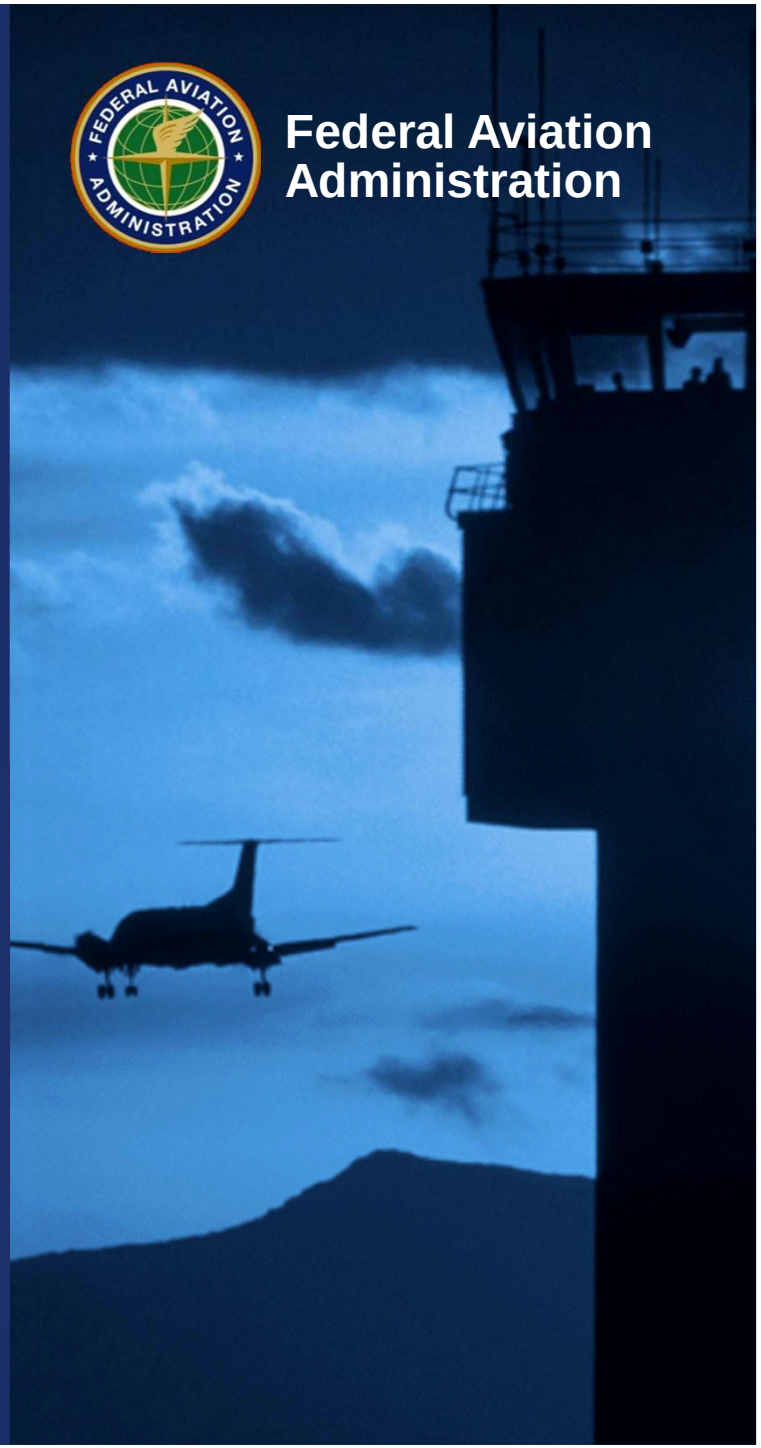
FAA Approach to Continued Operational Safety for General Aviation and Assessment of the Cessna SID

Federal Aviation Administration



Cessna SID Briefing to EASA
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Outline

- Brief History of COS Development and Approach
- FAA's Risk Assessment Approach
- FAA Approach to Cessna SID
- Cessna 100/200 Series COS Issues Under Review
- Additional Issues Under Review
- Our Path Forward for Aging Aircraft Programs

GA COS Environment – 2001 Timeframe

GA presentation at 2001 Aging Conference

- GA fixed wing fleet = 210,000 airplanes
- GA fleet average age > 30 years
- Wide variation in fleet design, use, and maintenance
- Advanced avionics installations make safer pilots, but will keep older airplanes in the fleet longer
- FAA taking a more proactive approach to GA COS
- Acknowledged recent accidents due to fatigue
- Public meeting on GA aging held in 2000
- "Airworthiness Concern Process" launched in 2000

GA: General Aviation
COS: Continued Operational Safety

GA COS Environment – 2001 Timeframe

Predictions/ forecasts in that GA presentation

- GA fleet average age = 40 years by 2010
- FAA will work closer with “type clubs” on COS issues
- FAA will better use service difficulty data
- FAA will develop risk assessment and risk management techniques
- FAA will provide guidance for GA fleet “fatigue management”

GA COS Environment – 2001 Timeframe

The 2001 culture in the GA community

- Major mfg's "get it"
- Most GA owners don't "get it"
- GA associations and "type clubs" often skeptical of FAA intentions
- Many GA mechanics unaware of safety issues posed by aging
- FAA certification and flight standards not always on the same page

The Path Since 2001

- **FAA "institutionalized" the Airworthiness Concerns Process**
- **FAA published GA age-related guidance**
  - In concert with Industry/Type Clubs/Associations
  - Mailed to 140,000 Owners of Airplanes built before 1974
- **Additional Roadmaps and Guidance Published Related to Fatigue, Damage Tolerance, Fail-Safe**
- **FAA conducted R&D on GA aging**
- **Several age-related accidents/incidents**
  - T-34, T-6, Cessna 402 Fatigue/Wing Failures
- **FAA ramped up GA community education and Associations and Clubs created training programs**

GA COS – How Close was the Forecast?

Predictions/ forecasts in 2001 GA presentation

- ☑ GA fleet average age = 40 years by 2010
- ☑ FAA will work closer with “type clubs” on COS issues
- ✗ FAA will better use service difficulty data (limited progress)
- ☑ FAA will develop risk assessment and risk management techniques
- ☑ FAA will provide guidance for GA fleet “fatigue management”

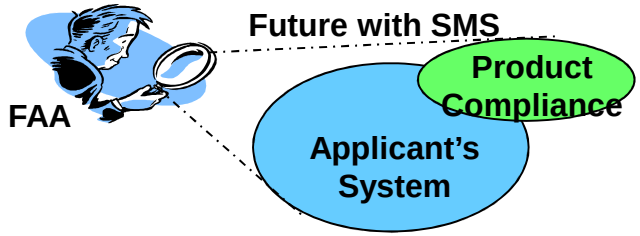
Where We are Today

- Healthy relationship between FAA and GA
- Active train and educate programs
- Major mfg's "get it" (Cessna has SIDs)
- Some owners "get it"
- Some mechanics aware of age-related safety issues
- FAA cert and flight standards usually on the same page
- Still wide variation in fleet design, use, and maintenance
- More rigorous/formal risk assessment and management
- FAA working with applicants on life extension programs

FAA's Risk Assessment Approach

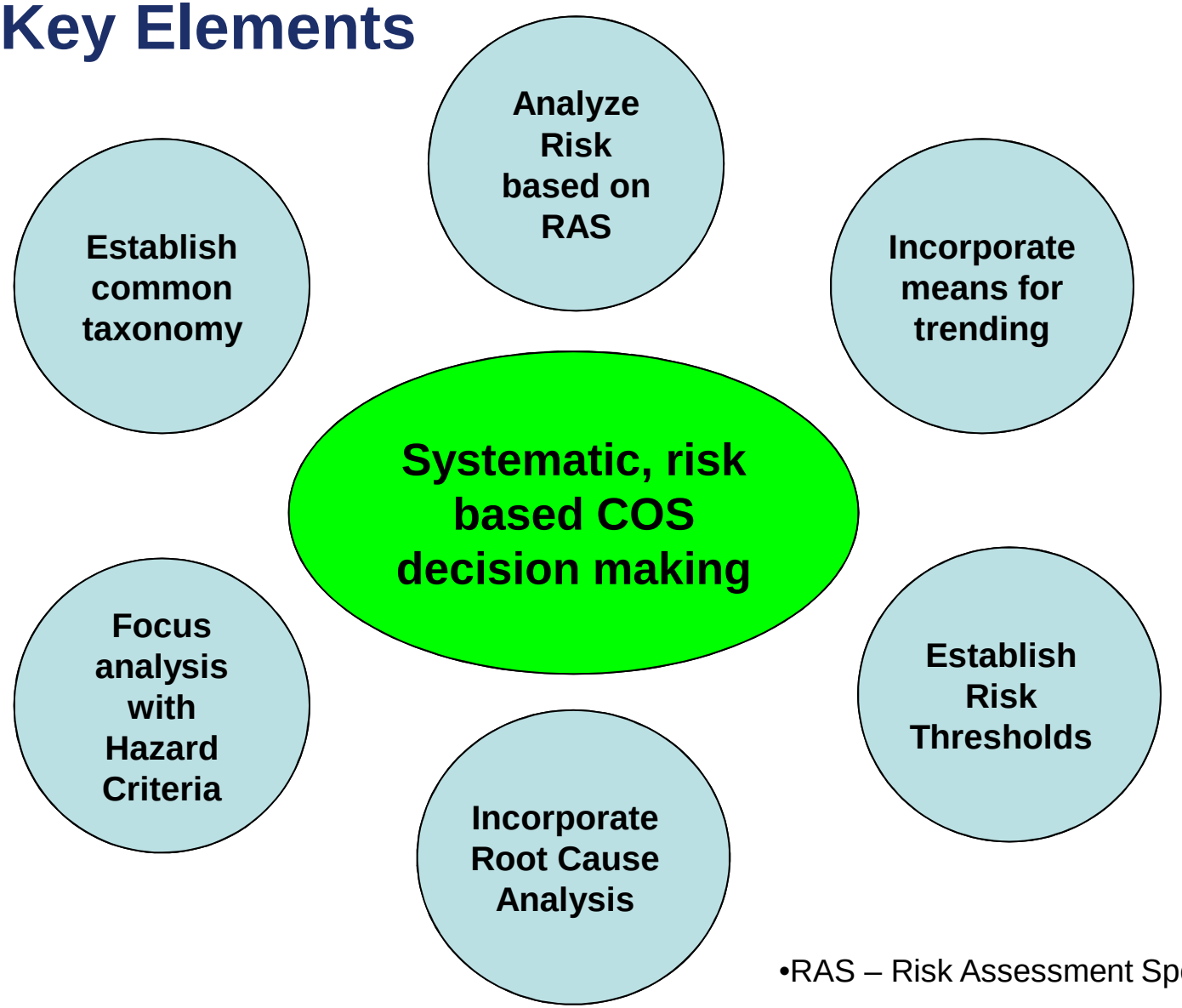
- **Monitor Safety Analyze Data**
  - FAA Order 8110.107
- **Approach Modified Slightly for Each FAA Directorate Considering Product**
  - Small Aircraft (SARA)
  - Large Transport (TARAM)
  - Engines
  - Rotorcraft
- **Helps us to address Aging Aircraft Issues**

FAA Safety Management System (SMS)



Process	Was →	Will Be
Risk Analysis Specification	Subjective	Corporately baselined
Risk-Based Resource Targeting	Personal assessment	Corporate, standardized approach to resource allocation
Designee Management	Locally focused	Corporate, risk-based approach to designees
Design/Production Approval	Stovepiped	Integrated / standardized
Applicant SMS	Non-existent	Applicant system based
Oversee Systems Performance	Tactical/specific	Integrated / Strategic / Global
Monitor Safety & Analyze Data	Reactive fixes	Reactive/Proactive / systems approach
Certificate Management	Production audit system	Design / production system - oversight
Staffing and Budget	Subjective	Need identified by system

MSAD Key Elements



•RAS – Risk Assessment Specification

MSAD Inputs and Outputs

•INPUTS → **•PROCESS** → **•OUTPUTS**

- In-Service Data
- DAH Supplied Data
- NTSB SRs
- FAA SRs
- AFS PI Input
- Operator Input
- Audit Results

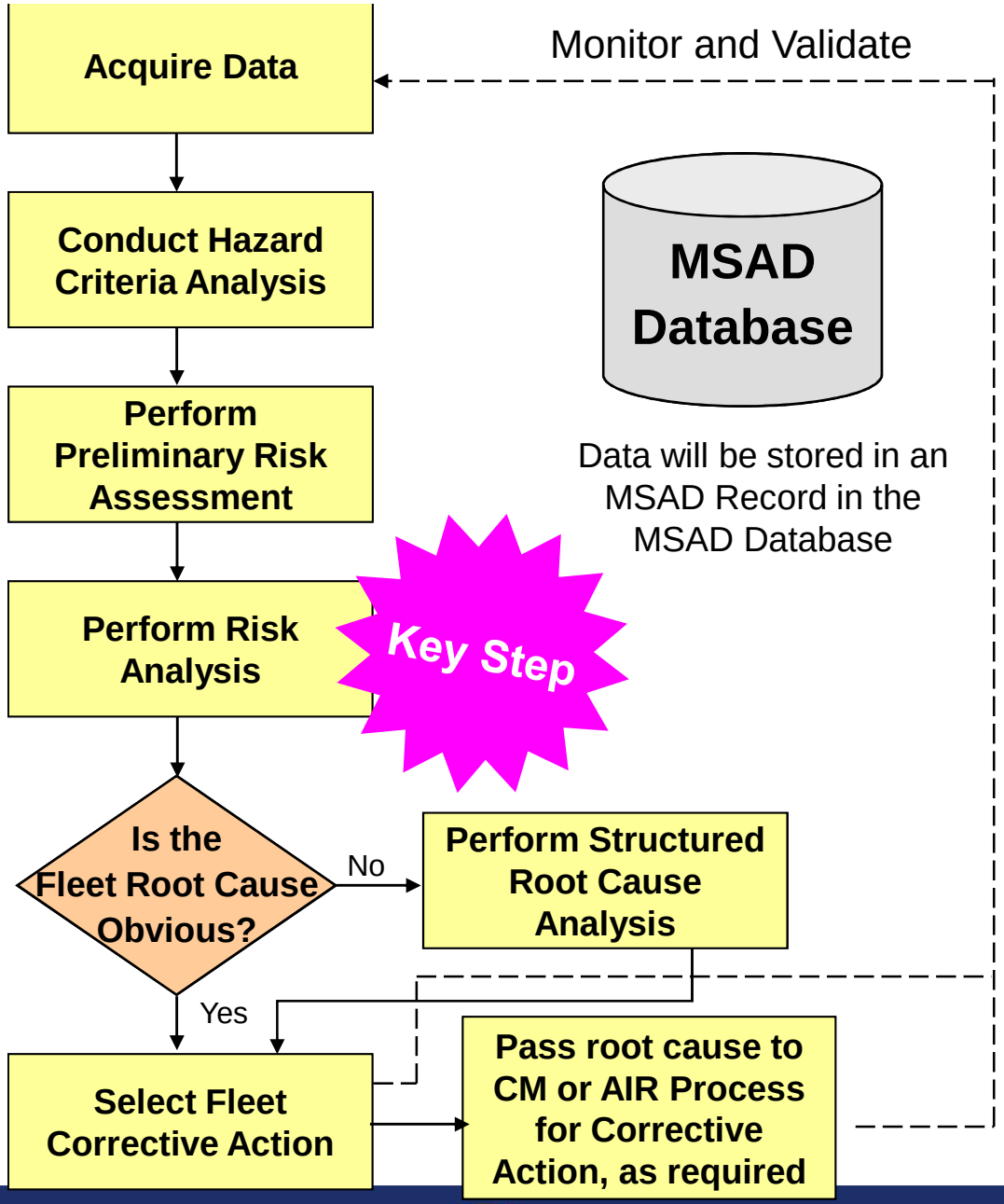
→ **•MSAD** →

- Initiate AD Process
- Initiate SAIB Process
- Input to Applicant Oversight Process
- Input to Rulemaking/Policy processes
- Recommendations for AFS Actions
- Lessons Learned

•Safety Data → **•Risk Based Decision** → **•Risk Management Options**

MSAD Process Flow

- Process generally flows from top to bottom
- Industry may take part/perform some activities
- Some activities will be conducted in parallel
- ASE may not go all the way through the process in some cases (i.e. risk determined not actionable)



Small Airplane Risk Assessment (SARA)

Overall Approach

- The FAA will use risk analysis as a tool in making continued operational safety (COS) decisions.

- The risk analysis should:
  - be as quantitative as possible,
  - define risk in terms of the expected frequency of failures and the probability that those failures will lead to undesired outcomes,
  - evaluate candidate control programs by the risk reduction they provide.

SARA Basics

Types of Risk Analysis

- **Random (Constant rate) failures**
  - Parts are equally likely to fail regardless of their age
  - Typically used by Mechanical & Electrical Systems, Propulsion

- **Wear-out failures**
  - Failures are increasingly likely as parts age
  - Typically used by Structures/Airframe

General SARA Process

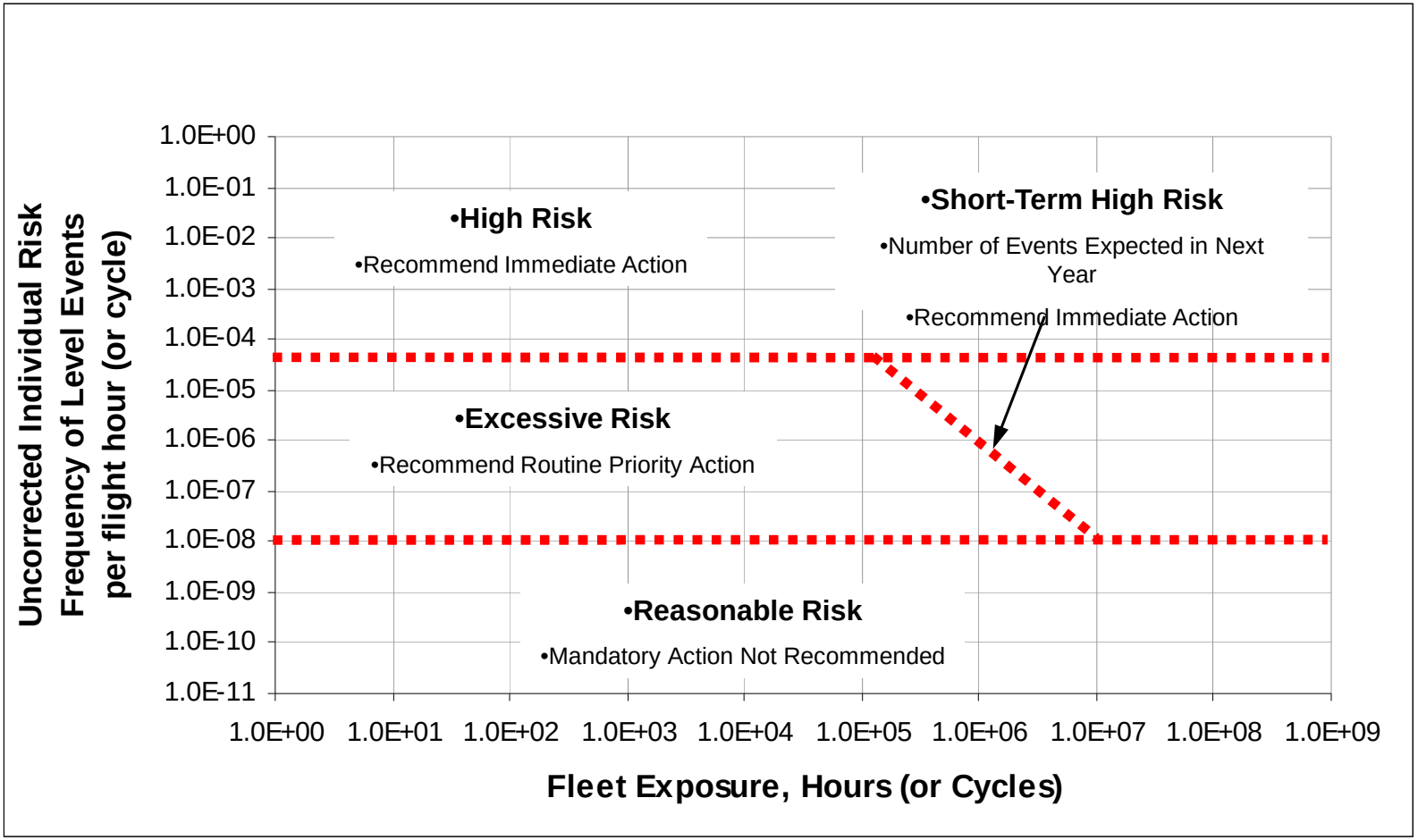
Basic idea is to

- Determine:
  - the chances of a failure (or defect) occurring
  - the chances that the failure (or defect) will result in an outcome of a given severity
  - the future exposure of the fleet to the failure condition
  - and the total number of outcomes of a prescribed severity.
- Compare these values to risk thresholds to determine a recommended airworthiness action
  - Airworthiness Directives (AD)
    - Immediate Adopted Rule (IAR)
    - Notice of Proposed Rulemaking (NPRM)
  - Special Airworthiness Information Bulletin (SAIB)

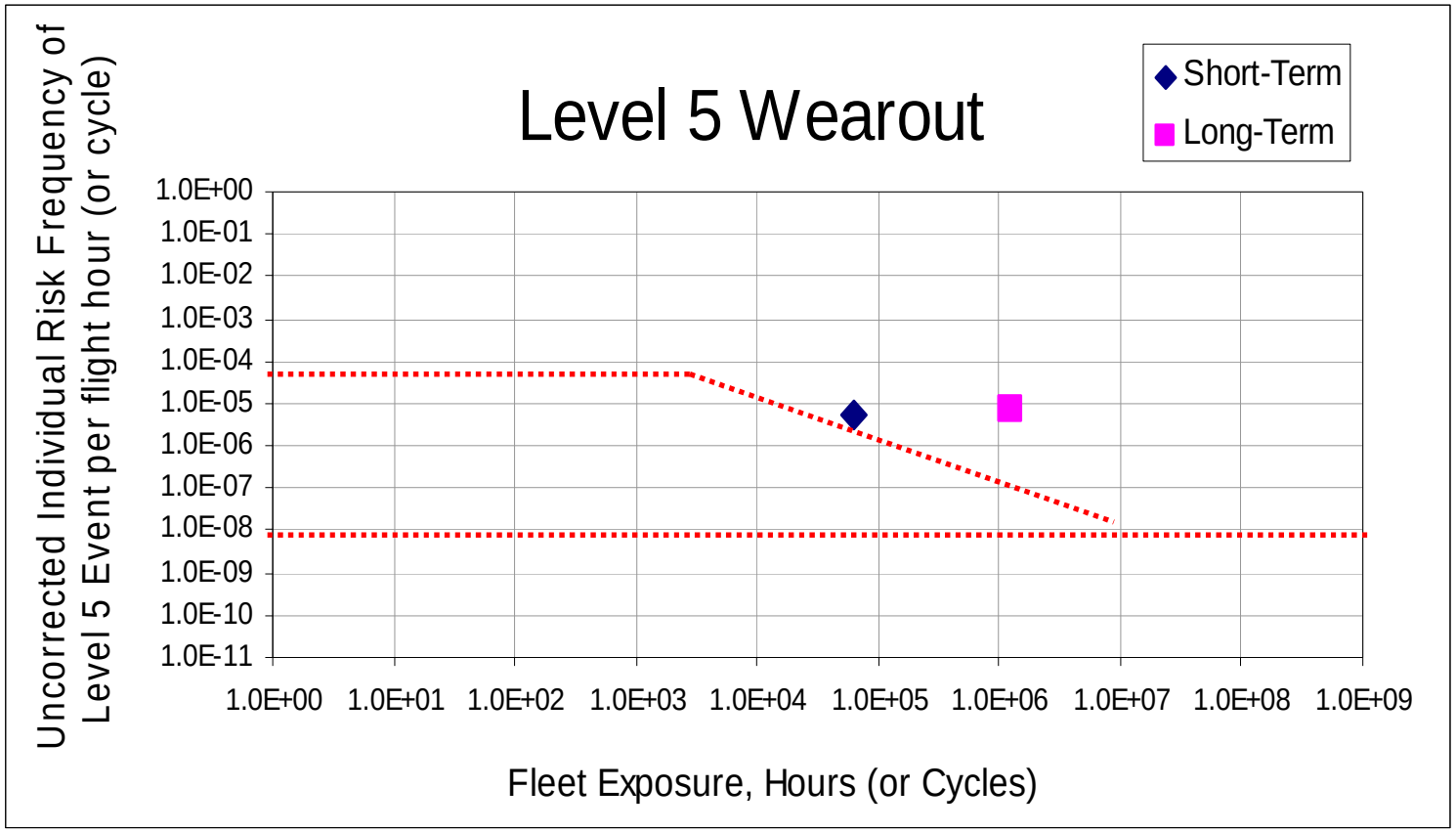
SARA Process for Airframe

1. Gather data
2. Determine the severity of the failure(s)
3. Perform Life Analysis
   - Statistical distributions
   - Predict future failures
4. Compare Life Analysis results to Directorate risk thresholds to determine which airworthiness action (IAR, NPRM, SAIB) and control program are appropriate.

SAD Risk Threshold – Trapezoid Method



Example Issue – Twin Cessna Wing Fatigue



SARA Benefits

- Provides measurement of effectiveness of candidate control programs
- Risk analysis based on accepted risk methods (AC 39-8)
- Risk thresholds based on the expected frequency of limit and ultimate loads
- Risk based on actual number of events
- Severity estimate based more on actual outcomes rather than worst case scenarios
- Method gives industry and public more transparency into our risk assessment methods and decision making process

FAA Approach to Cessna SIDs

- Questions arose following issuance of SIDs on Cessna twins
- Many public forums and open dialogue with Type Clubs, Member Organizations, FAA organizations in Certification and Flight Standards
- Thorough research of past accidents, incidents, service difficulty reporting data
- Conducted risk assessments using various methodologies
- Initial conclusions did not support mandate of entire SID program but did highlight key areas we may need to consider for mandate
- Publishing of 100/200-series SID has prompted similar course of action on our part

Cessna 100/200 Issues Under Review

- **Discussed in EASA SIB 2014-01**
- **Cessna 210 Wing Spar Cap**
  - AD 2012-10-04
  - Cessna has revised referenced Service Letter based on test results conducted during and following AD issuance
  - FAA reviewing reported results and will determine any follow-on action similar to what is stated in revised Service Letter
- **Cessna 200 Series Elevator and Trim Tab (foam filled)**
  - FAA still conducting review
  - If AD action were taken, we would consider recurrent inspection along with an elevator balance test on a less frequent recurrent interval
- **Cessna 100/200-series Rudder Pedal Torque Tube**
  - FAA still conducting review
  - Consideration of a dedicated, recurrent inspection in line with SID

Additional Issues Under Review

Cessna 300/400 Series

- 300/400-Series Spar Straps
  - Installation of spar straps on high time 310, 320, 335, 340, 414, 421, and 421C airplanes
  - FAA still reviewing 414 and 421 airplanes but do not currently plan mandate on 310 – 340 series
- 441 – Mandate of SID entirely or critical areas
  - Will be going through ACS process and getting public opinion
  - Analysis to date reflects focus on key areas
  - Horizontal Tail disbonding, Wing LE corrosion, and Fuselage Frame cracks/failures, Questions on LOV @ 22,500 hours
- 300/400-Series Gear Concerns
  - Numerous SDRs and Safety Recommendations over the years
  - Severity of Failures and incident/accident results along with SDR data doesn't usually support FAA mandates

Our Path Forward for Aging Aircraft Programs

- **Average fleet age will be >45 years by 2020**
- **Expand train and educate initiatives**
  - Maintenance, Reporting, Inspections, Overall awareness
- **Utilize value of usage monitoring**
  - Low cost recording equipment installed on new production
  - Examine possibility of installing on existing GA airplanes
- **Publish policy for life extension programs**
- **Institutionalized risk assessment and management**
  - Need better service difficulty reporting and monitoring
- **Apply lessons learned from prior activity as we take a proactive approach to current issues (402C to 441)**
- **Increased collaboration with our international partners**

List of Acronymns

AC – Alternating Current
ACP – Airworthiness Concern Process
AD – Airworthiness Directive
AIDS – Accident/Incident Database System
AIR – FAA Aircraft Certification Service
AFS – FAA Flight Standards Organization
APU – Auxiliary Power Unit
ASE – Aviation Safety Engineer
ASIAS – Aviation Safety Information Analysis and Sharing
CARB – Corrective Action Review Board
CM – Certificate Management
COS – Continued Operational Safety
DAH – Design Approval Holder
FAA – Federal Aviation Administration
FMP – Fatigue Management Program
GA – General Aviation
IAR – Immediately Adopted Rule
LE – Leading Edge
LOV – Limit of Validity
MSAD – Monitor Safety/Analyze Data
NPRM – Notice of Proposed Rulemaking
NTSB – National Transportation Safety Board
PMA – Parts Manufacturer Approval
PI – FAA Principal Inspector
RAS – Risk Assessment Specification
R&D – Research and Development
SAD – Small Airplane Directorate
SAIB – Service Alert Information Bulletin
SARA – Small Airplane Risk Assessment
SID – Supplemental Inspection Document
SDR – Service Difficulty Report
SMS – Safety Management System
SR – Safety Recommendation
TARAM – Transport Airplane Directorate Analysis Methodology
TIS – Time In Service
TSO – Technical Standard Order
Vd– Dive Speed