Appendix A: Table A.1: Some key initiatives related to the emerging concept of functional safety (1980 to the mid-1990s)

Item	Period	Projects & Initiatives	Key Outcomes
1	1980 - 1990	The Commission of the European Communities (CEC) funded a joint project between seven organisations. The project ran for 2 years from September 1983. These organisations already had programmes of research in the fields of Programmable Electronic Systems (PES's) and robotic safety. The CEC funding provided the opportunity to collaborate in the exchange of information which would, hopefully, lead to harmonization of approaches to assessment of PES's in this field across Europe. (Bell)	• Development of European approach; • Developing European network; • Identifying key challenges; • Identifying possible solutions.
2	1980 - 1987	Work began in the Health and Safety Executive (HSE), in the UK, on the development of guidance on the safe application of Programmable Electronic Systems. After several research projects and extensive collaboration and consultation with UK industry this led, in 1987, to the publication of guidance on "Programmable Electronic Systems in Safety-Related Applications" (HSE PES). This guidance was referred to as the "HSE PES guidelines" and are considered to be the first to be produced by a safety regulator covering industrial systems providing detailed guidance on the safe application of programmable electronic systems.	• Facilitated the adoption of programmable electronic technology for safety applications • The guidance was a major UK input into the Working Group developing the systems requirements of IEC 61508.
3	1980 - 1984	The UK proposed, through the relevant BSI Technical Committee, that an international standard be developed to deal with safety critical software. This led to an IEC Working Group being formed and active work on this project started in 1984. This work preceded the work on the systems aspects of functional safety. (see item 5).	• The publication of IEC 61508: Parts 1-7 (1998-2000) with respect to the specific sections concerning software.

Appendix A: Table A.1: Some key initiatives related to the emerging concept of functional safety (1980 to the mid-1990s) [Continued]

Item	Period	Projects & Initiatives	Key Outcomes
4	1985 - 1988	In 1985-1986 a UK proposal to the Advisory Committee On Safety (ACOS) of the IEC to develop an international standard on Programmable Electronic Systems (PES's) led to a Task Group to elaborate the proposal further. This led to an IEC Working Group being set up to develop an international standard on PES's.	• The Task Group elaborated the initial proposal and undeveloped basic contents. • The Task Group proposal was then voted on internationally and accepted. • This Task group document was the basis of the work undertaken by the IEC Working Group described in Item 5.
5	1988 - 2000	An IEC Working Group started work on and international standard title "Functional safety of Programmable Electronics Systems: Generic Aspects. The Software Working Group (see Item 3) and the Systems Working Group collaborated very closely with the intention of producing two standards, one for systems and one for software but after consultation on an early draft standard in 1989 it was agreed that one standard would be produced covering both systems and software requirements.	• The publication of IEC 61508: Parts 1-7 (1998-2000). • IEC 61508 was a generic standard to be used as a standalone but also to facilitate sector/product standards. • Safety Integrity Levels introduced in the 1989 draft.
6	1989	The IET (formerly the IET) published a document "A study of the computer-based systems safety practices of UK, European and US industry". This was funded by the UK DTI. (IET-Safety Practices Report). [IET- Safety Practices Report].	• In the context of standardisation, the overall view of the study was that a common international standard on safety related computer-based systems was supported within the UK, Europe and the USA.

Appendix A: Table A.1: Some key initiatives related to the emerging con-cept of functional safety (1980 to the mid-1990s) [Continued]

Item	Period	Projects & Initiatives	Key Outcomes
7	1989	DIN V 19250:1989: "Measurement and Control technology; Fundamental safety aspects to be considered for measurement and control equipment".	• This German standard had the concept of a Requirement Class (a precursor of the Safety Integrity Level (SIL)). The Requirement Class was a classification specifying the safety requirements needed to prevent and overcome specific types of dangerous failures. • The standard included a Risk Graph comprising eight Requirement Classes. (See item 8)
8	1990	DIN V VDE 0801:1990 "Principles for computers in safety-related systems".	• Specified required and recommended techniques for Hardware and Software (to a lesser extend) of computer systems for the DIN V 19250 risk levels. (See item 7)
9	1990 - 1990	A UK Government Consultation Document was published on the Safety of Computer-control Systems comprising two parts: SafeIT-1: The Safety of Programmable Electronic Systems. Covered several wide-ranging issues including that of standardisation. Indicated the advantages of all sectors following a common approach to standardisation but stressed the importance of the derivation of more specific sector standards from a generic standard. (SafeIT) SafeIT-2: Standards framework. Set out the proposed Framework Concept for the development of standards and elaborated Core Standards for the Framework. (SafeIT)	• The Standards framework influenced the development of IEC 61508. • The Safety-Critical Systems Club was conceived within the framework of the SafeIT initiative. The first Safety-Critical Systems Club Newsletter was published in November 1991.

Appendix A: Table A.1: Some key initiatives related to the emerging concept of functional safety (1980 to the mid-1990s) [Continued]

Item	Period	Projects & Initiatives	Key Outcomes
10	1991	Interim Def Stan 00-55/Issue 1 5 April 1991 – The procurement of Safety Critical Software in Defence Equipment Part 1: Requirements Part 2: Guidance	• Strong emphasis on the adoption of Formal Methods.
11	1991	Interim Def Stan 00-56/Issue 1 5 April 1991 – Hazard Analysis and Safety Classification of the Computer and Programmable Electronic System Elements of Defence Equipment. Issue 2 of 00-56 radically changed and became "Safety Management Requirements for Defence Systems" (13 Dec 1996). The emphasis evolved, certainly from Issue 3, to defence systems of all types and not just programmable.	• Claim limits introduce for dangerous systematic failures; • Claim limits based on Safety Integrity Levels (SILs); • Claim limit based on operational experience or where none existed based on qualitative failure criteria: SIL 1= Frequent; SIL 4 = Remote).
12	1988 & Revised 1992	Publication of HSE document "The Tolerability of Risk from Nuclear Power Stations". Suggested, for a risk of death for an individual worker, a risk boundary for what could be deemed just tolerable and one deemed unacceptable (i.e.10^{-3} per year). (SafeIT)	• Facilitated the establishment/demonstration of the Tolerable Risk. • This publication eventually led to the HSE publication "Reducing Risks, Protecting People". (R2P2)
13	1992	Education & Training Requirements for Safety Critical Systems IEE Public Affairs Board Report Number 12; January 1992	Recommendation: • Courses shall be developed and shall result in an accredited award (e.g. certificate).

Appendix A: Table A.1: Some key initiatives related to the emerging concept of functionalsafety (1980 to the mid-1990s) [Continued]

Item	Period	Projects & Initiatives	Key Outcomes
14	1994	MISRA (Motor Industry Research Association) 1994: Development of guidelines for vehicle-based software.	• MISRA Developed guidelines for vehicle based software. Based on principles from the emerging IEC drafts, including adoption of Safety Integrity Levels (SILs).
15	1995	Safety-Related Systems, Postgraduate Qualifications, Syllabus Proposals IEE Public Affairs Board Report Number 13; January 1995.	• Information about topics that postgraduate post-experience education and training safety-related and safety critical systems; • The topics were raised in modules based on the Safety Lifecycle.
16	1995 Updated 2003	"Out of Control-why control systems go wrong and how to prevent failure". Published by HSE (freely available to download). (Out of Control)	• The analysis of control system incidents underpinned the need for the concept of a Safety Lifecycle.

Appendix A: Table A.1: Some key initiatives relating to the emerging concept of functional safety (1980 to the mid-1990s) [Continued]

Item	Time period	Projects & Initiatives	Key Outcomes
17	1999 and updated in 2007. (Currently under review; new revision expected 2016)	Safety, Competency and Commitment- *Competency Guidelines for Safety-Related System Practitioners* Published by the IEE who managed the work to produce the guidelines which was carried out in collaboration with the British Computer Society (BCS). The UK health and safety executive commissioned the IET to manage the initial study that underpinned the development of the guidelines.	• Based on developing a Competence Profile, comprising three levels of competence, for each Task and Attribute. • Tasks are technical skills and knowledge; • Attributes are behavioural skills and knowledge.
18	2007	• Managing competence for safety-related systems- Part 1: Key Guidance. (Managing competence #1) • Managing competence for safety-related systems- Part 2: Supplementary material. (Managing competence #2) The guidance was issued by the Health and Safety Executive, the Institution of Engineering Technology and the British Computer Society.	• Guidance for those who are responsible for managing and assuring the competence of individuals and teams.