Developing Safety Management Systems

Shell Aircraft International’s Experience

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Why SMS and Why Me

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• Shell group aviation support needs:
  – 100,000+ flying hours per year
  – In 60+ countries
  – 90% of the aviation support needed is contracted-in
  – Numerous aircraft operators supply the service
  – Numerous types on aircraft, mostly helicopters

• One standard of operation required
  – Target accident rate is < 1 per million flight hours
  – Current offshore helicopter accident rate = 8 pm FH
SAI’s Approach for % gain in Individual Mitigation Measures for Helicopter Operations

- Late FAR 29/Enhanced Handling
- FFS Training + CRM/LOFT
- OC/QA/SMS
- HUMS/VHM
- HOMP/FOQA
- Perf Class 1/2e
- EGPWS/TCAS
- Tail Rotor Impact Warning

Percentage accidents prevented

Seven Key Initiatives Requires development work
The SMS Journey

The Journey Begins, a Mandated Requirement!
The Journey’s Start

• SAI became engaged in the development of SMS in aviation born out of the Piper Alpha oil platform disaster.

• Piper Alpha 1988
  – Gas explosion and subsequent oil fire
  – 167 killed
  – Maintenance and operational errors
  – Poor evacuation capability
  – Cullen report findings 1990
Lord Cullen’s Findings

Primary statement said:
“it was irresponsible for oil companies to operate a facility and not be fully aware of the risks”

“not only the facility, but the services supporting it were to be included”

The Cullen Reports’ Recommendations Included:

– A requirement for offshore operators to introduce Safety Management Systems and associated Safety Cases for every offshore facility.

– To carry out risk assessments and hazard analysis

– All hazards should be controlled, and the risks managed to levels that are as low as reasonably practical (ALARP).
AVIATION & THE ILLUSION OF SAFETY

Subsequent to the Apollo 204 Command Module Pad fire it was recognized that NASA had been using predictions of the future that were tinted by the rosiness of the past.

This ‘illusion of safety’ is beset by *false beliefs*:

- Airlines with a good safety record will continue to be safe
- Instructions and procedures for safe operations are in place, well read, understood, remembered and systematically used.
- Responsibility for Safety can be devolved to the line managers
- Trained, experienced employees are immune to errors
- It is sufficient that from time to time leaders talk about safety and its importance.

What Breaks this Illusion??
The SMS Journey

Developing the Structure
SMS Development

• Clearly to if Shell required its operators to introduce SMS and supporting Safety Cases they had to understand this requirement themselves.

• They gathered supporting information, some from industries like the Nuclear power operators and some developed by safety specialists in, or contracted to, the Shell Group.

• SAI, was engaged in this process from 1994.

• Shell Aircraft developed Guidance Material for aircraft operators and also developed systems for their own operations.
SMS The Big Picture

Firstly: Each Aircraft Operator needs to understand how effective its current systems of management are, and if they manage all aspects of the business?
Secondly: it needs to know how its next accident will occur, and before it occurs.
• What is the risk?
• What it should be doing to manage the risk to remove or control the causes of those risks.
An SMS can assist in knowing these answers, by:
• identifying risk,
• managing hazards,
• controlling potential threat,
• Using a process based approach to organisational safety.
SMS System development

Shell Aircraft expected the contracted aircraft operators to do the SMS development work on their own.

We thought that if we explained what we wanted, and agreed a price for its development, we could get what we needed.

We Could not, its not that simple!
How Many Management Systems

SAI recognised that it was essential to get the top management involved and committed to SMS.

To achieve this, we had to help and the SMS must add value to the organisation.

We recognised that one company needs one system of management.

Although, there may be several requirements for a system, such as: Safety, Quality, Environment, Finance etc.

We needed a model management system that can be applied to all aspects of the business.
ISO-9001 Based (S)MS Model

- Management Review
- Customer Satisfaction
- Remedial Action
- Investigation & Follow-up
- Incident Reporting
- Monitoring

- Principles & Policy
- Strategy
- Objectives
- Targets & Plans
- Standards
- Accountability & Competence
- Product Management (operate aircraft)
- Risk Assessment
- Hazard Management
- Corporate Culture
- Audit Review

AVIATION HAZARD MANAGEMENT
The SMS Journey

Understanding Risk Management
Risk Management

• We knew that the design of the aircraft was fully risk assessed through the FMEA process.

• We needed our aircraft operators to apply the same sort of process to the maintenance and subsequent flight of those aircraft.

• This was not an easy task, to do this you have to understand fully what the hazards are and what can trigger their release.

• Together with our operators we brainstormed a comprehensive list of all the hazards and threats and then built a list of scenarios in which these might occur, these we call hazardous events, these can be risk assessed.
The Mystery of Risk Management

- Risk assessment can be complex and achieved in many ways, but simply put aircraft operators need to know how often specific hazardous events might occur, and when they do how bad can it be (it’s a calculation).
- Further, risk assessments are a snapshot in time, not a fixed position; they change all the time.
- The variables that make them change are the current number of threats to safety, and the numbers and quality of the barriers or controls in place to provide safe operations.
- Therefore, management need indicators that tell us when risk levels change, so they can react.
# Risk Assessment Matrix

<table>
<thead>
<tr>
<th>Potential Consequence of the Incident</th>
<th>Increasing Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>People</td>
</tr>
<tr>
<td>0</td>
<td>No injury</td>
</tr>
<tr>
<td>1</td>
<td>Slight injury</td>
</tr>
<tr>
<td>2</td>
<td>Minor injury</td>
</tr>
<tr>
<td>3</td>
<td>Serious injury</td>
</tr>
<tr>
<td>4</td>
<td>Single fatality</td>
</tr>
<tr>
<td>5</td>
<td>Multiple fatality</td>
</tr>
</tbody>
</table>

Manage Through Normal HSE-MS procedures
incorporate risk reduction measure
Intolerable

Air Safety, Safety Management Systems, Human Factors in Aviation Management, Continuing Airworthiness
The SMS Journey

Building the Hazard Model
Basic Hazard Management Theory

- Accountability
- Competencies
- Training
- Physical Barriers
- HAZARDS (Fuel, Crew Actions, Un-airworthy Aircraft)
- Procedures
- Assurance
- Redundant Systems

Air Safety, Safety Management Systems, Human Factors in Aviation Management, Continuing Airworthiness
Generic Hazard Modelling

• The next problem we encountered, was although we now had a comprehensive lists of hazards, threats and potential hazardous events, the next step seemed to be too big for the operators.
• What was needed was a way of minimising the effort in understanding how to build a detailed hazard analysis.
• We provided methodology a “bow-tie” model and working with a group of pilots and engineers we built a generic hazard model that could be used by most aviation companies.
Hazardous Event Map

- Deviation from Intended Aircrew Flight Training/Air test Missions
- Aircraft Systems Failures Inc. Dynamic Failures
- Aircraft Deviates from Intended Safe Flight Path
- Flammable Materials in proximity to a source of ignition
- Un-airworthy Aircraft Released to Service
- Aircraft Deviates from Intended Ground Track
- Static Out of Balance situations
- Uncontrolled GSE in proximity to the Aircraft
- Encountering Adverse Weather Conditions
- Loss of contained fluid and gas under pressure
- Interface with Ramp Agents
- Interface with Maintenance Contractors
- Use of unsafe lifting equipment
- Loss of separation with other Aircraft
- Uncontrolled people in close proximity to a running propeller
- Ventilation
- Loss of containment of fuel or oil
- Encountering Unexpected External Conditions
- Loss of contained fluid and gas under pressure
- Interface with Maintenance Contractors
- Encounter with a potential HSE occurrence
- Aircraft Deviates from Intended Ground Track
- Un-airworthy Aircraft Released to Service
- Aircraft Deviates from Intended Safe Flight Path
- Flammable Materials in proximity to a source of ignition
- Un-airworthy Aircraft Released to Service
Hazard Analysis & Its Uses

All the Major Risks should be analysed and managed through detailed hazard analysis. Once completed - The uses of a hazard analysis is:

- **Initial analysis** - learning what is really in place to control hazards and threats, and how robust that is.
- **Audit tool** - used to identify how effective controls are.
- **Post Incident reviews** - learning what controls failed to work, or is missing.
- **Pre-amendment reviews** - to check what is documented on the subject.
- **Line management focus** – aide memoir as to what controls should be in place.
The SMS Journey

Working on the Culture
Corporate Safety Culture

“Safety is no accident”.
“It’s a planned event”.

Safety management systems should deliver a systematic approach to safety, based on:

• structured safety programmes
• a detailed risk assessment
• a hazard management programme
• closed loop processes underpinned by QA
• and essentially a positive safety culture.
Defining the Company Safety Culture should be a corporate leadership decision, although it usually isn’t. It’s normally a non decision. However, its Top Management’s actions not their words that have a significant effect on the culture.

As in all things, extremes are never the right choice, yet as an industry we have supported Blame for many years and more recently No Blame. Neither work!
Styles of Safety Culture

- **Generative**
  Safety is built into the way we work and think

- **Proactive**
  We work on problems that we still find

- **Calculative**
  We have systems in place to manage all hazards

- **Reactive**
  Safety is important we do lots of it after every accident

- **Pathological**
  Who cares if we are not caught

Increasingly informed society
Increasing trust and accountability

If not managed it can go the wrong way
Safety Culture and Performance

• The Company’s safety culture is the most significant influencing factor on safety performance.

• The safety performance of the staff and the influences of their supervisors and managers can determine the level of human error suffered by the Company.

• The Company Culture can be improved if a high level commitment is there.

• The Company’s safety performance is the product of the Safety Culture of the organisation plus it’s Luck Factor
The SMS Journey

Assuring the SMS System
SMS - Assurance

We have developed an assurance methodology:
This is used in two ways as:
• a Self Assessment Tool used by the operator &
• an Audit Tool used by Shell Aircraft International
This tool is the SMS SAQ booklet
We broke down the management system requirements to:
• 8 key elements with
• 33 sub-parts
Each has four qualifying statements (levels 1 – 4) and compliance with each level is obligatory.
The SMS Journey

Closing Notes
Why do Systems Fail

Systems like SMS and QA frequently fail to deliver on the promise because there is:

• A lack of leadership and active involvement from senior managers.

• A lack of commitment to the system providing the drive to make it work.

• A lack of direction in the systems, often control is devolved to middle manager levels.

• A lack of understanding, by all but the specialists.

• Middle Management Apathy.

• The staff’s belief it’s a “flavour of the month initiative”.
What Do You Need to Do

• Real commitment, from management and staff can make its Safety Management System work to its benefit, if it is key to the Company’s Corporate Objective.

• You do have to improve safety and integrate your systems if you are to survive and grow financially.

Closing Thought on Safety?

“If you continue to do more of what you have already done, you will only get more of what you already have”