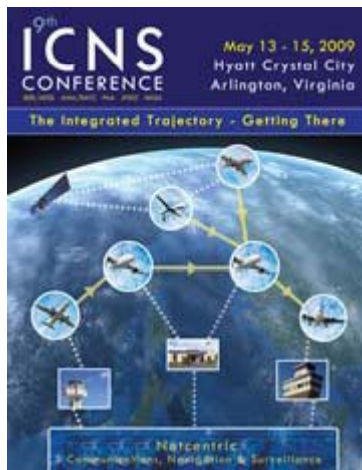


# Towards an integrated Aviation Security Incident Management capability in NextGen and SESAR



ICNS Conference 2009  
May 13-15, 2009



# Overview

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- Setting the scene
- Aviation Security – team effort
- iASIM – conceptual building blocks
- Experiments
- NextGen and SESAR
- Summary

# Driving Theme – Two Towers



integrated  
(Aviation Security)  
Incident Management

- Common approach like “Barad Dur” (Sauron’s tower)
- Extremely powerful
- Patrolled by (many) orcs
- But – let one little hobbit in, and the whole thing comes crashing down

# One little hobbit ...

**OWL Ontology:** [process.owl](#)

**Annotations:**  
owl:versionInfo : 1.0

**Total Number of Classes:** 1537 (Defined: 1537, Imported: 0)  
**Total Number of Datatype Properties:** 39 (Defined: 39, Imported: 0)  
**Total Number of Object Properties:** 102 (Defined: 102, Imported: 0)  
**Total Number of Annotation Properties:** 2 (Defined: 2, Imported: 0)  
**Total Number of Individuals:** 150 (Defined: 150, Imported: 0)

**Advanced Ontology Statistics:**

**Number of Inconsistent Classes:** 1  
IRI: [process:owl:DepthHear](#)  
No. of OWL: 1  
No. of Sub-Classes: 1921  
No. of Super-Classes: 1  
No. of Disjoint Properties: 10  
No. of Domain-Function Properties: 0  
No. of Inverse Properties: 2  
No. of Symmetric Properties: 0  
No. of Transitive Properties: 0

**Assertions causing the inconsistency:**  
process:owl:DepthHear - sub(Nothing)  
1) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
2) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
3) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
4) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
5) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
6) [process:owl:DepthHear](#) C [process:owl:Nothing](#) ("2" is not a integer)  
7) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
8) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
9) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
10) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
11) [process:owl:DepthHear](#) C [process:owl:Nothing](#)  
12) [process:owl:DepthHear](#) C [process:owl:Nothing](#) ("3" is not a integer)

1537 classes,  
1 modeling error  
= failure!



# What has this to do with iASIM?

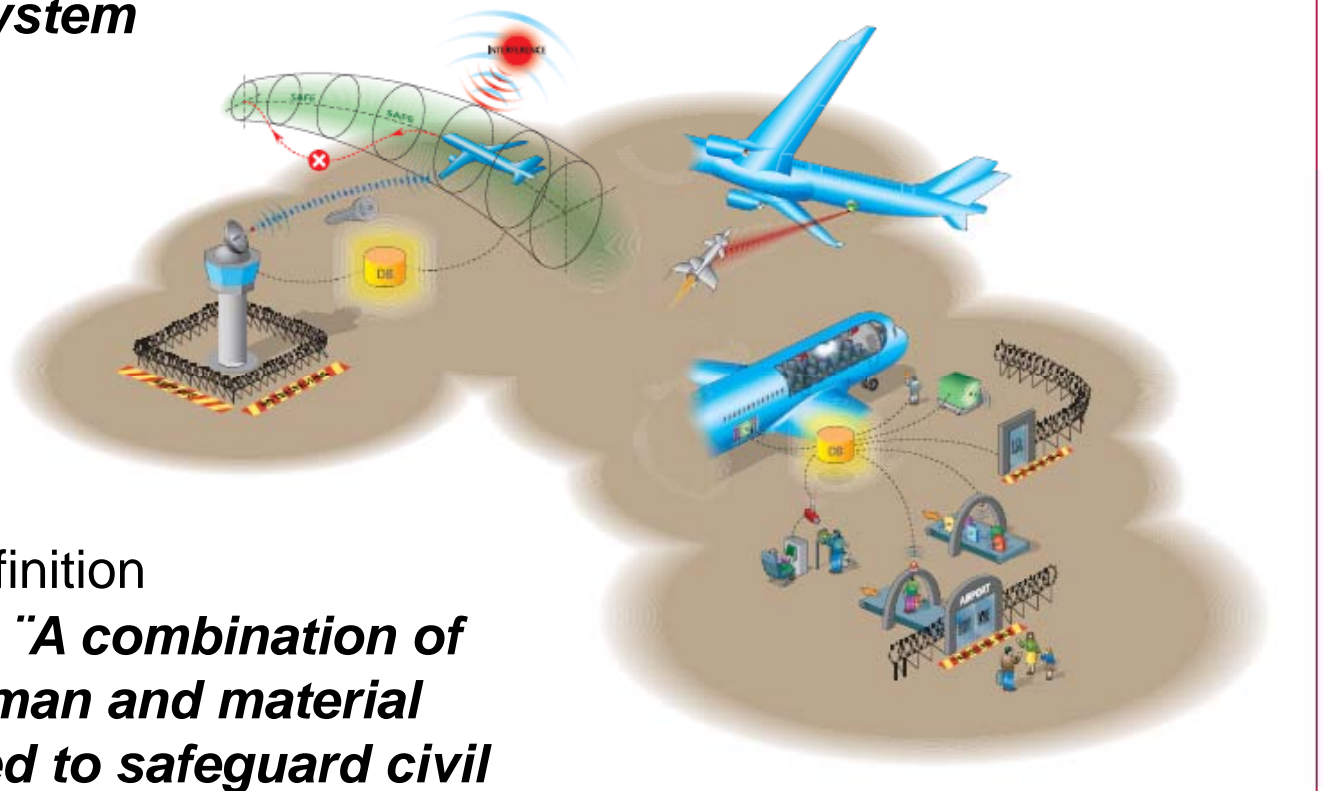
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- Significant amount of data across air transportation community. With increasing traffic the volume of data will increase.
- More (powerful) information does not help – operators drown in “infoglut”
  - “meaning” is required
  - technology can help
- Situation management is based on situational awareness and actionable information
  - we need a way to express “situation” and not a fact (and leave interpretation to operator) or a conclusion (and leave liability of false action to operator)

# Aviation Security

## *Aviation Security*

- an integrated system*
- a team effort*



ICAO Annex 17 Definition

***Aviation Security: "A combination of measures and human and material resources intended to safeguard civil aviation against acts of unlawful interference"***

# iASIM – a team effort

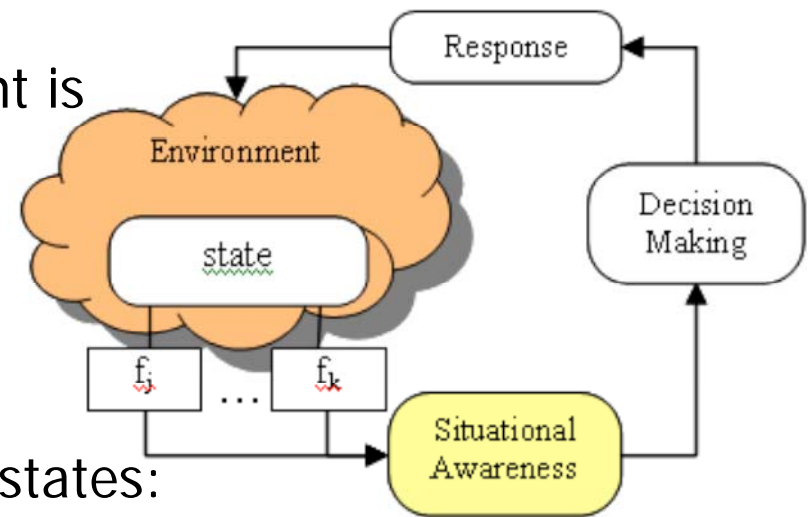


<p><b>Primary (Self Protection)</b></p> <p>An outcome that disrupts the ATM/ATC assets or impacts service provision or the safety of staff.</p>	<p><b>Scenarios</b></p> <p>Mortar attack on ATC centre Radar equipment vandalised Spoofing of communications Attack on IT</p>
<p><b>Secondary (Supporting Action)</b></p> <p>An outcome where ATM/ATC provides support to the respective national authorities responding to the incident.</p>	<p><b>Scenarios</b></p> <p>Hijack in flight MANPAD on approach Security alert at airport</p>
<p><b>Tertiary (Advisory)</b></p> <p>An outcome where ATM/ATC are not involved in the mitigation of, however, supports response and recovery in general.</p>	<p><b>Scenarios</b></p> <p>Riots in Paris Medevac during flooding</p>

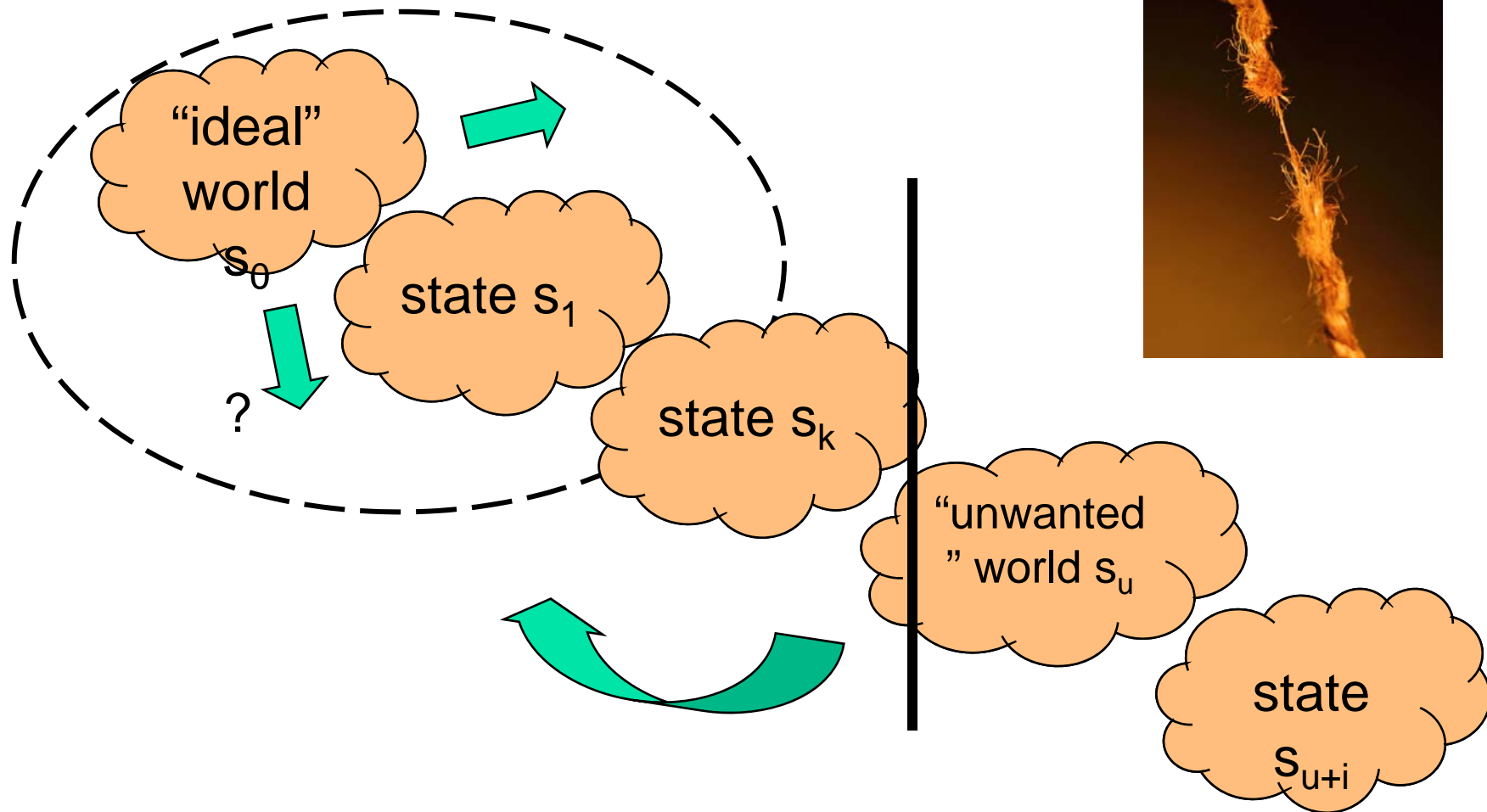
- Aviation Security not solely a “national (sovereignty) job”
- Air transportation industry / ATM community tied together

# Situation Management

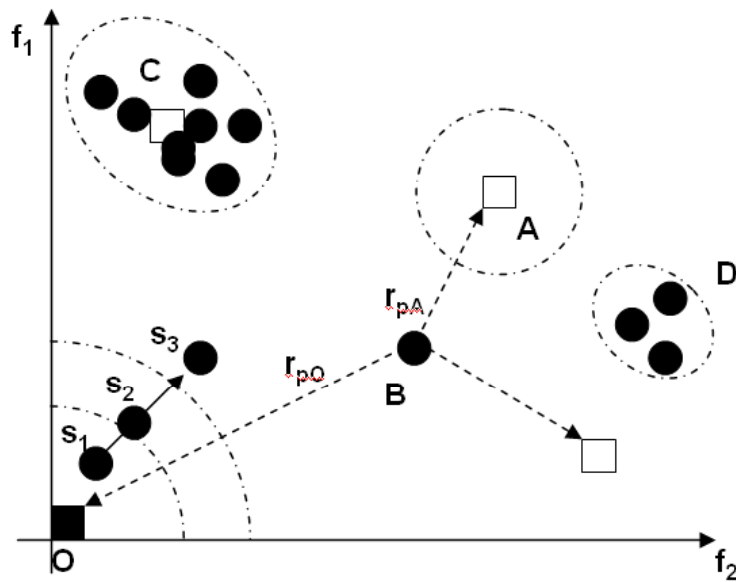
- Incident (or Situation) Management is based on a loop of Situational Awareness, Choice Selection and Response Deployment
- SA is the “State of knowledge that results from a process”
- Environment in a finite number of states:  $S = \{s_1, s_2, \dots, s_n\}$ ; each state identified by features  $f_{ik}$
- Identify the feature set (to a degree of certainty)  
→ Identify the state (to a degree of certainty)
- Use fuzzy logic & neural network learning to assess the feature set
  - Stressed, high temperature, drunk....



# Situation Management



# State-Space-Model



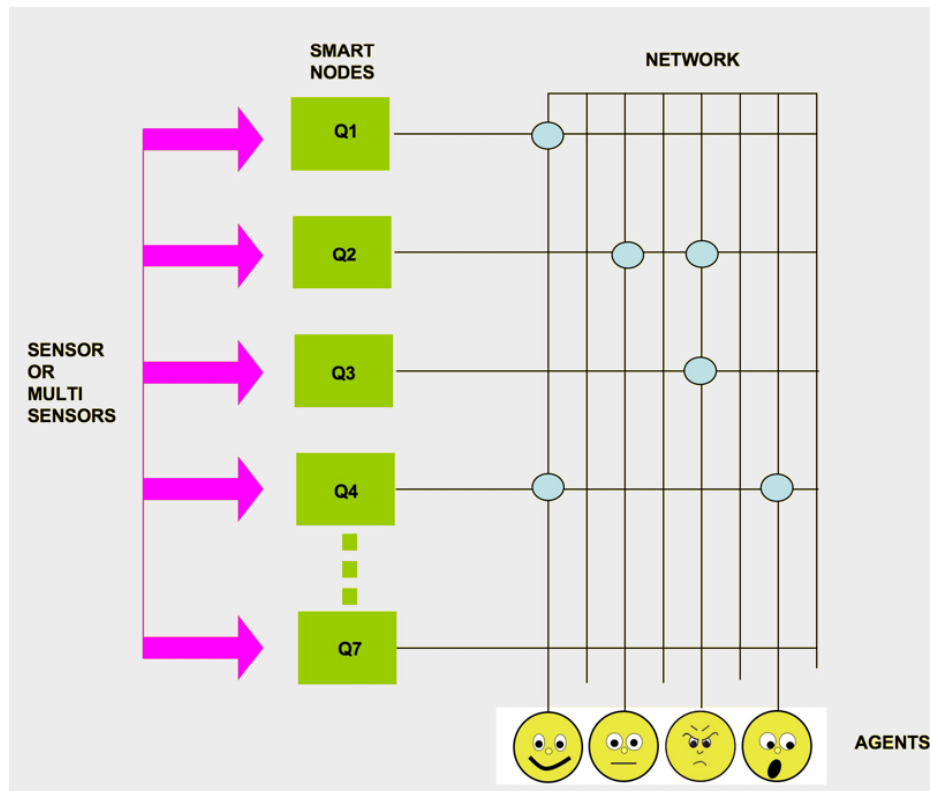
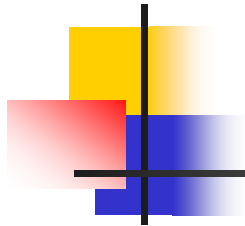
- The “working horse” for situation management

Identification of “known states” (bad and good!)

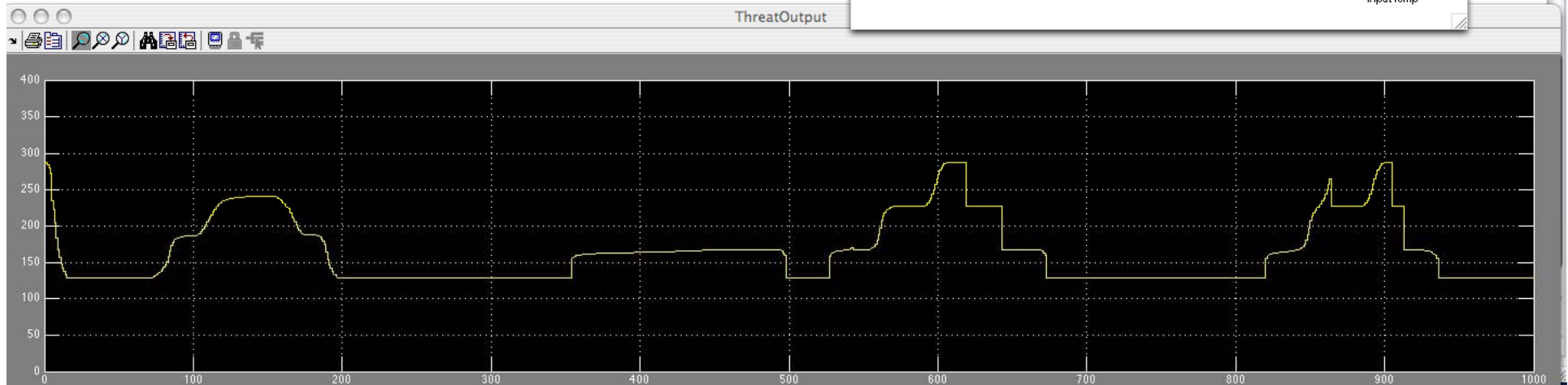
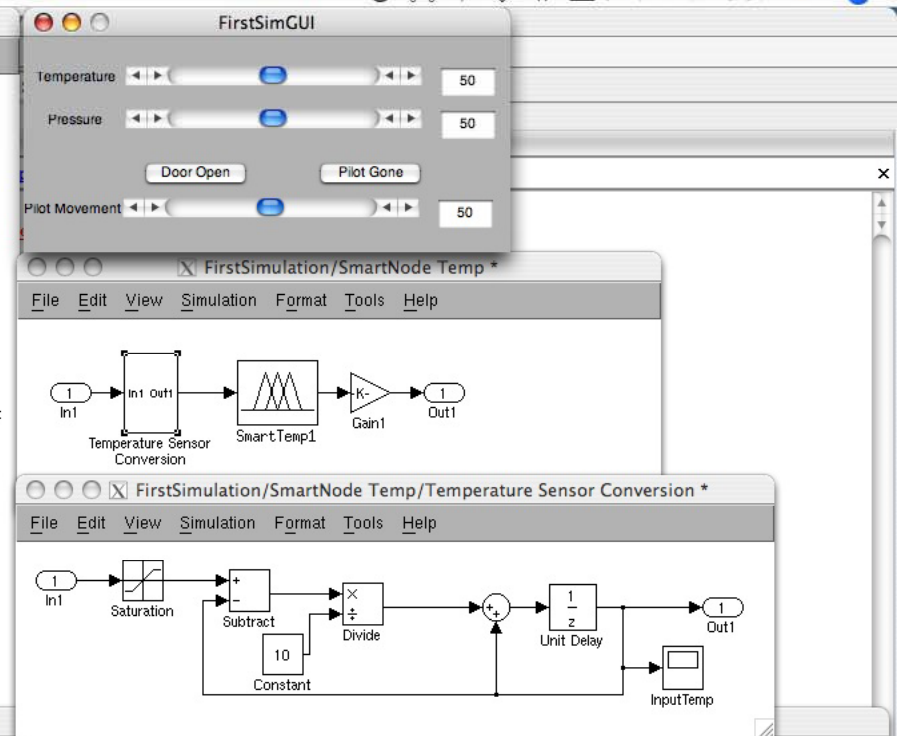
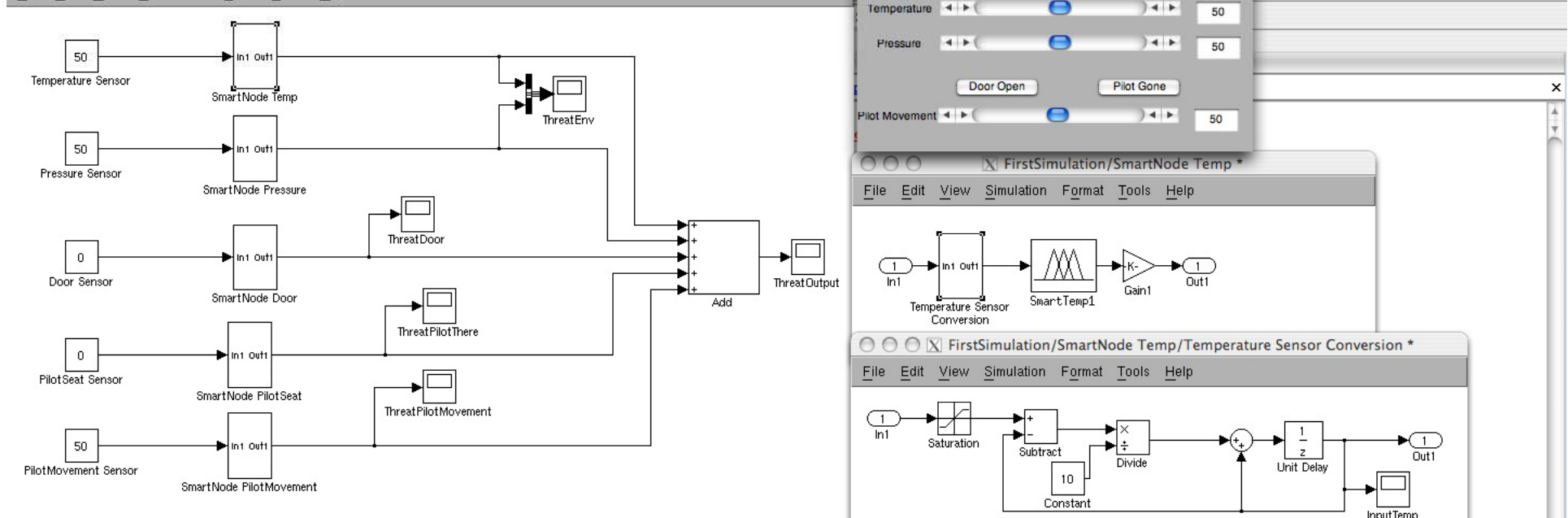
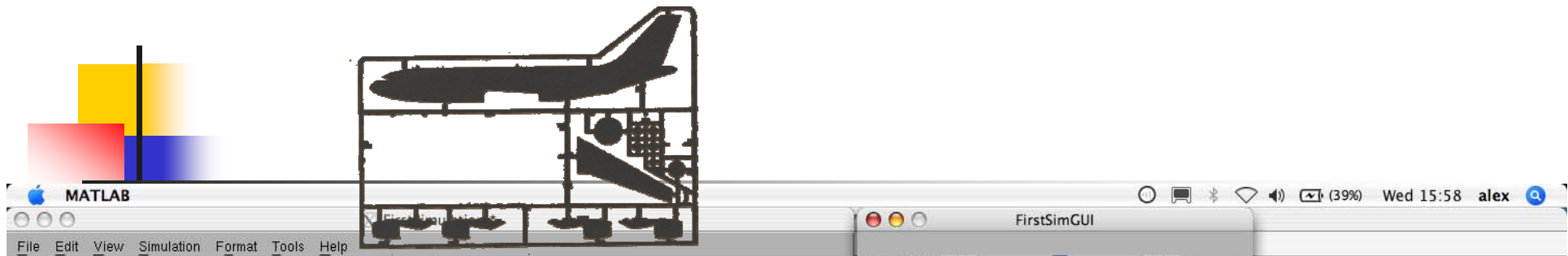
- Discovery of new states
- Early warning
- Projection (trend and velocity)

Most importantly:

- “smart”
- “no hobbit syndrome” (break due to inconsistencies)
- automated learning



- Smart Node outputs should follow a pattern
  - Airplane flight
- Threat Profile generated from all Smart Nodes
  - used to detect anomalies before they become situations
- Multiple ways of concatenating the smart nodes
  - Weightings of each node, normal ranges etc
- Assign personalities to the concatenations
  - Paranoid/Laid back/Reactive/Conservative



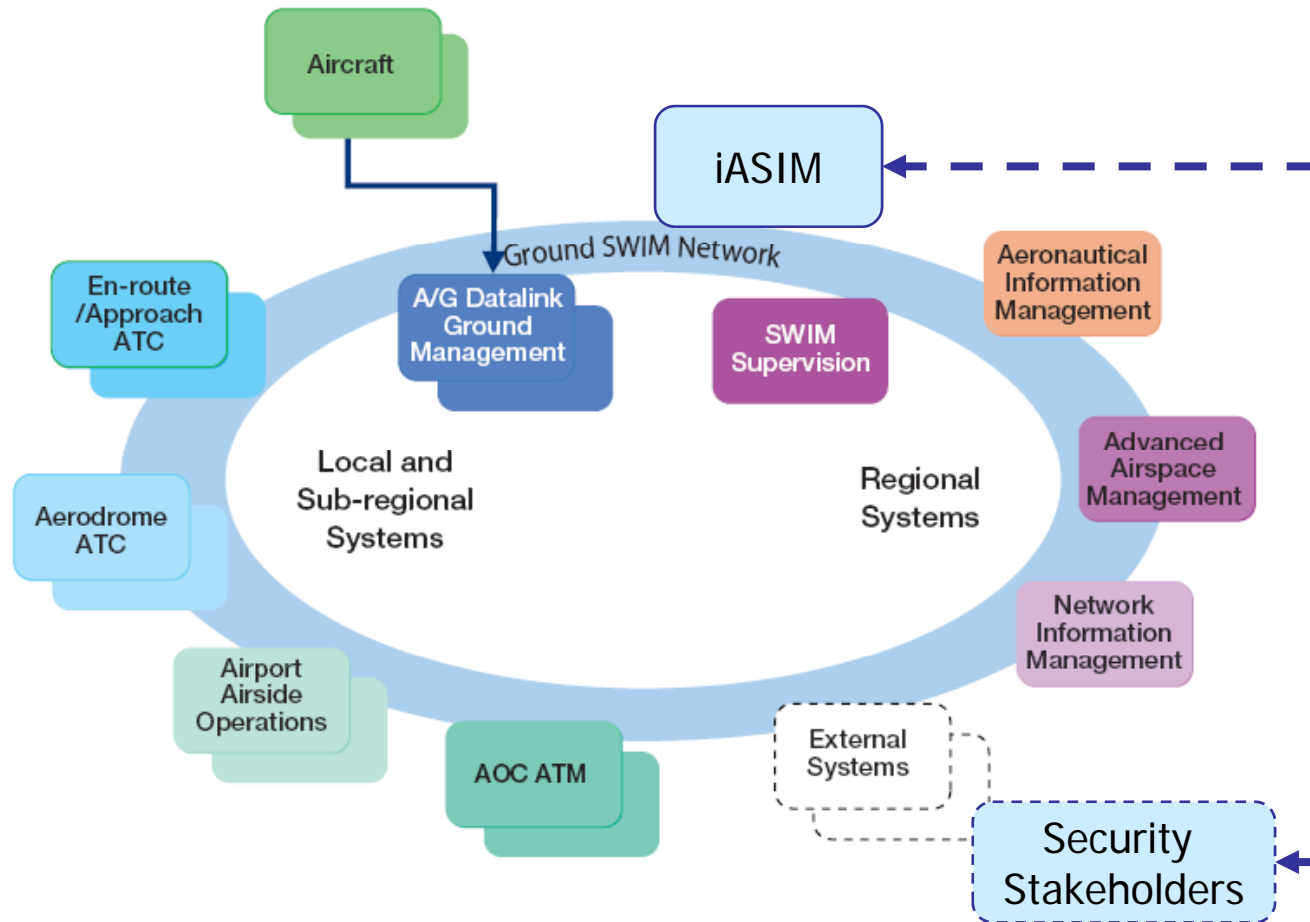


# NextGen and SESAR

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- Shift from a distributed network of independent units to a network of integrated co-operators
- Cornerstones
  - Information management
  - Data services
  - Network infrastructure

# NextGen/SESAR - Dual Use

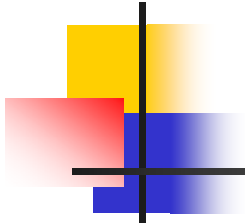




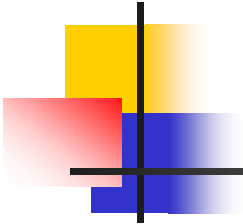
# Summary / Conclusions

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- Aviation Security is a team effort and thus a “secondary mission” for all ATM stakeholders
- iASIM is based on situation management and information fusion
- Significant amount of data available across industry
- Joint effort requires a seamless network infrastructure (including the aircraft) and data services to support incident management



- NextGen and SESAR offer an unique (“technological”) opportunity to make a quantum leap in aviation security!
- What it takes is to make use of a “dual use” approach which could help to improve security situation management at minimum additional costs.
- SWIM offers the platform!
- iASIM is the “next generation” capability!



- Further questions or lost?

Feel free to contact

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