



Safety Management Systems in Aviation
Rob Lee, PhD.



Some background...

The International Civil Aviation Organisation, ICAO

- The Convention on International Civil Aviation (the Chicago Convention) sets out the standards and recommended practices for commercial aviation operations worldwide.
- The Convention forms the basis upon which the International Civil Aviation Organisation, ICAO, was established. ICAO is part of the United Nations.

Changes in aviation: accident investigation

- The primary focus of air safety investigation has moved from the performances of individual 'frontline' operators, such as pilots, air traffic controllers and maintenance engineers, to consideration of the performance of the system as a whole.





Accident Investigation: ICAO Annex 13

- The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents.
- It is not the purpose of this activity to apportion blame or liability.
- Protection of information gathered in the investigation
- Systemic investigation
 - organisational and management information

Organisational and management information (to be included in the Final Report)

- Pertinent information concerning the organisations and their management involved in influencing the operation of the aircraft.
- The organizations include, for example, the operator; the air traffic services, airway, aerodrome and weather service agencies; and the regulatory authority.
- The information could include, but not be limited to, organizational structure and functions, resources, economic status, management policies and practices, and regulatory framework.

Systems safety philosophy

- Every accident, and incident, no matter how minor should be regarded as a failure of the system, and not of a person or people
 - even though human error, or non-compliance with procedures or rules, will almost certainly be involved in some way.

Integrated safety management systems (ISMS)

- Have evolved from the concepts of human factors and systems safety
- They provide a practical means of applying these concepts in aviation operations, and in other high technology industries
- With the objective of maintaining and enhancing operational safety

- In all aspects of operations, including safety, we must consider human performance, including human errors and non-adherence to procedures, in the context of the total system of which the person, or people, are part



Definitions used in aviation



Safety Management is defined as the systematic management of the risks associated with flight operations and related ground operations to achieve high levels of safety performance.

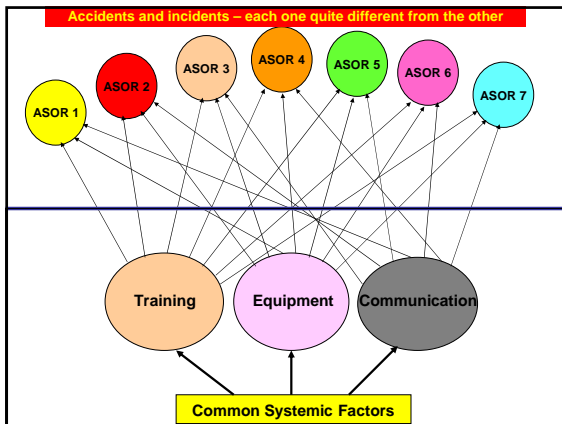
A Safety Management System is:

- a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures (ICAO Annex6)
- an explicit element of the corporate management responsibility that sets out an operator's safety policy and defines how it intends to manage safety as an integral part of its overall business. (CASA, 2002)

Why the 'traditional' approach to safety management ultimately does not enhance safety

- Concentration on the 'surface' issues of safety incidents or accidents, such as maintenance error, or pilot error, means that underlying systemic factors may be missed
- Operational experience, accident investigation, and research has shown that if the underlying systemic factors which contribute to an occurrence are not rectified, other occurrences will occur due to the same contributing factors

- The same underlying systemic factors may be common to many different accident and incident scenarios each with different combinations of triggering events.
- An ISMS is a proactive safety management tool which, if properly designed and implemented, provides a means of detecting and rectifying such safety deficiencies before they combine with local triggering factors, such as human error, or bad weather, to contribute to an accident or serious incident.



For almost every aviation accident or incident, civil or military, the subsequent investigation has shown that:

- The main contributing factors were present before it happened
- In some cases they were common knowledge, had been formally documented, and many people were not surprised by what happened
- In all cases, they could have, and should have, been identified and fixed before the accident or incident

- This is **not** looking at accidents with the benefit of hindsight
- It is simply a fact
- The absence of an integrated safety management system in some of the organisations directly involved was a key factor in explaining why critical safety deficiencies were not identified and rectified beforehand

SQ006 Taipei 31 October 2000

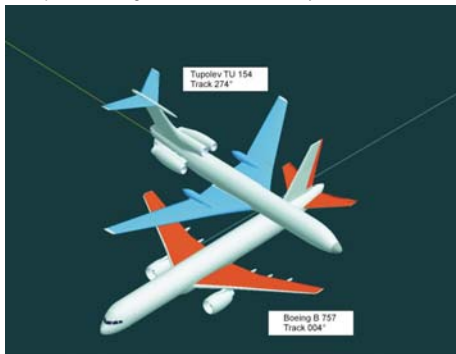


Fig. 1.12.3.2-1 Aft Portion of Aircraft



Figure 13 – A new section of Taxiway N1 centreline marking added and Runway 05R threshold markings (piano keys) being removed soon after the accident

Example: Ueberlingen mid-air collision 2 July 2001



Collision between B757-200 and TU154M showing the relative positions of the aircraft at impact



Crash site with fuselage and cockpit of TU154M



ICAO SMS requirements

SMS Standards and Recommended Practices (SARPs) relevant to SMS are set out in:

- Annex 6: Operation of Aircraft
- Annex 1: Air Traffic Services
- Annex 14: Aerodromes

Annex 6: Operation of Aircraft

3.2.4 From 1 January 2009, States shall require, as part of their safety programme, that an operator implements a safety management system acceptable to the State of the operator that, as a minimum:

- (a) identifies safety hazards;
- (b) ensures that remedial action necessary to maintain an acceptable level of safety is implemented;

Annex 6: Operation of Aircraft, cont

- (c) provides for continuous monitoring and regular assessment of the safety level achieved; and
- (d) aims to make continuous improvement to the overall level of safety.

Annex 6: Operation of Aircraft, cont.

3.2.5. A safety management system shall clearly define lines of safety accountability throughout the operator's organisation, including a direct accountability for safety on the part of senior management.

Transport Canada SMS regulations, June 2005

Safety Management System

- 107.03** A safety management system shall include
- (a) a safety policy on which the system is based;
 - (b) a process for setting goals for the improvement of aviation safety and for measuring the attainment of those goals;
 - (c) a process for identifying hazards to aviation safety and for evaluating and managing the associated risks;
 - (d) a process for ensuring that personnel are trained and competent to perform their duties;
 - (e) a process for the internal reporting and analyzing of hazards, incidents and accidents and for taking corrective actions to prevent their recurrence;

- (f) a document containing all safety management system processes and a process for making personnel aware of their responsibilities with respect to them;
- (g) a process for conducting periodic reviews or audits of the safety management system and reviews or audits for cause of the safety management system; and
- (h) any additional requirements for the safety management system that are prescribed under these Regulations.

Size

107.04 A safety management system shall correspond to the size, nature and complexity of the operations, activities, hazards and risks associated with the operations of the holder of a certificate referred to in section 107.01

The fundamental components of an integrated safety management system:
The CASA model



Fundamental components of a safety management system

- The CASA model
 - Sets out the 10 basic components of a safety management system
 - An organisation can have as many specific ISMS components as it wishes, provided all the underlying basic components are present
 - An organisation may already have many of these components in place
 - But they may not form an **integrated** safety management system

Basic Elements of an ISMS (CASA, ICAO):

- senior management commitment,
- hazard identification and analysis,
- risk management,
- accident and incident investigation,
- audit and evaluation,
- proactive accident prevention programs,
- training and education,
- documentation,
- data base construction and analysis,
- organisational culture,
- safety reporting system

Components of an Integrated Safety Management System



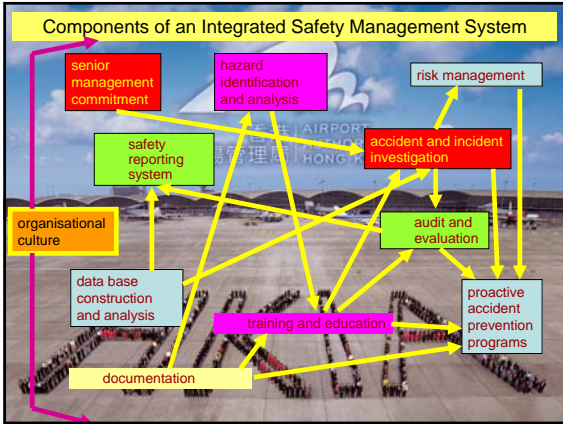
To be effective, safety management systems **must** be **INTEGRATED**

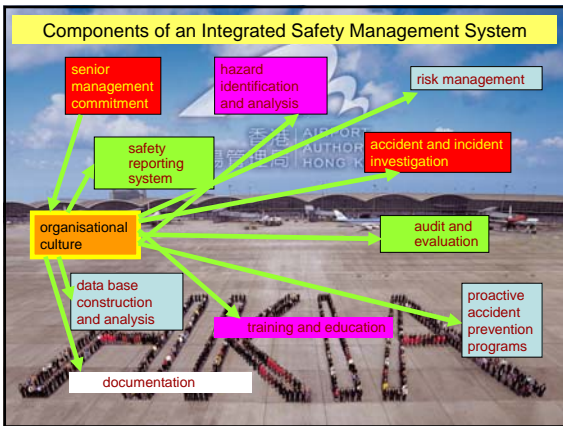
- All the components of the SMS must be integrated with each other
- The SMS must also be fully integrated into the management processes of the organisation
 - operational
 - financial
 - human resource management

- To achieve integration of all the different elements of a SMS, they must communicate using a common language
- The different SMS elements must be constructed using a common paradigm
- This paradigm is provided by systems safety and human factors concepts, at both the individual and organisational levels

Integrating the components of an ISMS with each other

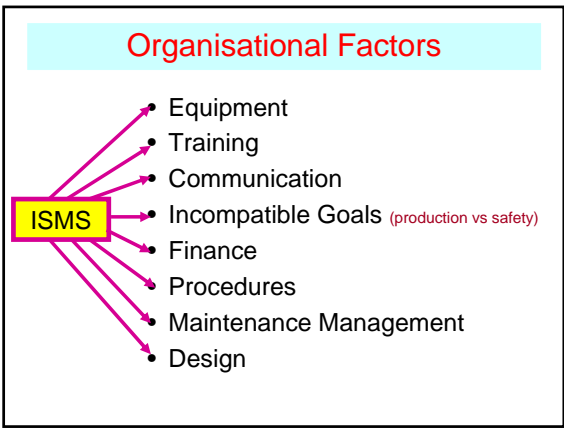
- To understand this internal integration of the ISMS, we can carry out a 'link analysis' of the ISMS components
- For each link, we ask the questions:
 - “How will we link these components together?”
 - “How will they communicate?”
- Examples...





Integrating the ISMS into the business and operational processes of the organisation

- How can the ISMS be integrated into the way the company does business?
- The Reason Model provides a useful guide to this process
 - as it identifies key organisational factors in the agency concerned
 - many are generic



- The ISMS is a dimension of all organisational, or systemic, factors
- It is an essential business component in managing the totality of all the risks faced by the organisation

Emirates ISMS
 - an example of the integrated application of human factors and systems safety within an airline

- An ISMS is more than just the sum of its individual components
- It requires a different way of thinking – a systems approach
- Therefore, it requires a different approach to management – a systems approach
- Each ISMS component cannot be considered in isolation
- Each component must be considered in the context of the total ISMS

The principles of safety management systems are generic

senior management commitment,
 hazard identification and analysis,
 risk management,
 accident and incident investigation,
 audit and evaluation,
 proactive accident prevention programs,
 training and education,
 documentation,
 data base construction and analysis,
 organisational culture,
 safety reporting system

They apply equally well to the healthcare system as they do to the aviation system

- The major challenge for the healthcare system is to create an organisational culture in which healthcare personnel will be intrinsically motivated to understand, accept, and facilitate the implementation and ongoing maintenance of integrated safety management systems
- The lessons learned in the aviation industry and other high technology industries can be directly applied to the healthcare system.

