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Title: “Risk Minimization by the use of Failure Mode Analysis in the Qualification of New Technology, applied to Intelligent Field Systems“

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Industry has recognised the value of failure mode analysis, which is being used on a rapidly expanding scale, to minimise risk, increase the probability of success and target product development spend to optimise life cycle costs for new technology. This paper illustrates best practice in failure mode analysis for oil and gas projects, by using recent case studies addressing intelligent well completions, and sand control including expandable technologies. The paper explores how these methods are applied to larger integrated systems, such as intelligent fields.

From a systems perspective and despite the completely different origins and objectives, there are striking similarities between an intelligent oil field and an integrated air defence system. We use this comparison to highlight key aspects: both are networked systems connecting many individual assets with one or several control centres, operating in real time and being mission-critical. Both systems require effective reversionary modes to minimise the impact of failures on the primary deliverable (hydrocarbon production and surveillance coverage respectively).

The paper highlights how methods originating in the defence and aerospace industries are adapted for the specific requirements of oil and gas projects, and identify the key issues from recent project experience, namely –

- Complete system approach
- Functional requirements
- Life-cycle phases
- Traceability
- Cost of failure
- Directly usable results that are fed back into the design, development and implementation processes.

These issues are critical wherever the risk of applying new technology is high, which is true of most oil and gas E&P projects, particularly those with significant downhole complexity as they are subject to the worst operating conditions and the highest consequences of failure. Risks are also seen to increase when the system depends upon software control and networking communications. *Intelligent field systems have all of these.*