Big data for improving aerospace safety

Overview of NLR research activities

FSS Public Workshop
Brussels – 8 March 2017

Gerben van Baren
vanbaren@nlr.nl
“Big data is in the eye of the beholder”
States that have fully implemented an SSP should focus on the systemic identification of existing and emerging hazards and the mitigation of safety risks across the aviation system through the analysis of multiple data sources, with the goal of achieving predictive risk management.

Technical capabilities should be developed to collect and analyse data, identify safety trends and disseminate results to relevant stakeholders. An SSP may require investments in the technical systems that enable analytical processes, as well as knowledgeable and skilled professionals required to support the programme.

The analysis of various forms of safety data is needed to develop effective mitigation strategies specific to each State or region.
States that have fully implemented an SSP should focus on the systemic identification of existing and emerging hazards and the mitigation of safety risks across the aviation system through the analysis of multiple data sources, with the goal of achieving predictive risk management.

The analysis of various forms of safety data is needed to develop effective mitigation strategies specific to each State or region. Technical capabilities should be developed to collect and analyse data, identify safety trends and disseminate results to relevant stakeholders. An SSP may require investments in the technical systems that enable analytical processes, as well as knowledgeable and skilled professionals required to support the programme.

**Motivation – ICAO Global Aviation Safety Plan**

- Multiple data sources
- Various forms of safety data
- Technical capabilities
- Knowledgeable and skilled profs

**=**

- Predictive risk management
- Effective mitigation strategies

---

FSS Public workshop | Big data for improving aerospace safety | Gerben van Baren | vanbaren@nlr.nl
Contents

Data

Techniques

Applications/Information

- Processing
- Analysis
- Modelling
- Visualisation
- Monitoring
- Prediction
1. Data driven performance monitoring
2. Data + machine learning = Prediction of indicators
3. Analysis / visualisation of data from occurrence reports
4. Data + risk modelling = risk picture
5. Text and data mining of occurrence reports
Data driven performance monitoring: Flight path data
Data driven performance monitoring

Quality of data

• Is it complete?
• Is it accurate?
Data driven performance monitoring
Collecting and processing 10,000 flights per hour

Tests on SURFsara Hadoop cluster / SPARK
- Scaling in volume: longer time periods
- Scaling in variety: more airports
- Including shared data
Data driven performance monitoring

Fusion data sources, focus on exposure data
Data driven performance monitoring
Convert data into performance information
Data driven performance monitoring

Convert data into performance information

Traffic density on runways/taxiways
Prediction of indicators using historical and actual data, state-of-the-art software and tool-sets

- Actual weight
- Weather
- Position
- A/C type
- Fuel policy
- Flap settings
- Runway

---

FSS Public workshop | Big data for improving aerospace safety | Gerben van Baren | vanbaren@nlr.nl
Prediction of indicators using historical and actual data, state-of-the-art software and tool-sets
Analysis / visualisation of data from occurrence reports

![Graph showing flight phase analysis and initial location of fire/smoke/fumes 1.](image)
Data and risk modelling, Risk picture, blind comparison
Text and data mining of occurrence reports

Similarity of narratives in occurrence reports

Runway condition (selected items)

Runway condition (all items)

Approach type flown

% of Total
In summary

Data

• Flight path
• FDM
• Occurrence
• Weather

Techniques

• IT infrastructure
• Data mining
• Machine learning
• Text processing
• Visualisation

Applications/Information

• Monitoring of performance
• Prediction of indicators
• Learning from occurrence reports

Multiple data sources

=  

Various forms of safety data

Technical capabilities

Knowledgeable and skilled pros

=  

Predictive risk management

Effective mitigation strategies