

System Safety Management Transformation

Accident Investigation and Prevention
Aviation Safety Analytical Services Division
AVP-220

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Presenters:

Janeen Kochan (Volpe), Mindy Robinson (FAA),
Kelly Curran (Volpe)

Participants:

HSI, Saab Sensis, Safe Sky Analytics, MCR, ISA,
Volpe, GMU, NLR

Joint Work:

EUROCONTROL



Federal Aviation
Administration



System Safety Management Transformation (SSMT)

- **SSMT Purpose**
- **SSMT Tools**
 - Airport Surface Anomaly Investigation Capability (ASAIC)
 - Safety Investigation Toolkit for Analysis and Reporting (SITAR)
 - Wake Vortex Safety System (WVSS)
 - Integrated Safety Assessment Model (ISAM)
- **SSMT Process**
 - Table Top Exercise
 - How to evaluate a proposed change



System Safety Management Transformation

System Safety Management (SSM)

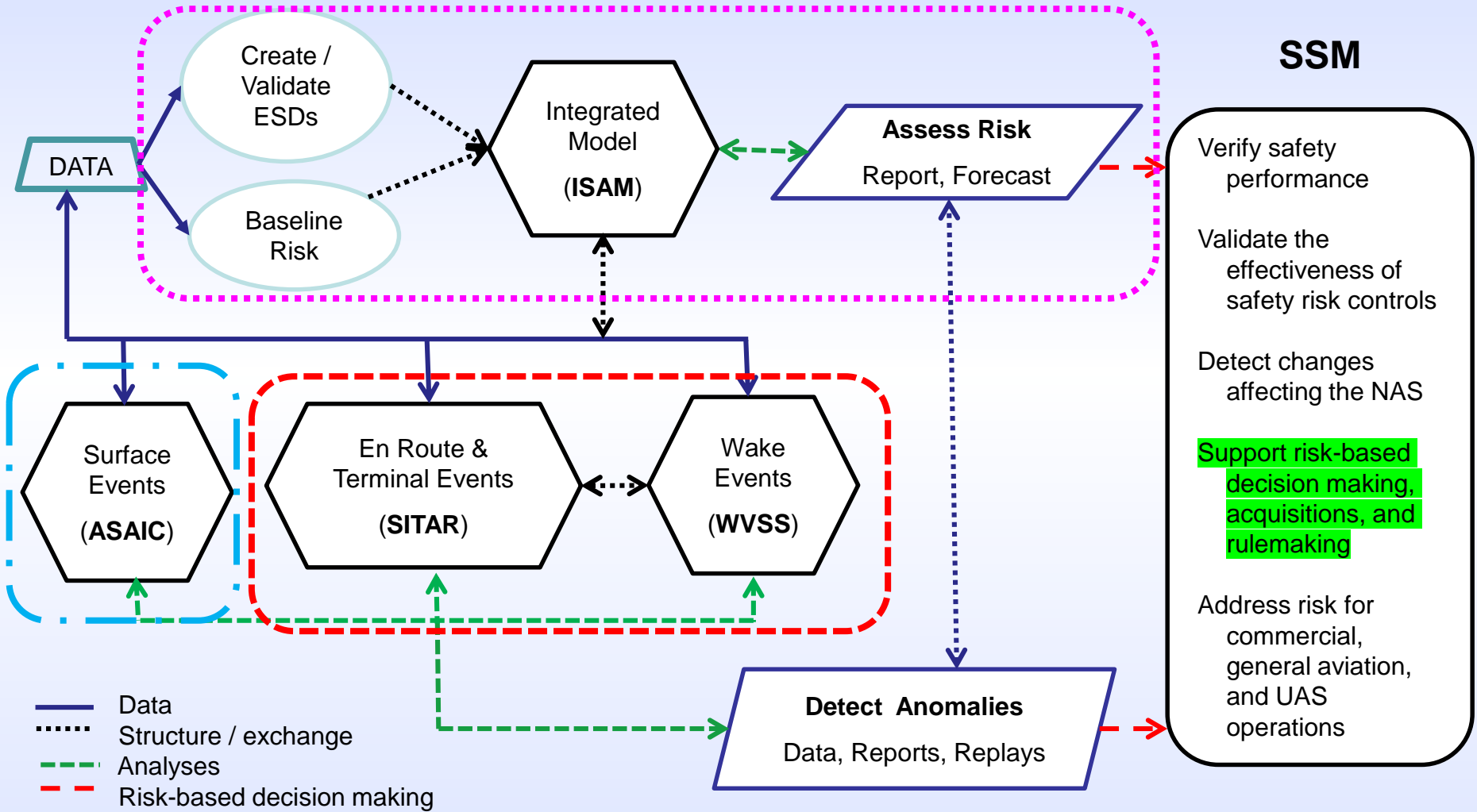
- Aims to develop and implement the policies, processes, and analytical tools that the FAA and industry will use to ensure safety
- Will define the evolving role of analysis for improving safety in the current and future NAS
- Ensures that changes introduced with NextGen enhance or do not degrade safety while delivering capacity and efficiency benefits to the FAA and users

System Safety Management Transformation (SSMT)

- Develops capabilities to baseline, monitor, and forecast risk assessment within the air transportation system
- Coordinates with other risk assessment and management programs (such as ASIAs) to proactively identify emerging risks
- Provides input into the Administrator's Strategic Initiatives for Risk-Based Decision Making
- Supports NextGen and other mission deployment decisions through "decision quality" analysis
- Supports rulemaking initiatives through alternatives analysis
- Supports detailed business case analysis for acquisition of safety-related investments and procedural changes
- Coordinates with EUROCONTROL under Appendix 8 to Annex 5 (NAT-I-3454)



SSMT Program Design



SSMT Tools

Airport Surface Anomaly Investigation Capability (ASAIC)

- *Measures surface/runway anomalies/encounters*

Safety Information Toolkit for Analysis and Reporting (SITAR)

- *Measures terminal/en route anomalies/precursors*

Wake Vortex Safety System (WVSS)

- *Models wake encounters and severity*

Integrated Safety Assessment Model (ISAM)

- *Baseline and predictive risk assessment built on Event Sequence Diagrams (ESDs) and Fault Trees (FTs)*

Table Top Exercise (TTE)

- *Process to elicit subject matter expert contributions to the validity and reliability of the data produced by SSMT tools and to evaluate proposed changes*



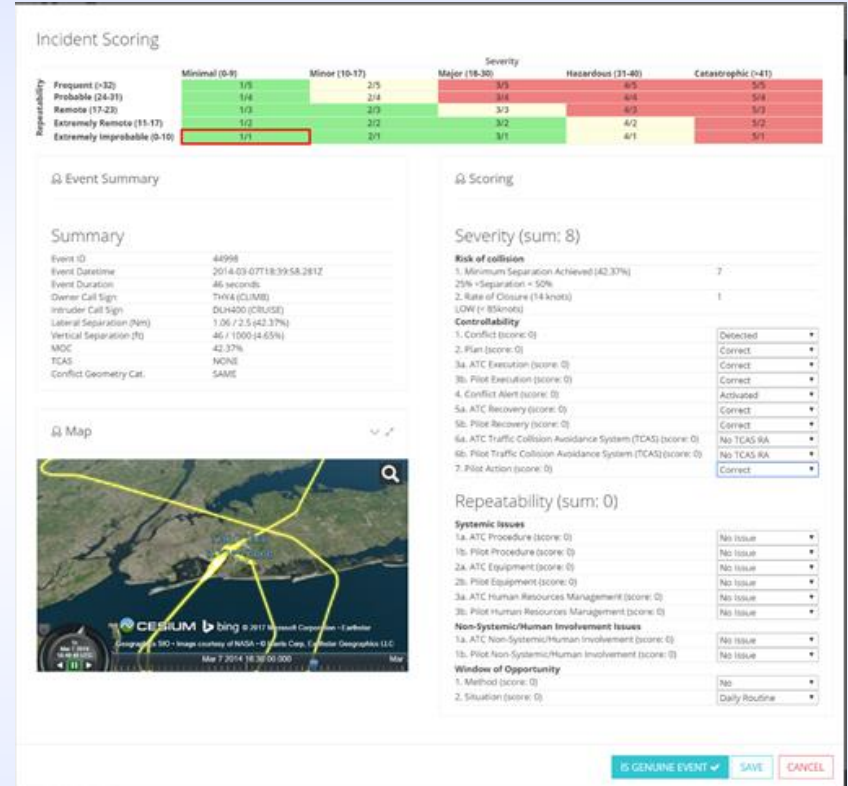
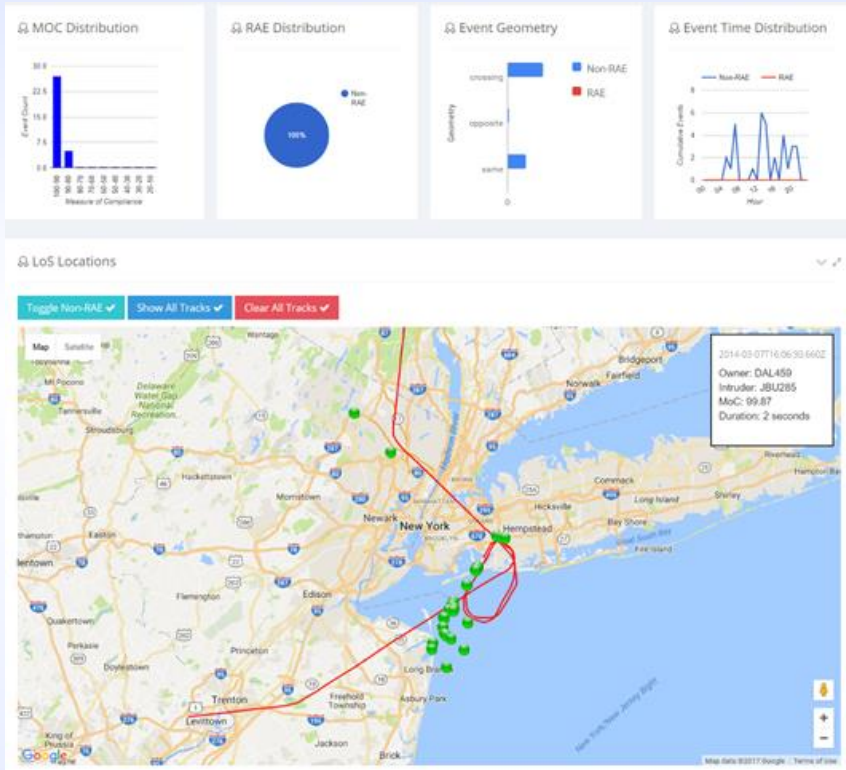
Airport Surface Anomaly Investigation Capability (ASAIC)



Safety Investigation Toolkit for Analysis and Reporting (SITAR)



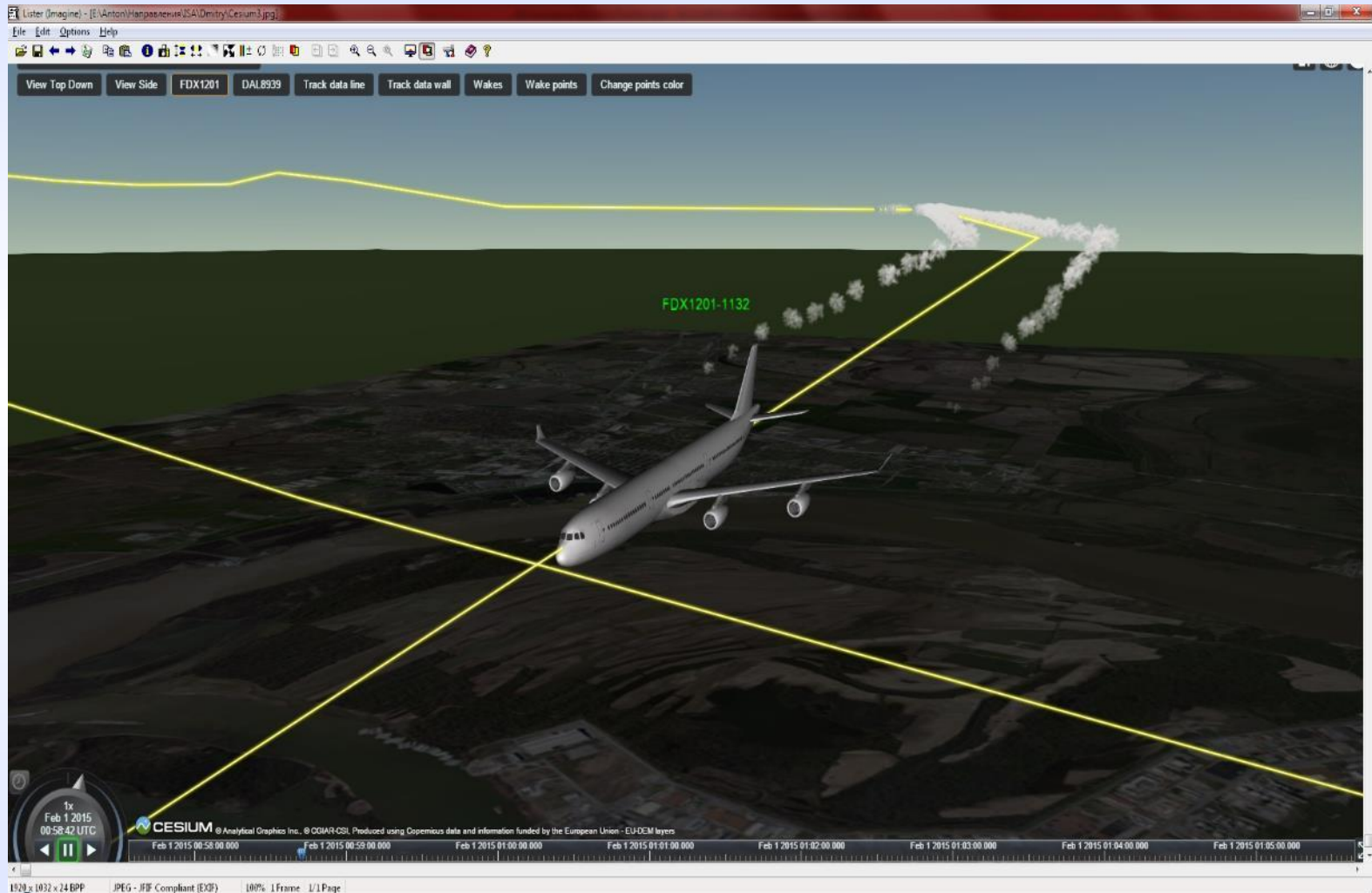
SITAR



Wake Vortex Safety System (WVSS)



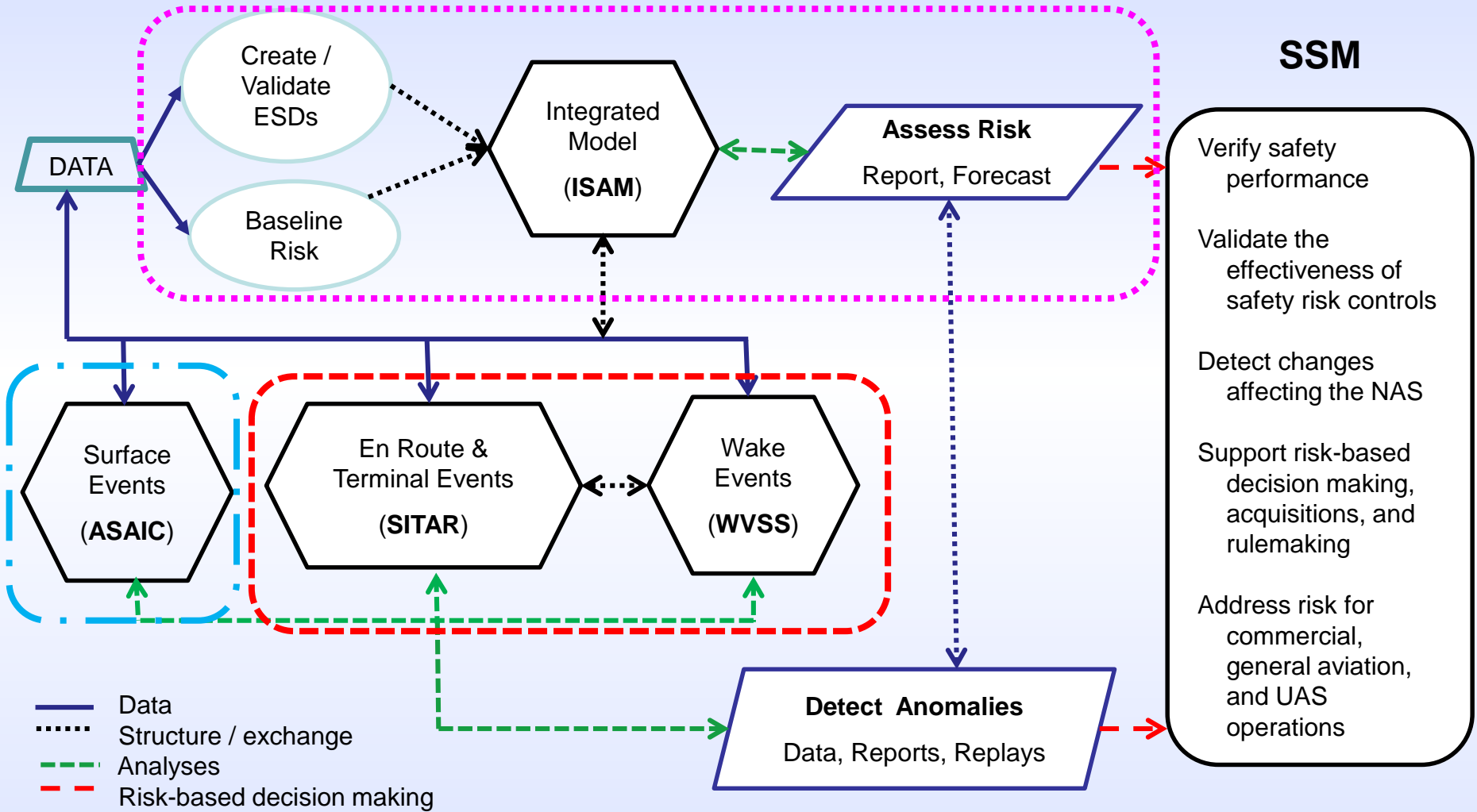
WVSS

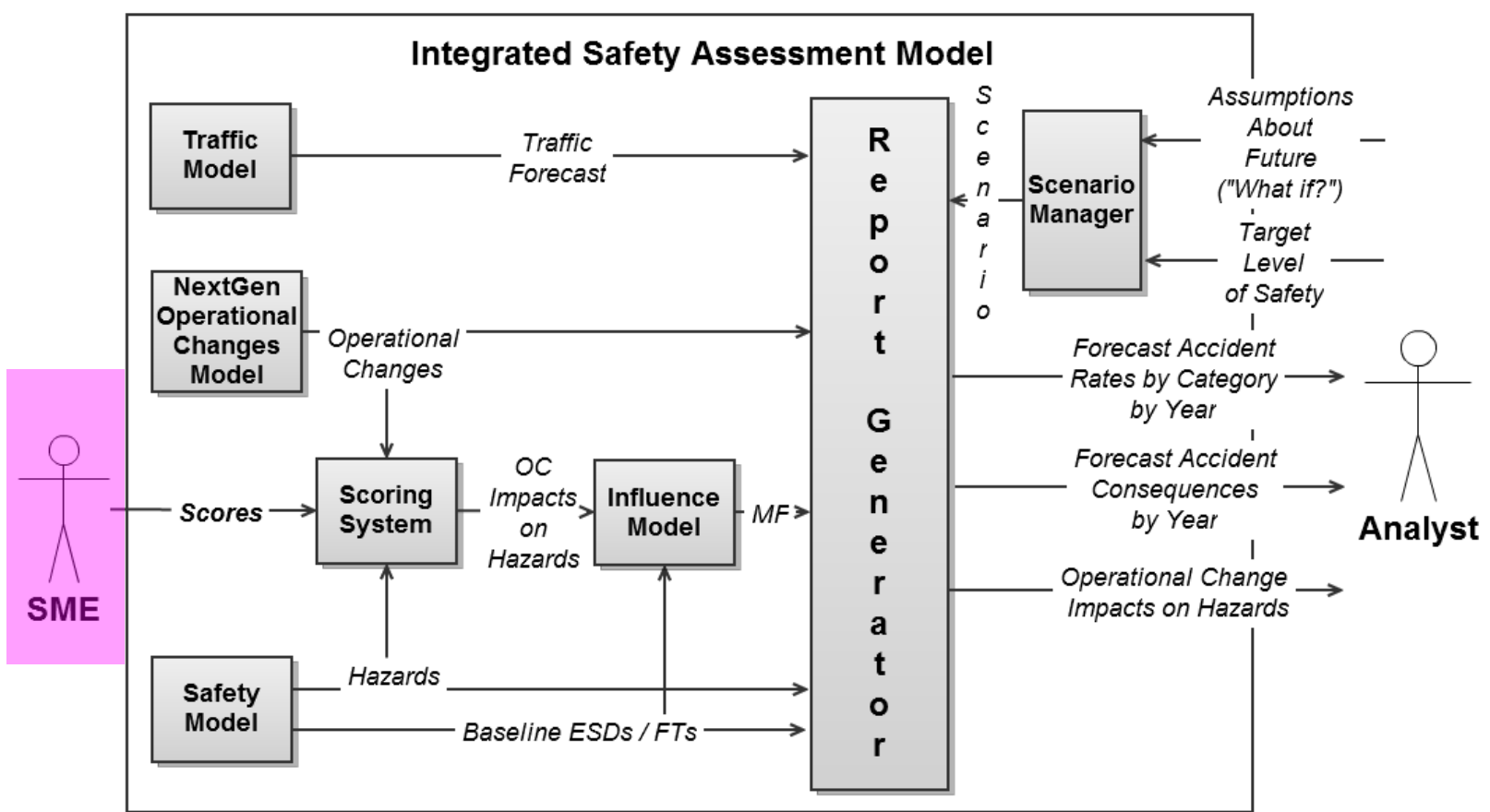


Integrated Safety Assessment Model (ISAM)



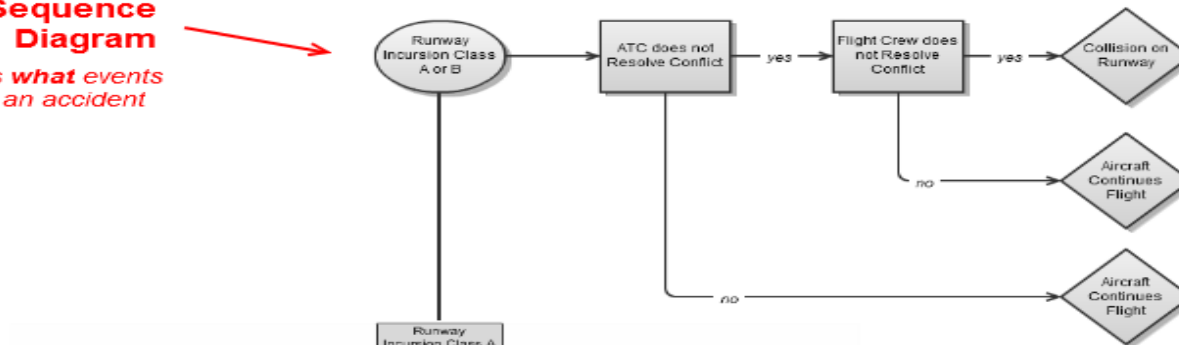
SSMT Program Design





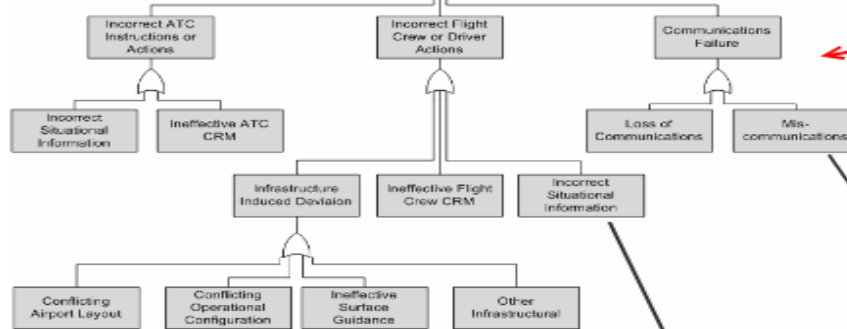
Event Sequence Diagram

Describes **what** events occur in an accident



Fault Tree

Describes **why** the events occur in an accident



Comm Degradation due to VHF Bandwidth Limits
 Frequency Congestion
 Frequency Interference
 Poor Interagency Coordination
 Language Barriers
 Non-Standard Phraseology

Hazards

Describes **hazardous conditions** tracked and managed by FAA

- Incorrect Surface Electronic Guidance
- Unknown Performance or Intent of Other Aircraft
- No ATC
- Aircraft Non-Equipped (ex. TCAS / ADS-B)
- Surface Electronic Guidance Unavailable
- Information Constraint
- Construction
- Poor / No Access Control Procedures

ISAM

ISAM - Home



Operational Improvements

Create and review proposed operational improvements.



Safety Models

Interactive risk models composed of fault trees leading to initiating events, and event sequences that describe how safety events conclude.



Traffic Forecasts

Review projections for future volume and fleet mix for different proposed future scenarios of air travel.



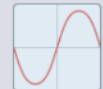
Scenarios

Build case studies from a range of configurable model parameters and assumptions.



Assess Hazards

Estimate the potential impact of proposed operational improvements on specific aviation hazards.



Influence Model

Review the parameters that are used to convert subject matter expert opinions into quantified risk assessments.



Target Levels of Safety

Review the target levels of safety that have been set for a range of possible futures.



Reports

Generate an output report from an ISAM scenario.



ISAM

ESD	Initiating Event
1	Aircraft system failure during take-off
2	ATC event during take-off
3	Aircraft directional control by flight crew inappropriate during take-off
4	Aircraft directional control system failure during take-off
5	Incorrect configuration during take-off
6	Aircraft takes off with contaminated flight surface
8	Aircraft encounters wind shear after rotation
9	Single engine failure during take off
10	Pitch control problem during take-off
11	Fire on-board aircraft
12	Flight crew member spatially disoriented
13	Flight control system failure
14	Flight crew member incapacitation
15	Ice accretion on aircraft in flight
16	Airspeed, altitude or attitude display failure
17	Aircraft encounters moderate or greater turbulence not related to wake
18	Single engine failure in flight
19	Unstable approach
21	Aircraft weight and balance outside limits during approach
23	Aircraft encounters wind shear during approach or landing
25	Aircraft handling by flight crew inappropriate during flare
26	Aircraft handling by flight crew inappropriate during landing roll
27	Aircraft directional control related systems failure during landing roll
31	Aircraft are positioned on collision course
32	Runway incursion involving a conflict
33	Cracks in the aircraft pressure boundary
35	Conflict with terrain or obstacle imminent
36	Conflict on taxiway or apron
37	Wake vortex encounter
38	Loss of control in flight (LOC-I) due to inappropriate aircraft handling
39	Runway incursion involving incorrect presence of single aircraft for takeoff
40	ATC event during landing
41	Take-off from a taxiway
42	Landing on a taxiway
43	Landing on wrong runway

- How often do undesirable conditions occur?
 - Precursor rates
 - Barrier failure rates
 - Accident rates
- How far up the chain do failures progress before a risk control prevents the failure from becoming an accident?
- What impact will planned changes to the NAS have on the effectiveness of the risk controls?
- How is the system performing relative to the target level of safety?



Table Top Exercise (TTE)



Table Top Exercise – Loss of Control Inflight

- TTE used to elicit expert judgment to enhance fault tree structures and to predict effect of changes
- Formal process
- Can be accomplished in-person or remotely via web-conferencing
- Your organization wants to identify if angle-of-attack indicators will help mitigate loss-of-control inflight
- You assemble an expert panel
- Conduct the Table Top Exercise
- Evaluate the qualitative data in the context of your question

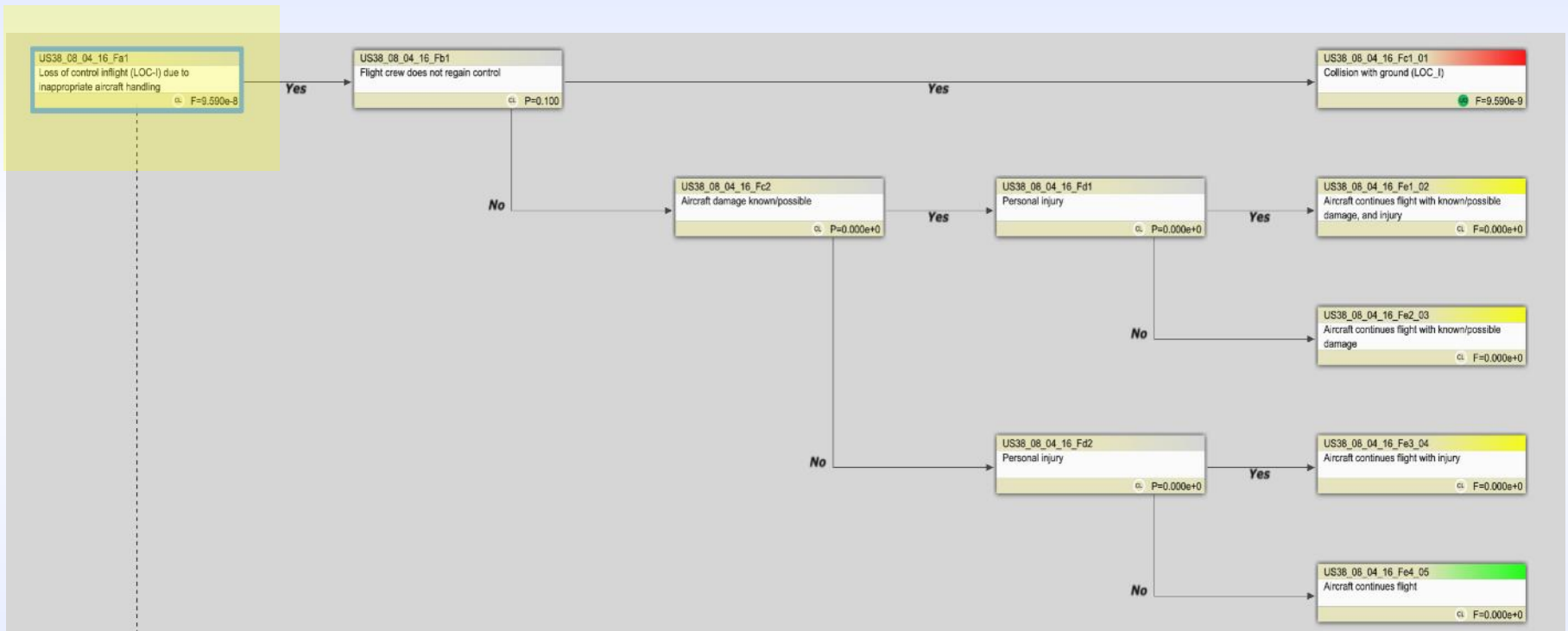


Table Top Exercise – Loss of Control Inflight

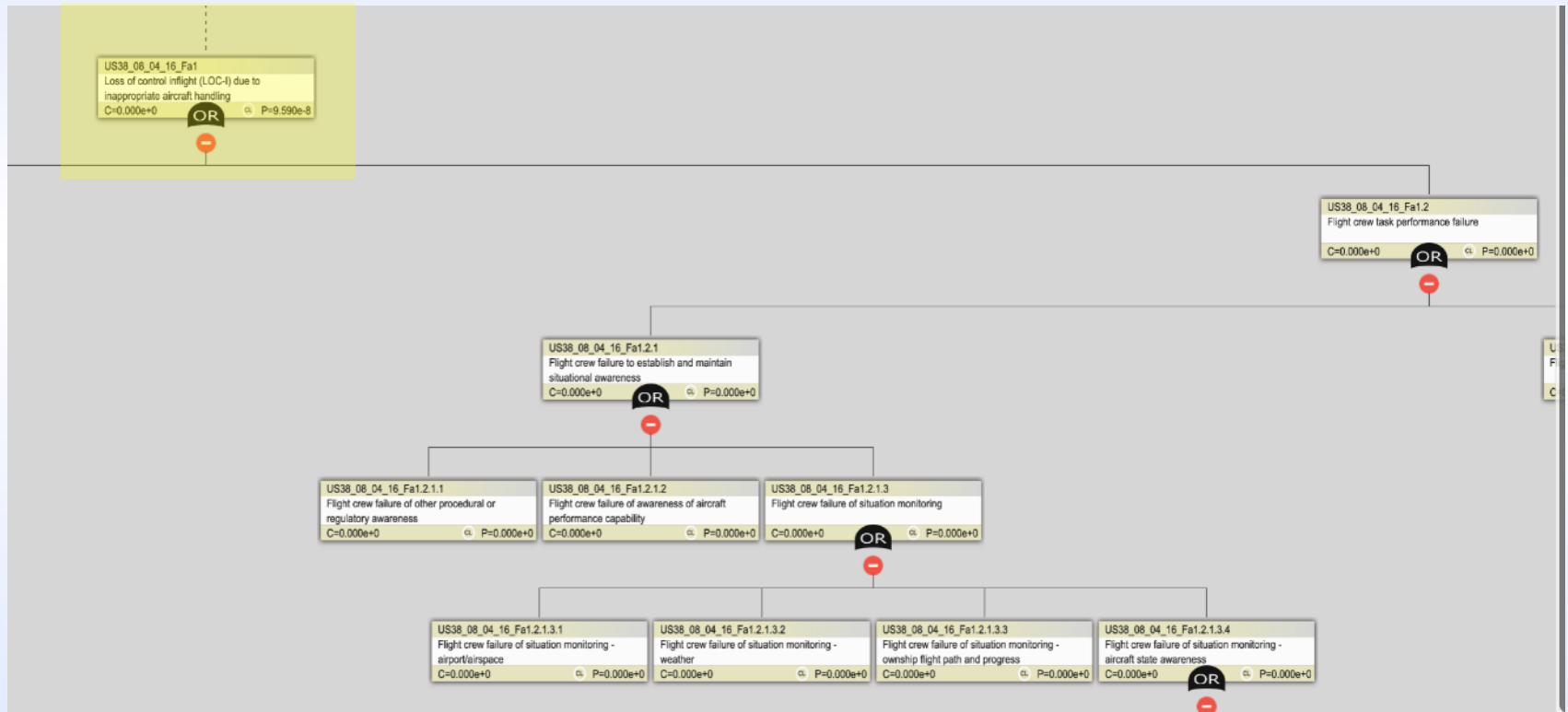
- Subject Matter Experts (SMEs) will evaluate information in the context of the fault tree of interest
- Accident, incident, and event data can be evaluated in light of the proposed change
- SMEs will “score” whether the change would increase or decrease risk to the system



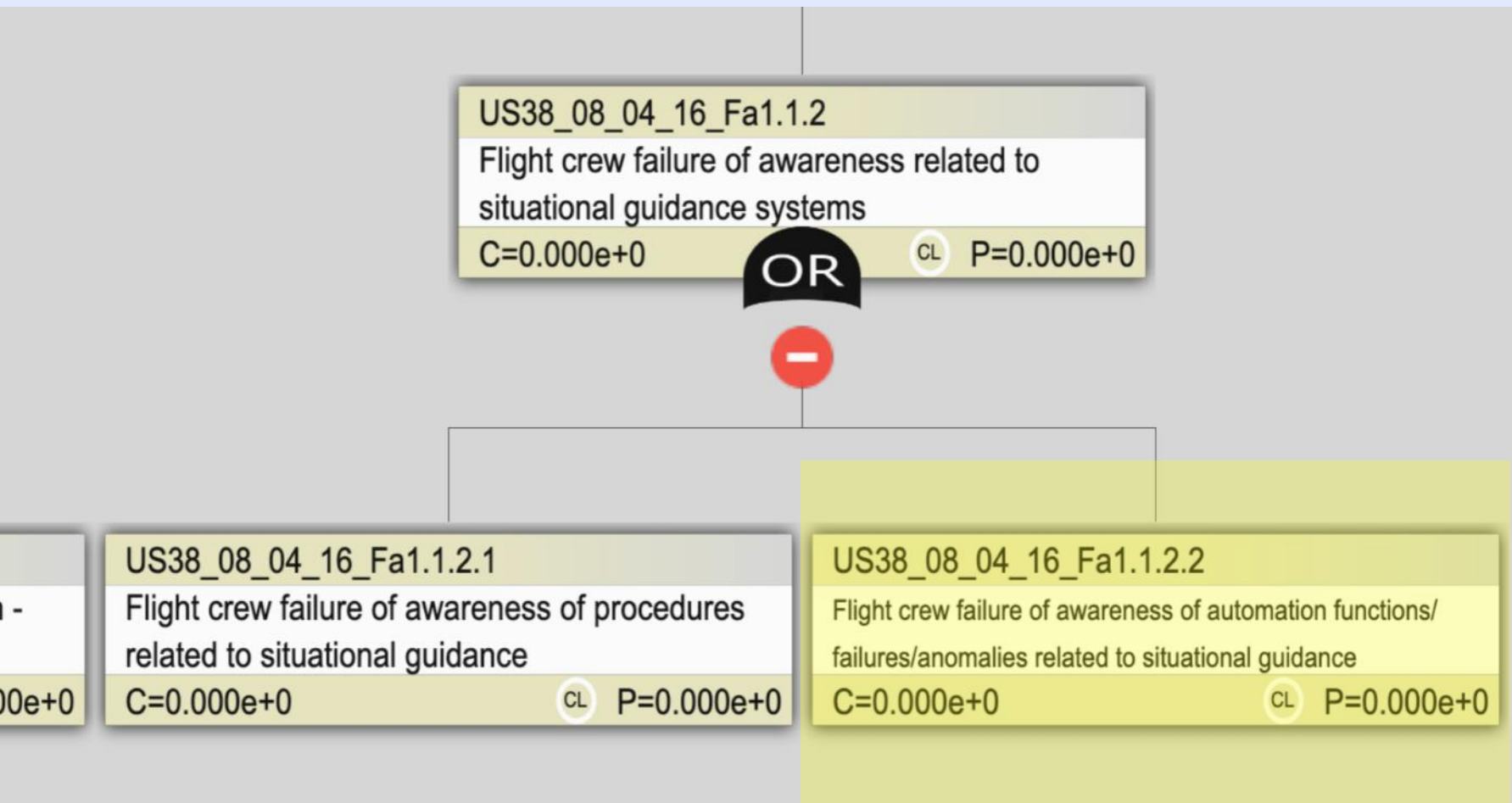
Loss-of-Control Inflight ESD



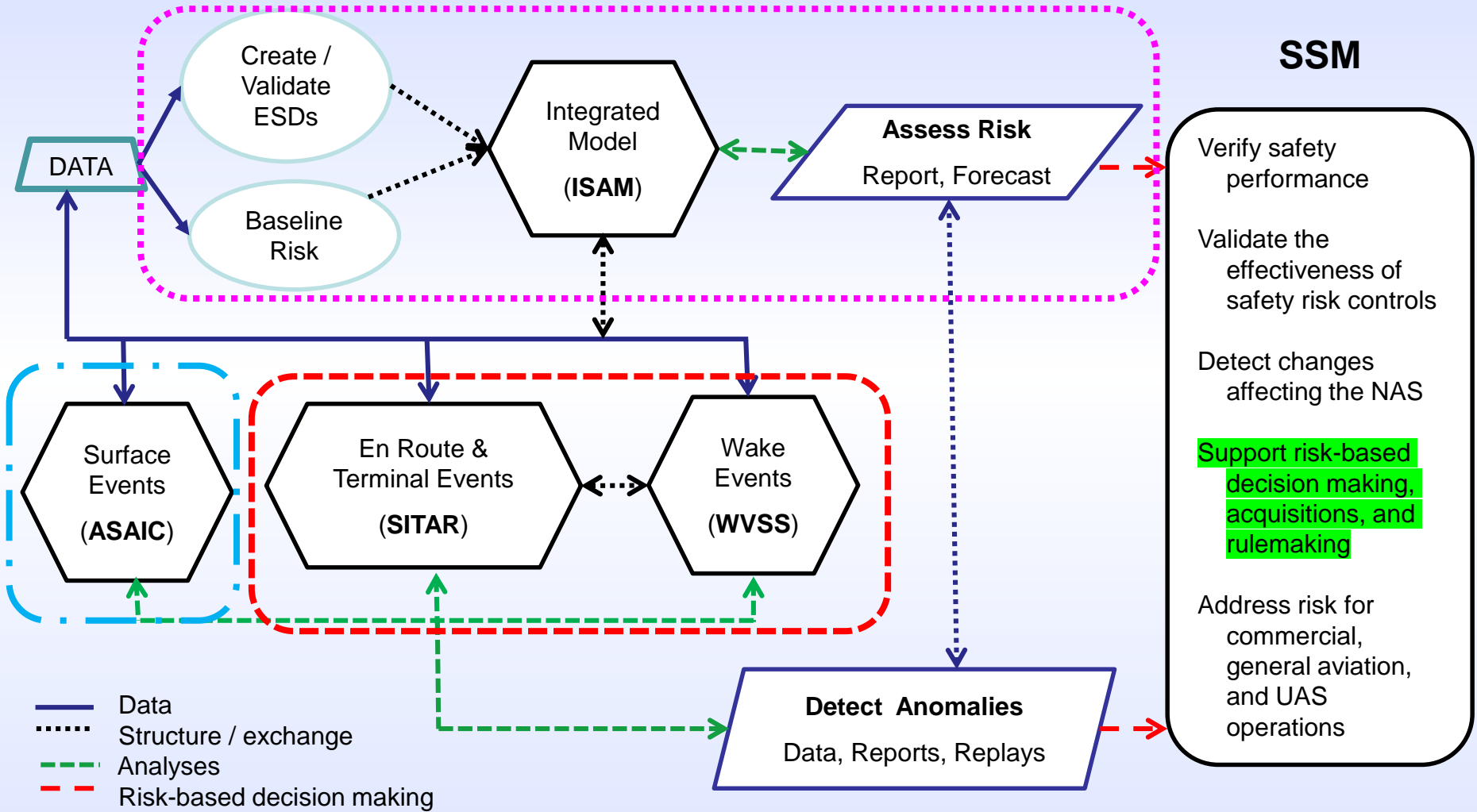
Loss-of-Control Inflight Fault Tree



Loss-of-Control Inflight Fault Tree



SSMT Program Design



SUMMARY

Collectively, the SSMT tools allow for a systematic integration process for multiple inputs to monitor and improve aviation safety.

For more information or to request User Guides,
please contact:

Program Manager

Aleta Best

Aleta.Best@faa.gov

202-267-8684

