Building Trust in Data Assets for Real-Time Aviation Analytics
AirbusAirSense brings new, trusted, actionable insights combined with multi-source, real-time ADS-B data for improved end-to-end decision-making across aviation stakeholders.

**BENEFITS**

- **Improve situational awareness:**
  - Surveillance beyond your infrastructure
- **Identify operational bottlenecks:**
  - Spot anomalies and outline performance potential
- **Optimize resource utilization:**
  - Increase capacity, decrease costs, maintain performance

**PRODUCT OFFER**

- **Trusted Live Data Services:**
  - Global, real-time aircraft tracking fused from various sources
  - Flight-related events in real-time providing input for decision making
- **Insightful Advanced Analytics:**
  - Historic, live and predictive analytics though APIs and dashboards
Digital products create measurable customer upside

Historic Big-Data Analytics
- Benchmark past performance
- Analyze asset history
- Flag unusual operations

Real-Time Analytics
- Provide situational awareness
- Generate alerts and warnings
- Analyze impact of operations
- Identify bottlenecks during operations

Predictive and Prescriptive Analytics
- Predict future system state
- Early warnings for disruptions
- Suggest Actions to improve performance

Trusted Tracking Data Service
- Track all aircraft, anywhere
- Ensure true information
- Merge complementary data
AirSense Solution delivers real-time, reliable, cleaned and fused data and surveillance-based analytics using our cloud-based architecture to make information easy to consume and enable better decisions.

**Digital Product Structure**

**PRODUCT LAYER**
- Airspace Efficiency Toolbox
- Trusted Track with Quality Framework
- Predicted Time of Arrival API
- Global Integrated Airport Capacity Model
- Etc.

**WIDGET LAYER**
- Aggregation
- ML / AI Models
- Visualizations
- APIs
- Etc.

**KNOWLEDGE LAYER**
- Data Fusion
- Data Cleaning
- Data Enrichment
- Event Detection
- Etc.

**RAW DATA Suppliers**
Aircraft Position Data

Aircraft positions are:

• Self reported (e.g. ADS-B)
  • Aircraft broadcasts its position

• Actively interrogated (e.g. Radar)
  • A signal is sent to the aircraft, reflected, and received

• Passively observed (e.g. MLAT, spotters)
  • A signal from the aircraft if received and analyzed
What is ADS-B?

- Aircraft position data
- High update interval (2Hz)
- High precision (GPS ~few meters)
- “Simple“ receiver equipment
- Explicit uncertainty
- Mandated for commercial aircraft
- Several stakeholders collect data
  - ANSPs
  - Companies
  - Private persons
  - Etc.
ADS-B Opportunities

- New view on operations of assets
  - Aircraft centric
  - Infrastructure centric (Airspace, Airports)
  - Passenger centric
- Large amount of data
  - Significant statistics
  - Machine learning
  - Global picture

So we can create actionable analytics!
• Data supplier specific infrastructure
• Data supplier specific format
• 2+ Billion messages sent per day
• 100+ GB per day, 3+ TB per month, 35+ TB per year
• Challenging to handle:
  • Storage
  • Processing
  • Analytics
• Varying data quality
2 Trajectores: Which one is wrong?
Data Quality issues: Wrong position reports – Deep Dive

2 Trajectores: One has more uncertainty!
Data Quality issues: Ambiguous Meta Data

• ADS-B provides data, who is operating an aircraft
  • Specifically, we can identify an aircraft by it’s ICAO and the airline by the Airline ID
• The ICAO field is a unique ADS-B transponder ID
  • This would likely only change when the transponder is serviced / replaced
• The Airline ID is generated from the first 3 characters of the ADS-B “callsign” field

How can there be more than one airline per ICAO?
**Data Quality issues:** Ambiguous Meta Data – Deep Dive

There can be more than one airline per ICAO if:

- We count “NULL” values
- An aircraft uses the registration as callsign
- Multiple Airlines share the same aircraft

Actionable information!
Data Quality issues: Ambiguous Position information

- Multiple data providers send information about aircraft positions at different times
- Positions get rounded to nearest decimal
- Timestamps have different accuracy
Data Quality issues: Ambiguous Position information – Fuse data

- Understand data specific limitations
- Account for Provider specific parameters
- Fuse data into one “true” stream

Provider A
Provider B
Fused Stream
Provide best possible truth of data:

- Ingest
- Fuse
- Clean
- Enrich
- Distribute

Make uncertainty explicit with every position
Share assumptions and code with analysts
• 2 million messages per minute
• Kafka – easy message handling
• Kubernetes – resilient service provision
• Docker – flexible deployment
600 Analysts working with this data
Open source inside the company:
• Shared code base
• Shared data base
• Shared compute resources
• User exchange (meetings / hackathons)
Commercialize analytics architecture
- Database
- APIs
- Dashboards

Develop widgets

Deliver products

Dashboard

1. Filter aircraft by airline and equipment
   - Airline:
     - ANY -
   - Equipment:
     - ANY -

2. Select aircraft based on registration
   - Registration:

Show analysis for selected registration.

Selected Registration: DAIIIM

Aircraft Utilization

Visualization
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