ARMS

The enabler to understanding Risk

CHIRP Maintenance Meeting

28th March 2012

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ARMS Background

ARMS – Aviation Risk Management Solutions working group

Formed in 2007 (Jari Nisula – Airbus, Andrew Rose – British Airways)

Jun 07 – Oct 09  Safety practitioners from over 20 aviation organisations

The Mission of the ARMS Working Group is to produce useful and cohesive Operational Risk Assessment methods for airlines and other aviation organisations and to clarify the related Risk Management processes.
Effective risk management requires us to monitor the performance of our system.

ARMS techniques enable the best use of the data and knowledge to enable the optimum risk management decisions.

Possibilities…
Llanbury Consulting
RISK - The Big Picture

G-VXLA  G-VXLB  G-VXLC  G-VXLD

G-VXLE  G-VXLF  G-VXLG  G-VXLH

Llanbury Consulting
RISK - The Big Picture
The ARMS Concept

Event Risk Classification (ERC)

Safety Events

All Data

Database

Data Analysis
- Frequencies
- Trends
- Identification of Safety Issues

Investigations

Safety Performance Monitoring

Safety Issue Risk Assessment

*RIRA*

Safety Issues

Scenarios

Actions to reduce risk

Register

Safety Issues

Hazard Analysis

All collected safety data
- Categorized
- ERC values

Llanbury Consulting
'RISK' – The Big Picture

ARMS Working Group 2009

Event Risk Classification

This activity is about measuring performance and risk in the system based on historical events:
Risk classification – NOT Risk Assessment

Severity of the potential accident outcome + Probability of the event resulting in that outcome* = Risk

*Llanbury Consulting
'RISK' – The Big Picture

* Probability of occurrence is derived from the data
ARMS Event Risk Classification (ERC) Framework

What is the probability of this event progressing to that credible accident outcome?

If this event had escalated into an accident, what would have been the most credible accident outcome?

- Catastrophic accident with multiple fatalities >8
- 1-8 fatalities, multiple serious injuries, major damage/loss to the aircraft
- Minor injuries, minor damage to aircraft
- No potential damage or injury could occur

The shared Aviation Risk Space

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ERC - Severity Question

The severity question has to be based on the credible accident outcome and not some intermediary point.  

Why?

Because this is a measurement exercise for risk across the aviation system so you have to measure to the same point

Intermediary outcomes (such as 'unairworthy aircraft') are only separated from accidents by probabilities and these are accounted for in the next question.

ERC - Probability Question

Probability is a difficult question for us

It is very subjective based on our personal experience so the ARMS approach suggested adopting a barrier principle:

What was the effectiveness of the remaining barriers between this event and the accident scenario?

Effective / Limited / Minimal / Not Effective

Barriers are an easier concept for us to judge but this approach is still subjective and perhaps over simplistic with regards to the effectiveness of barriers.

So …
Significant work is on-going with the UK CAA (involving airlines, EASA, FAA, EC, etc.) to develop a structured barrier model approach to answer the probability question:

- What barriers stopped this event progressing?
- What other barriers could also have stopped this event progressing?
- How reliable are those barriers?

It is a whole presentation on its own but in brief it is evaluating standardised approaches to developing and using models for different scenarios to determine:

**Common Risk Classification Framework**

What are the barriers in this scenario? How important is each barrier? What is the status of the barriers in this case?

If this event had escalated into an accident, what would have been the most credible accident outcome?

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Framework approach to the ERC

It makes the semi-automated risk classification of masses of system generated data a possibility...

As an aviation system we over rely on employee reporting data as our key (and separate) window on performance

- Reporting data is a rich source but narrow in its scope
- System generated data lacks detail but has wide coverage
- Combined they become a powerful source of system performance knowledge

"The whole is greater than the sum of its parts." - **Aristotle**

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The ARMS Concept

Event Risk Classification (ERC)

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- Trends
- Identification of Safety Issues

Safety Performance Monitoring

Safety Issue Risk Assessment

SIRA

Actions to reduce risk

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Safety Issues

Scenarios
Safety Issue Risk Assessment

PREVENT

- Maintenance error
- Flight ops hazard
- Hazard on ground

Triggering EVENT

- ATC hazard
- Weather hazard
- Technical hazard

AVOID

- Undesirable operational state

RECOVER

- Catastrophic accident (e.g. mid air collision)
- Major accident (e.g. overrun)

MINIMISE LOSSES

- Minor safety occurrence (e.g. turbulence bruises)
- Negligible

Example SIRA for operations into areas of forecast volcanic ash

Triggering EVENT

- Flight into area of forecast volcanic ash

Undesirable operational state

- Inadvertent encounter with higher than expected density of volcanic ash

ACCIDENT OUTCOME

- Unrecoverable engine failures resulting in catastrophic accident
- Injuries & damage sustained during emergency diversion & landing
- Loss of control due ash damage to airframe or sensors
- Midair collision as a result of ash avoidance and recovery maneuvers
Define the Safety Issue precisely:
• Scope the issue in terms of hazards, locations, a/c types
• Develop the related potential scenarios:
  • There may be several (accident) scenarios within one Safety issue.
  • Select the most critical (one or more) for the risk assessment.

KLM UK example

- Analyse (each) Scenario using the BOWTIE model:
  • Assign a top event for the Hazard under consideration; The point at which control is lost.
  • We can consider the top event to be the Undesirable Operational State (UOS).
  • Identify the hazards: Generic & Specific/Risk Assess & Defend/Assign Responsibilities/Define Controls
  • Identify the Consequences/Mitigate the consequences/Assign Responsibilities/ Define Controls
  • Integrate controls where possible.
ARMS SIRA Excel application

- Analysing the risk factors and barriers

- Needed figures can be obtained from the event database or estimated

Conclusion

ARMS offers powerful tools in the cohesive understanding of risk across the aviation system:

ERC and its associated barrier framework provides a basis for the common measurement of risk performance across aviation

So reach for the possibilities of a cohesive picture of risk performance for maintenance within the whole aviation context…
Questions and Further Information

Questions

Contact:
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ARMS link –
http://www.skybrary.aero/index.php/ARMS_Methodology_for_Risk_Assessment