - current)

Upgraded Network Rail's off-line Key Management Centres (KMC) for TL and NCL to interface with GB's new on-line KMC (the OKMS), and trained users in its operation.

Providing support to the OKMS programme, including technical review, process definition and overseeing KMC-KMC integration testing.

2. ECDP ETCS Systems Engineer (Apr 2022 – Dec 2024)

Provided ETCS and systems engineering expertise to Siemens on the East Coast Digital Programme. Involving specifically:

- working with cross-industry partners to ensure operability of technical systems;
- architecture modelling;
- requirements analysis and compliance verification;
- SRAC management;
- integration testing of on-line key management systems.

3. P2R ETCS TSR Assurance Engineer (Nov 2020 – Mar 2023)

Duncan worked with NR’s project engineers, operations specialists and other stakeholders to ensure ETCS trains are suitably protected against overspeeding in ESR/TSRs when operating near/in the ETCS L2 area near Paddington and Heathrow Airport. Duncan produced the Safety Justification Report to justify that the associated changes are safe and acceptable.

4. RBLS/OTTO ETCS Systems Engineer (Jun 2020 – Apr 2023)

Duncan provided systems and ETCS expertise on NR's RBLS project, the aim of which is to develop a new train protection system that uses ETCS Limited Supervision (LS) mode to enhance the protection provided by TPWS. In particular Duncan wrote the System Definition, Concept of Operations and supported NR's appointed System Integrator with specifying requirements for the new systems and products.

5. UKAEA Systems Engineer (Mar 2019 – Jun 2020)

Systems engineer at UK Atomic Energy Authority (UKAEA) / Remote Applications in Challenging Environments (RACE) developing architectures/models, eliciting requirements and helping engineers specify, design and deliver upgrades to the JET Remote Handling Systems.

6. Common Safety Method (CSM) Trainer (Oct 2018 – Oct 2019)

Duncan is an approved trainer of Network Rail's one-day CSM training workshop, and delivered training to dozens of Network Rail engineers and managers across the UK.

7. LINX Safety Case (Sep 2018 – Mar 2019)

LINX is a message distribution system that is integral to NR's plan to deliver a number of Rail Operating Centres across Britain, each of which will use advanced Traffic Management technology. Duncan is working with Network Rail and its suppliers to document LINX's compliance with BS EN 50128 and to produce a generic LINX Safety Case.

8. Western ETCS System Safety Engineer (Aug 2016 – Aug 2018)

Duncan worked with Network Rail on the Western ETCS project to ensure that adequate assurance is provided to install and operate the trackside ETCS equipment (i.e. RBC, balises and LEUs). This involved liaising with approval bodies (e.g. SRP), independent assessors (e.g. AsBo/ISA), operators and suppliers to ensure that hazards are adequately identified and controlled, and document the outcome in a Safety Case.

9. Provision of Interim Key Management Centre for Thameslink (Apr 2016 – Jun 2016)

Duncan defined the requirements and subsequently developed and commissioned an ETCS Key Management Centre (KMC) for use on Network Rail's Thameslink project.

The KMC enables the project to generate and distribute ETCS encryption keys (KTRANS and KMAC) to ETCS equipment i.e. the trains' EVCs and the RBC, which are subsequently used to secure the data communications between trains and RBCs.

10. Thameslink Compliance Assessment (Sep 2015 – Mar 2018)

Duncan generated compliance arguments to show that the ETCS trackside signalling system being supplied by Siemens to NR for Thameslink complies with the Control, Command and Signalling TSI and applicable NNTRs. This involves understanding the requirements in the various TSI Subsets / standards, liaising with technical experts, documenting the proposed (at this stage) approach/evidence to show compliance and presenting/agreeing this information with NR and the DeBo/NoBo.

11. Thameslink Systems Engineering (Feb 2013 – May 2018)

Duncan helped Siemens develop the trackside ETCS signalling system for the Thameslink project. He worked with domain experts to derive system requirements and application rules to meet customer requirements and developed system models (e.g. UML using Artisan) and interface requirements to show that the integration of tailored off-the-shelf products satisfy the customer's functional and non-functional requirements.

Activities included provision of advice on rich requirements tracing, performance analysis, hazard analysis, design reviews and support to suppliers to ensure that requirements can and are shown to be achieved.

12. Software support to Multilateration system for use in ATM surveillance (Jul 2012 – Jan 2013)

Duncan provided support and advice to his client regarding achieving and showing compliance with the requirements of ED-109 (closely related to RTCA DO-178B) in advance of an audit by their client. This included revision of planning documents (e.g. SDP, SVP), the software requirements specification and review of vertical and horizontal traceability.

13. Safety Assessment of Collision Avoidance System for a UAS (Feb 12 – Jan 2013)

Duncan developed a FHA and PSSA for a collision avoidance system that is proposed for use in a UAS that will allow use of the UAS outside segregated airspace. This has involved taking into consideration the needs of airspace approval and aircraft certification to identify relevant hazards and derive applicable and necessary assumptions and requirements.

14. Safety Assessment of an Armoured Fighting Vehicle (Aug 11 – Jan 12)

Duncan worked within a team of 5 engineers in his Client's organisation to perform the safety assessment of a major part of this AFV. His specific responsibilities included conducting/documenting HAZOPs, performing subsequent safety analysis, authoring the safety case (report) and supporting the main Client and their suppliers in design reviews to ensure hazards are adequately controlled and are shown to be so.

15. Safety Assessment of Multilateration system for use in ATM surveillance (May 11 – Jun11)

Duncan provided technical support to produce safety documentation for a system that uses multilateration of aircraft transmissions to calculate the aircraft's position. This information is used by controllers to monitor and manage the safe movement of aircraft. This involved defining safety targets, identifying hazards, deriving systems safety requirements and collating evidence that the requirements are achieved. This information was documented in FHA / PSSA / SSA reports consistent with the guidance in the Eurocontrol Safety Assessment Methodology (SAM).

16. Independent Safety Advisor to Ceres Power Limited (Oct 10 – Mar 11)

Duncan was appointed by Ceres Power Limited, a publicly listed manufacturer of CHP systems that use novel fuel cell technology, to act as an independent Safety Advisor for aspects of the design and certification process. Duncan reviewed the safety assessment approach, the results of the safety analysis and associated derived requirements. Additionally Duncan audited aspects of the safety and engineering programme to ensure that activities were being carried out as planned and that appropriate evidence (from safety, design, manufacture, build, test, installation, operation) was available to support the Safety Case. Duncan reported the recommendations to the Ceres safety committee and the board appointed Technical and Operational Risk Committee.

17. Protection System – Architecture Development, Software Team Leader, Software Design and Development (Feb 08 – Dec 10)

Duncan worked in various roles during the engineering of this flight-critical subsystem for a new fighter aircraft which was certified to DO-178B (level B). This involved the use of DOORS for requirements management/tracing, UML (using EA) for defining the software design, modelling tools (i.e. Freemat) to design high-level algorithms, Code Composer for development of C code for a Texas Instruments (TI) DSP and LDRA for static analysis.

As Software Architect, Duncan worked with the Client to define software requirements, resolved technical issues, maintained the High Level Design and ensured designs were produced and implemented taking into account cost, schedule, Client intent, qualification, complexity and future needs. Additionally Duncan defined the strategy for providing requirements traceability and assisted in defining verification strategy for some requirements.

As Development Team Lead, Duncan formed the development team of 10 software engineers and defined the detailed design and implementation processes.

Following parenthood, Duncan completed the detailed design, implementation and verification of one of the major sub-systems, and performed detailed code review of other sub-systems to de-risk performance, determinism, occupancy and maintainability issues.

18. Nuclear Safety Assessment – Safety Assessment of the Architecture of the Instrumentation and Control Systems for a Nuclear Power Station (May 09 – Jul 09)

Duncan was part of the team for step 3 of the Generic Design Assessment of a nuclear power station. In particular he helped define the criteria for the assessment and carried out the assessment of the suitability of the architecture of the instrumentation and control systems against the NII's Safety Assessment Principles.

19. Senior Systems and Safety Engineer for WATCHKEEPER – Thales UK (Dec 2004 – Jan 08)

Duncan undertook a variety of roles on this complex UAV project for Thales, including Project Manager, Senior Engineer and for the last year as Technical Authority. Key responsibilities included:

- determining appropriate safety activities and ensuring they are carried out adequately, for example, Hazard Log management, system safety analysis reports and specification of safety requirements for sub-system suppliers to be contracted against;
- leading safety assessments of the programme's supply chain against 00-56 issue 3 and providing guidance on how to overcome identified weakness;
- presenting to Thales' customer, the MoD, and the MoD's SMEs and Independent Assessors, on various aspects of the WATCHKEEPER safety programme;
- determining approach for management and integration of safety data to produce a convincing Safety Case.

20. Systems and Safety Engineer for LM CD – Ultra (Jul 2005 – Oct 2005)

Praxis was part of a consortium being led by Ultra to provide equipment and services to allow the MoD to explore the use of loitering munitions by the armed forces. Duncan carried out a preliminary safety and environmental risk assessment in support of the bid to provide the MoD with confidence that safety and environmental risks could be adequately managed should the contract be awarded to Ultra.

21. System Architecture/Analysis/Modelling – Eukorail (South Korea) – Alstom Transport (May 2004 – Nov 2004)

Duncan carried out system-level analysis for the Electrical and Mechanical (E&M) equipment for a new railway line from Seoul to Incheon International Airport. The contract contained very detailed requirements/specifications for the sub-systems: signalling (supplied by Alstom), rolling stock, communications, power supply, SCADA, catenary systems and platform screen doors. Duncan supervised another engineer and worked closely with the project's customer, other Eukorail engineers and suppliers. He produced a model of the overall system architecture, elicited top-level system functions, documented how the sub-systems achieve the required system functionality and estimated the execution time for critical functions. The work involved gaining an in-depth understanding of all of the sub-systems and their interfaces, and was accepted by the end customer.

22. Safety Engineering for Network Rail – WCML (Jan 2004 –Apr 2004)

Duncan worked with Network Rail to help them gain safety approval for enhanced operations on the West Coast Main Line. The project aimed to demonstrate that the safety risks associated with new operations are acceptable. These risks were assessed across 13 different infrastructure areas, e.g. electrification, structures, stations, radio. Duncan produced the assessment for 'Data Management', which includes requirements, asset and signalling scheme data. With the help of domain experts, he identified the risks associated with incorrect / unavailable / ambiguous data, evaluated this risk and recommended ways to reduce it to an acceptable level.

23. Safety Engineering for a Submarine System (Nov 2003 – Dec 2003)

Duncan carried out the preliminary hazard analysis (PHA) of this system and subsequently produced a PHA report identifying the hazards and assumptions made during the analysis.

24. Safety Engineering for a New Military Reconnaissance System (Jul 2003 – Oct 2003)

Duncan was part of a team carrying out safety analysis for a new UAV (Unmanned Air Vehicle). He provided safety support to Thales during the procurement phase of the programme. The analysis was being undertaken according to the requirements of Defence Standards 00-55 and 00-56 and JSPs 318B and 454.

Duncan updated the earlier work including hazard identification; causal and consequence analysis; and derivation of system and subsystem safety requirements and their associated safety integrity and developed the Safety Case to support the Prime Contractor's bid to the MOD. Part of the work included assessment of major subsystem suppliers' capability to comply with project standards and making recommendations for improvement. The recommendations were implemented and were a significant factor to a positive report being provided to the MOD by the ISA (Independent Safety Auditor).

Duncan was responsible for the development of key safety deliverables, particularly Safety Case Reports, the Hazard Log and the electronic Safety Case.

25. Miscellaneous Internal Praxis Projects (Apr 2003 – Jun 2003)

Duncan carried out a number of small projects including automation of the time reporting procedure for one of Praxis' sister companies, production of a white paper on Data Management that was presented at an international conference in Canada, and modelling of internal business processes, and development of product requirements for Praxis' eSafetyCase technology.

26. Research into Management of Critical Data for ERTMS (Oct 2002 – Mar 2003)

Duncan was the technical lead for a small team of engineers throughout this research project carried out for Railway Safety. Its primary goal was to identify a framework for the management of high integrity configuration data to operate a new train signalling and protection system (namely ERTMS). The project developed a framework, identified the requirements for each component of the framework and identified specific techniques that could be used to ensure the integrity of data through its lifecycle. Input to the project came from review of material in the public domain, from discussions with people working in critical data management and through a structured workshop (similar to a HAZOP) attended by engineers.

27. Product Acceptance for Railtrack (Jul 2002 – Aug 2003)

Duncan worked with Railtrack (now Network Rail) towards product acceptance of a novel trackside power supply system, which uses microprocessors to facilitate high availability of a power supply to trackside equipment without the need to lay redundant power supply cable next to the track. Duncan developed a specification of the system's requirements, which is to be used to define Railtrack's requirements for the system, so that solutions can be assessed against them.

28. Systems Engineer for TASW (Feb 2002 – Jul 2002)

This was a large railway signalling project, managed by Bombardier as part of Railtrack's Thameslink 2000 (TL2k) project

Duncan worked closely with the Systems Engineering Manager on this large, critical (time, cost, and safety), complex and innovative project.

Duncan's main tasks during this time included:

- review of the project's system engineering processes against current best practise, as defined by a combination of elements of CMMI and IEEE 1220;
- development of a process (and tool) to record and report project-wide engineering issues;
- production and issue of a procurement specification for one of the project's major subsystems and interview of tenderers; and
- consolidation of the assets needed by the project into a format to support identification of overlaps and under laps and subsequent procurement.

Practical Experience

Machines and Operating Systems

Windows, Unix

680x0, 8051, TI2812

Standards

Def–Stan 00-55, 00-56, 00-58 MOD standards for Safety Critical Defence Equipment

Cenelec 5012x RAMS and software standards for Railway Applications

RTCA DO-178B

Programming Languages

Python, DXL (for DOORS), C, C++, Assembler, SQL, Pascal, BASIC, FORTRAN, HTML, PHP, XML, XSL, Perl, JavaScript, VB and programming of PLCs.

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Software Tools

Databases: Access, MySQL, Oracle, DOORS.

LDRA TestBed Analyser.

MS Office, MS Project, MATLAB, Freemat, Visio.

UML using Enterprise Architect, Artisan and Visio.

Adelard's 'Assurance and Safety Case Editor' (ASCE).

Formal Training

APMP - IPMA Level D (2007)

PRINCE 2 Practitioner (2005)

STORM – systematic risk analysis of operational risk – Praxis (March 2004)

GSN Workshop – Origin Consulting (Feb 2004)

Facilitation Skills – (July 2003)

Engineering Safety Management – The Yellow Book – Praxis (May 2002)

Managing Risk Associated with Human Error - HRA (2000)

SPARK Software Engineering Course - Praxis (1999)

REVEAL Requirements Engineering Course - Praxis (1999)

Technical Planning Workshop - Praxis (1998)

Published Papers

D Dowling, D Jackson - Top-down Meets Bottom-up: Experiences in Integrating Existing Components in Transport Systems, Presented at INCOSE Spring Conference, Swindon UK, May 2005

K Frazer, D Dowling, M Ainsworth, Developing Data Management Processes for Safety Critical Systems, 21st International System Safety Conference, Ottawa, August 2003.