



How Functional Safety has and is impacting the modern world

A brief look at what has been happening in the area of functional safety since the introduction of IEC 61508 over 25 years ago, some good, some not so much!

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In the beginning?

- IEC 61508 released in 1998, - basic safety standard for functional safety,
- Culmination of more than two decades of work, by regulators, industry and standard bodies including UK HSE 1987, EEMUA 1989, CCPS 1992, ISA 1995 and of course IEC & BSI groups.
- The catalyst for PES standards was driven by computer control systems incidents during the transition from hardware to microprocessor-based systems dating as far back as the 1960s.
- 40 years since it was first identified that, although new technology brought enormous benefits, if we couldn't learn to identify and manage the associated hazards, then we would not be able to fully reap the rewards.
- So, what has been the impact of FS since 1998 and during technological change what should we consider, such as AI and Cobots for AAL?
- We have seen a great improvement in the way we manage our safety-related systems.
- The knowledge base has certainly evolved as complexity has increased, and the number of Functional safety practitioners has also grown.
- Let's explore!



So what negative impact has FS had?

- Initially, the standard seen as the domain of the C&I team.
- Several years before process, mechanical and safety engineering began engaging with the standard and its industry versions such as IEC 61511.
- A negative impact on SIL determination studies due to lack of multidisciplinary approach.
- Probability of over or under engineering of safety functions, in some cases research (Marszal) suggests by as much as 50%.
- Improvements came with improved competence of the teams that reduced the impact of those early years.
- But it is very difficult for a high hazard business to convince a regulator that the derating or removal of a risk control measure is a positive step or considered continuous improvement.
- The impact of lack of understanding of FSM and the rationale behind it was also a negative impact.
- Many companies assumed QMS was enough therefore, approaches to FSM were disjointed and inconsistent.
- Verification, validation and FSA was misunderstood causing system failures and incidents.
- Improved competency, software tools and formal FSM oversight at critical phases has helped address this.
- Terms such as “Achieving Systematic Capability” were not widely understood nor was the link to human error or even that guidance was included in the standard.

So what has been the positive impact of FS?

Apart from providing a good living for a lot of FS engineers. FS has many positive impacts for how safety-related systems are designed & managed across industries through sector standards & guidance that have been developed for:

- Household Appliances
 - Electrical & Gas Distribution
 - Nuclear Industry
 - Process Industry
 - Machinery Industry
 - Entertainment Industry
 - Automotive Industry
 - Railway Industry
 - Medical Industry
 - Aerospace Industry
 - Automated Valves & Robots
- All use parts of the IEC 61508 basic safety standard.



The impact of many Standards?

- Sector standards have improved how engineers manage FS in their industries, which are written in terms and definitions they can relate to, for example:
 - SILs are expressed in relatable scales.
 - FS Standards can be harmonised, where required.
 - FSP, Assurance and Assessment is proportionate.
 - Verification and Validation is sector orientated,
 - Targeted Operation & Maintenance & Testing
 - Hardware & Software techniques can be shared across sectors.
 - Shared learning across industries due to common basic standard



Current Impact.

- Several incidents can be related to poor FSM over the last 25 years, such as:
 - Buncefield (2005)
 - Texas Refinery (2005)
 - Flare Drum overfills (2009)
 - Automotive fatality (2009) .
 - ESD Valve failure (2018)
- All of these and other PES related incidents have provided learning for the businesses directly involved and the wider FS community.
- FSM, V&V and FSA has improved greatly over the last 10 years and the number of competent practicing FS Engineers has grown.



Future Impacts

- 25 years ago we would not have envisaged FS techniques and measures being used in household appliances or the entertainment industry.
- Standards addressing Active Assisted Living (AAL) apply IEC 61508 for the FS concepts.
- The increased use of robotics
- AI is already raising safety concerns, and its safe (2024) & secure (2023) application is the subject of current guidance and developing standards.
- Cyber Security must be embedded in safety-related systems design and standards are struggling to keep pace with an ever-changing landscape.
- Some countries have already legalised the application of FS standards, their mandatory use should a serious consideration specifically in areas such as autonomous vehicles.



Summary

- We have seen great improvements in the application of the FS standards and the competency of engineers applying them over the last 25 years.
- There is now a multitude of committees looking at the various facets of FS in technological groups as well as industry sectors.
- FS is now a discipline in many industries and a subject taught in Universities as well as in vocational courses.
- But, for the standards committees, institutes and associations who develop the guidance to keep pace and remain relevant with the changes in modern world the next generation of engineers need to engage and join in.
- Today's agenda covers many of the key topics of FS, please enjoy your day.



Any Questions?

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What's next....

Slot	Start Time	Paper	Finish Time
3	10:00	Slot 3: T6A and TCSA History and Principles Peter Brown – Lloyds Register / Andrew Derbyshire - ERM	10:20

We would be more than happy to discuss membership with you (<https://61508.org/membership/>)