Safety Risks in an Airworthiness Organisation

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May 2016

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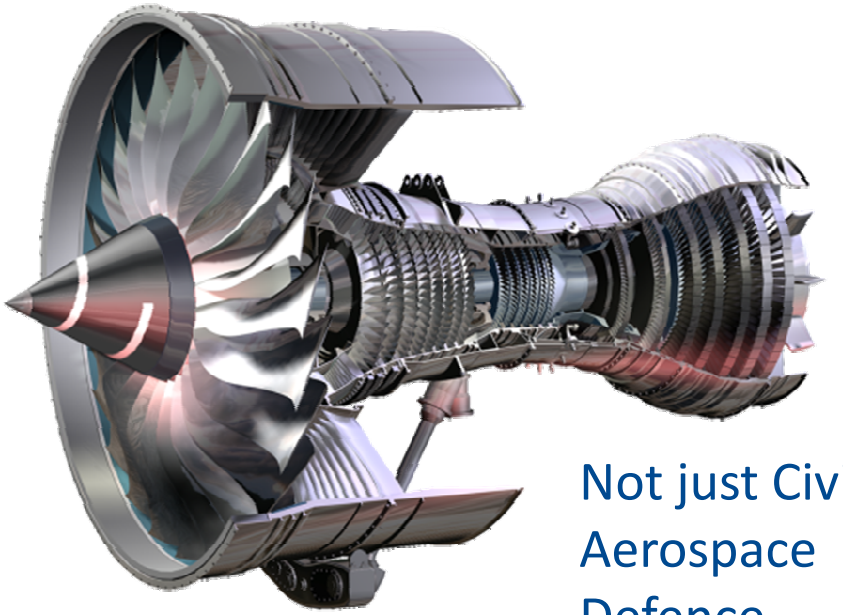
One Safety Management System



Not just Civil
Aerospace
Defence
Nuclear
Marine
Power Systems

Gas Turbines
- Design
- Manufacture
- Maintain
- Services

Global
- UK
- Germany
- USA
- Singapore

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What Can Manufacturers Affect?

Assumptions of Operation

Analysis and Demonstration

Instructions and Limits

Conforming Product

Behaviour of the product in operation

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Risk management requirements – ICAO Annex 19

2. Safety risk management

2.1 Hazard identification

2.1.1 The service provider shall develop and maintain a process that ensures that hazards associated with its aviation products or services are identified.

2.1.2 Hazard identification shall be based on a combination of reactive, proactive and predictive methods of safety data collection.

2.2 Safety risk assessment and mitigation

The service provider shall develop and maintain a process that ensures analysis, assessment, and control of the safety risks associated with identified hazards.

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Risk management requirements – CS-E

CS-E 510 Safety Analysis

(a)

(1) An analysis of the Engine, including the control system, must be carried out in order to assess the likely consequence of all Failures that can reasonably be expected to occur…..

(2) A summary must be made of those Failures that could result in Major Engine Effects or Hazardous Engine Effects …. together with an estimate of the probability of occurrence of those effects.

(3) It must be shown that Hazardous Engine Effects are predicted to occur at a rate not in excess of that defined as Extremely Remote…..

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Risk management – Continued Airworthiness

Part 21

(c) Investigation of Reported Occurrences

1. When an occurrence …….. results from a deficiency in the design, or a manufacturing deficiency, the holder of the type-certificate ……. or the manufacturer as appropriate, shall investigate the reason for the deficiency and report to the Agency the results of its investigation and any action it is taking or proposes to take to correct that deficiency.

2. If the Agency finds that an action is required to correct the deficiency, the holder of the type-certificate…… or the manufacturer as appropriate, shall submit the relevant data to the Agency.

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Traditional Approach

- **In line with CS-E and Part 21**

  and

- **In line with Rolls-Royce safety policies, for example:**
  - ***Single Point Mechanical Failure***

  The design of all new products shall avoid single point failures that lead to a hazardous consequence either directly or via a credible progression route.
  If it is not reasonably practicable to design out the failure, it should be mitigated by incorporating independent defence into the product.
  When neither of these is reasonably practicable, the rate of the failure must meet appropriate levels.

  and

- Ensure the solution to any continued airworthiness issue makes the risk as low as reasonably practicable

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Traditional Approach – Questions/Observations

- Focused on the direct risk of product failures
- Does it meet the intent of Annex 19?
- Different ‘language’ to operators
- Numerical compliance
- Top risks ?
- Applicability to production and maintenance organisations ?
- Requires limited consideration of organisational barriers that ensure safety

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Operators v. Product (Engine) hazards

UK CAA Significant Seven

1. Loss of control
2. Runway Overrun or Excursion
3. Controlled Flight into Terrain
4. Runway Incursion and Ground Collision
5. Airborne Conflict
6. Ground Handling Operations
7. Airborne and Post-crash fire

CS-E Hazardous Engine Failures

(i) Non-containment of high-energy debris

(ii) Concentration of toxic products in the Engine bleed air for the cabin sufficient to incapacitate crew or passengers

(iii) Significant thrust in the opposite direction to that commanded by the pilot

(iv) Uncontrolled fire

(v) Failure of the Engine mount system leading to inadvertent Engine separation

(vi) Release of the propeller by the Engine, if applicable

(vii) Complete inability to shut the Engine down

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What more can we do?

- **Our safety hazard list and mitigations should**
  - Work for the whole organisation
  - Be easy to understand - from the Company Board to Subcontractor
  - Be easy to comply with
  - Fit in seamlessly with enterprise risk management
  - Be comprehensive
  - Target areas where there is room for improvement fast

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Steps so far

- **Updated company safety policy**
- **ALARP in design guidance in place**
- **Periodic Safety Reviews introduced**

► Projects have always run regular product safety review boards which ensure continued airworthiness items are being addressed

► Function have always run Safety Assurance Boards address more generic issues – for example significance of new methods to safety

► New Periodic Safety Reviews go a step further – review all safety documentation for a project over time, and address concerns

- Starting point is the Chief Engineer's judgement on top risks for the product
- 32 periodic safety reviews held in 2015

- **Production and Maintenance metrics introduced**
- **Management Action Reporting System developed**

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Challenges – what are the top risks to product safety ?

Some UK Design and Manufacturing industry thoughts

- Other business pressures taking precedence over safety
- Complacency and believing its safe anyway
- Failing to maintain clear responsibilities in complex organisations
- Failing to maintain capability to deliver safe products due to high levels of change including new business models
- Believing that only a few things are ‘critical to safety’ and failing to recognise that just about everything can have a safety impact given the complexity of products
- Making the wrong decision because of media/external pressures
- Understanding new technology
- Lack of technical competence given growth in the industry, movement of people and new technology
- Failure to control technical change – design, production and maintenance - given the complexity, size and depth of products, organisations and supply chains
- Failure to manage data – eg not knowing why things were done, not learning lessons, particularly noting the longevity of some aerospace products

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Challenges

1. Agreeing how to usefully capture organisational risks on a safety hazard chart, because:
   - Its hard to assign a numerical value to organisational risks – typically need multiple risk events before a product failure
   - They are often not specific to safety
   - They are not seen as safety
   - The topics are fundamental to the organisation
2. Integrating safety risk in an enterprise risk system
3. Effectively managing risks that aren't just safety – with visibility of the safety significance
4. Being certain risks are fully mitigated because:
   - They cover a lot of what the organisation does – very wide ranging
   - Complex products, complex organisation
   - The size and nature of the risk changes with the business

The risk system must fit the organisation

(No prescriptive regulation!)

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Summary

- Defining and managing hazards is a key part of an SMS
- Product failure hazards have been defined and managed with numerical assessments historically
- Improvements have been introduced to risk identification and management for design, production and maintenance
- Still reviewing how best to systematically manage organisational risks which could impact safety
- It’s not ‘one size fits all’ - the size, culture and nature of an organisation are important

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Can we make safety simple?

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Production and Maintenance Metrics

Leadership and Accountability

1. Number of EASA Form 51 UK Production Organisation changes

Level of Safety

None – under design

Conforming Product

2. Audit metric (Production and Maintenance)
3. Part Right First Time (Production)
4. Number of retrospective concessions (Production)
5. Number of Management Action Reports (Maintenance)
6. Mandatory Occurrence Reports trends (Production and Maintenance)
7. Number of external customer escapes
8. Test Pass Rate

Maintaining and Improving Product Safety

Covered by response to other items

Safety Awareness and Competence

9. Regulatory and Human Factors training

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Rolls-Royce Company Safety Policy

Principles

- Leadership commitment and accountability
- Level of product safety
- Maintaining and improving product safety
- Conforming product
- Safety awareness and competence

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