Boeing Safety Management System Overview

Doug Kihm
Technical Fellow, Systems Engineering
Boeing Commercial Airplanes
May 15, 2012
Aviation Safety Responsibilities Are Shared

**Air Safety**

- Operated safely
- Maintained properly

**Government**
- Airworthiness requirements
- Safe operating environment

**Manufacturers**
- Safe airplane design
- Manufactured in conformity to the approved design
- Initial operating & maintenance manuals
- In-service safety

**Airlines**
Safety Management System (SMS)  
ICAO model

Safety management system — a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.

ICAO SMS Framework  
“4 Components”  
“12 Elements”

Safety Policy and Objectives
1.1 Management commitment and responsibility  
1.2 Safety accountabilities  
1.3 Appointment of key safety personnel  
1.4 Coordination of emergency response plan  
1.5 SMS documentation

Safety Risk Management
2.1 Hazard identification  
2.2 Safety risk assessment and mitigation

Safety Assurance
3.1 Safety performance monitoring and measurement  
3.2 The management of change  
3.3 Continuous improvement of the SMS

Safety Promotion
4.1 Training and education  
4.2 Safety communication
Boeing safety leadership
Working together for a safe, efficient global system

Promote worldwide safety culture

Cooperation
Assure healthy safety foundation
Data driven

Aligned focus
Promote proactive risk management
Knowledge sharing

DESIGN | BUILD | OPERATION | MAINTENANCE | INFRASTRUCTURE | REGULATION

Safety Integration Across the Value Stream
Boeing’s Commitment to Safety

“ensuring safe travel for all passengers and crew is the primary focus of the Boeing men and women who design, build, test, deliver and support its airplanes.”

Safety Policy
Assure Healthy Safety Foundation

Boeing’s Commitment to Safety

Boeing promotes aviation safety in a number of ways:

- By using robust processes to produce safe products
- By continuously monitoring the performance of the worldwide fleet
- By leveraging new technology to enhance safety
- By participating in accident investigations
- By working together with others to make sure flying is as safe as possible

From the Boeing Commercial Airplanes website
Robust processes produce safe products:

Design

Safety is the primary consideration when Boeing engineers design an airplane.

Testing

Boeing ensures its airplanes meet rigorous design standards and certification requirements through equally rigorous validation testing.

Safety Risk Management:

- Initial
- Hazard Identification
- Risk Mitigation

From the Boeing Commercial Airplanes website
Continuous monitoring of worldwide fleet performance:

Boeing continually monitors in-service aircraft performance to proactively identify areas where the design of current and future models can be enhanced.
Leveraging new technology to enhance safety:

Boeing develops and incorporates new technologies to enhance safety. Through research, development and collaboration, Boeing has developed sophisticated technologies that provide distinct safety advantages, such as:

- Vertical Situation Display
- Predictive windshear equipment along with improved windshear-training programs for pilots
- Enhanced Ground Proximity Warning System

From the Boeing Commercial Airplanes website
Participating in accident investigations:

Boeing’s safety efforts primarily focus on preventing accidents from occurring in the first place, however, a great deal of effort goes into supporting accident investigations to ensure that the same kind of accident does not recur.

- Industry and government safety experts study accidents to identify “intervention strategies” for preventing the same kinds of accidents in the future.
- The strategies include new training aids for flight crews and mechanics, new operating procedures, infrastructure improvements, aircraft design modifications, and incorporation of new technologies into the aviation system.
Boeing’s Commitment to Safety

Working together with others to make flying even safer:

Aviation safety is the combined result of

- Regulatory oversight
- How airplanes are designed and produced
- How crews operate and maintain them
- How air traffic and airport infrastructure support them

An example of this collaboration is the Commercial Aviation Safety Team (CAST), which comprises hundreds of representatives from airlines, manufacturers, labor and government.

From the Boeing Commercial Airplanes website
Boeing’s Commitment to Safety

Boeing promotes aviation safety in a number of ways:

- By using robust processes to produce safe products
- By continuously monitoring the performance of the worldwide fleet
- By leveraging new technology to enhance safety
- By participating in accident investigations
- By working together with others to make sure flying is as safe as possible

From the Boeing Commercial Airplanes website
Boeing Uses Robust Processes to Produce Safe Products

Airplane-Level Safety Assessment

Hazard Identification/Risk Mitigation

Configuration Selection  
Firm Concept  
Program Launch  
PDR  
Firm Configuration  
CDR  
Start Major Assembly  
Build  
Certification First Flight  
First Delivery

Timeline

Concept Development  
Joint Definition  
Detail Design & Release  
Build  
Flight Test  
Support

Airplane FHA

Define Threats  
Define Separation Requirements  
Preliminary Particular Risk Assessment  
Common Mode & Resource Assurance Analysis  
Hardware Software Mechanical Systems

PASA

System FHA

FHA – Functional Hazard Assessment  
FMEA – Failure Mode & Effects Analysis  
FTA – Fault Tree Analysis  
PASA – Preliminary Airplane Safety Assessment

Preliminary FTA

Preliminary Particular Risk Assessment

FMEA

FTA

Engineering Safety Review

Zonal Analysis

Copyright © 2011 Boeing. All rights reserved.
Type Design Certification Airworthiness Regulations, Procedures and Industry Standards Meet the Intent of SMS by Identifying Hazards and Risk Mitigations for the Initial Design
Boeing’s Commitment to Safety

Boeing promotes aviation safety in a number of ways:

- By using robust processes to produce safe products
- By continuously monitoring the performance of the worldwide fleet
- By leveraging new technology to enhance safety
- By participating in accident investigations
- By working together with others to make sure flying is as safe as possible

From the Boeing Commercial Airplane website
Promote Proactive Risk Management Approach

Boeing In-Service Safety Process

Safety Assurance

Data

- Accidents
- Incidents
- In-service events

Potential issue analysis

Hazard Identification

- Accident investigation
- FAA continued operational safety program

Issue classification

Risk Mitigation Corrective action management

Review boards

Safety enhancements

>12 million Boeing flights
Promote Proactive Risk Management Approach

Boeing Data Capability

More Reactive

Changes based on accidents

More Proactive/Predictive

Single incidents are taken to review boards (Boeing process since late ’90s)

Single events trigger deep data dives and are taken to the boards (available today)

Action based on trending of safety significant events or identification of patterns in event history

Discovery of as-yet unrecognized risks, action on same
Assure Healthy Safety Foundation

Boeing’s Commitment to Safety

Boeing promotes aviation safety in a number of ways:

- By using robust processes to produce safe products
- By continuously monitoring the performance of the worldwide fleet
- By leveraging new technology to enhance safety
- By participating in accident investigations
- By working together with others to make sure flying is as safe as possible

From the Boeing Commercial Airplane website
**Assure Healthy Safety Foundation**

**Improved Situational Awareness Features**

**Vertical Situation Display**
- Provides vertical view of flight plan route
- Displays terrain under lateral flight path

**Safety Risk Management:**
- Predictive
- Hazard Identification
- Risk Mitigation
Boeing’s Commitment to Safety

Boeing promotes aviation safety in a number of ways:

- By using robust processes to produce safe products
- By continuously monitoring the performance of the worldwide fleet
- By leveraging new technology to enhance safety
- By participating in accident investigations
- By working together with others to make sure flying is as safe as possible

From the Boeing Commercial Airplane website
Assure Healthy Safety Foundation
Participating in Accident Investigations

Coordination of Emergency Response Plan

- **Pre-event**
  - Boeing Investigation Team ready to respond if called upon by government agency leading an investigation

- **Event**
  - Boeing helps all stakeholders understand the data

- **Investigation**
  - Initial lesson learned

- **Final recommendation(s)**
  - Follow-on actions

Possible safety enhancements:
- Training
- Procedures
- Infrastructure
- Design
- New technologies
Boeing’s Commitment to Safety

Boeing promotes aviation safety in a number of ways:

 By using robust processes to produce safe products
 By continuously monitoring the performance of the worldwide fleet
 By leveraging new technology to enhance safety
 By participating in accident investigations
 By working together with others to make sure flying is as safe as possible

From the Boeing Commercial Airplane website
Boeing Regional Aviation Safety Initiatives

**Latin America**
- Support RASG-PA and RAST-PA

**US**
- Support US CAST/ASIAS safety initiatives

**ICAO**
- Participate in ICAO safety activities
- Support ISSG and GASR update
- Support Global Runway Safety Initiative

**Europe**
- Support ECAST safety activities
- Support RASG-EUR

**CIS**
- Support RASG-EUR

**Middle East**
- Support RASG-ME and RAST-ME

**Asia Pacific**
- Support RASG-APAC and RAST-APAC

**Africa**
- Support RASG-AFI and RAST-AFI

Copyright © 2009 Boeing. All rights reserved.
U.S. Commercial Aviation Safety Team

Key stakeholders come together to cooperatively develop, implement a prioritized safety agenda

Manufacturers
- Aerospace Industries Assoc.
- Airbus
- Boeing
- General Electric*
- Flight Safety Foundation

Operators
- Airline Pilots Assoc.
- Allied Pilot Assoc.
- Air Transport Assoc.
- Air Transport Assoc. of Canada
- Association of Asia Pacific Airlines
- Assoc. of Professional Flight Attendants
- Int’l Air Transport Assoc.
- Int’l Fed. of Airline Pilot’s Assoc.
- National Air Carriers Assoc.
- Regional Airline Assoc.

Government
- Dept. of Defense
- Federal Aviation Admin.
  - Aircraft Certification
  - Flight Standards
  - System Safety
  - Air Traffic Operations
  - Research
- National Aeronautics & Space Administration
- Int’l Civil Aviation Org.
- European Aviation Safety Agency (ECAST)
- Transport Canada
- National Air Traffic Controllers Assoc.
- National Transportation Safety Board

* Representing P&W and RR
Boeing Safety Management Summary

- Boeing is committed to the safety of its products and the people who fly on them
- Boeing’s safety management culture and processes have been used successfully for many years
- Boeing’s safety management culture and processes exceed the objectives of SMS supporting regional safety initiatives
Questions?