Best Practice for NM Safety Management Tools - Experience Sharing to Enhance Safety (ES2)

"Moving towards Safety Intelligent tools"
ASMT User Stories and Beyond

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NATS
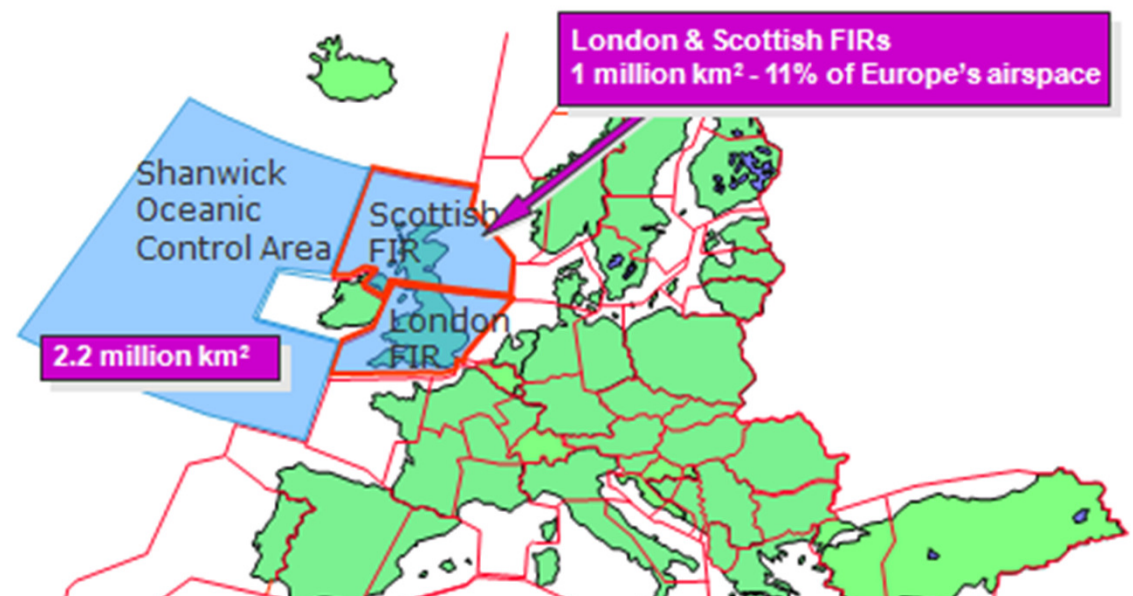
NATS & UK airspace context

NATS is the UK's leading air navigation service provider, handling over **2 million** flights each year. Traffic in **2016** was even more than forecast.

NATS provides air traffic control services from 2 control centres (covering **domestic** and **Oceanic** flights, with IAA) and 14 **airports** in the UK, as well as a wide range of commercial solutions to over 30 countries internationally.

Shanwick Oceanic Control Area

2.2 million km²

Scottish FIR

London FIR

London & Scottish FIRs
1 million km² - 11% of Europe's airspace

Use of safety data

What do we use safety data for?

- Monitor ongoing levels/trends of safety;
- Inform safety improvement decisions;
- Quantify effects of safety improvement activities;
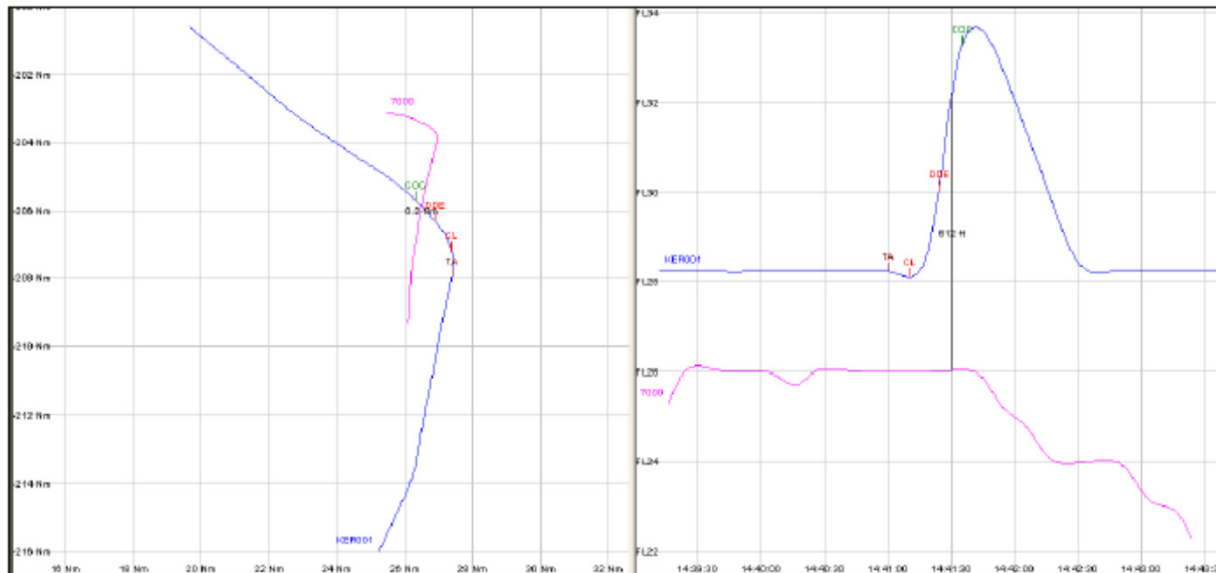- Model and assure safe implementation of new concepts/designs/procedures.

TCAS - simulated data for Investigations

Currently the primary use of TCAS data within NATS is to provide detail to Air Traffic Control **Investigators**, after an incident.
These are based on an InCAS **simulation** using radar data as input.

InCAS Simulation

CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
TA	Traffic Alert	DDE	Don't Descend	DE	Descend
RA	Resolution Advisory	CL	Climb	COC	Clear of Conflict

TCAS - ASMT data used in Touchstone project

NATS version of ASMT v3...

Previously TCAS data from ASMT used in
Touchstone project:
- alerts involving commercial traffic
  weighted by advisory type;
- **combined** with other systems data;
- highlighted hotspots in airspace;
- looked at Centres/sectors with
  high values and those which
  changed over time.

TCAS - Skytrail tool

NATS seeks to improve safety through airspace design changes. One project currently being progressed is looking at independent parallel approaches (**IPA**).
IPA has the potential to increase the number of TCAS RA's so the project asked our team to look into simulating these for the proposed design. NATS Analytics created a tool called **Skytrail** to perform this – this mimics the TCAS logic and takes 3D track designs as input. A selection of deviations with varying start point/angle/etc are then simulated, assuming no pilot/controller correction.
The output is given in terms of time from blunder to RA, as well as by location.

The Skytrail tool could be applied for other
regions as part of NATS' commercial offering.

Safety intelligence

NATS

Safety Intelligence approach is an important part of the [NATS Strategic Plan for Safety](#), including:
- Looking at **lower level events** (not just events scoring on RAT) and at leading indicators (e.g. VDAT – SFL changes – level busts);
- Looking at bolstering **things which go well** (NATS uses a method called "**Day2Day**");
- Ensuring as many people as possible involved in safety improvement have **access to the safety data/analysis** so they can swiftly take any actions required or highlight emerging trends. We have done this though our BI data warehouse and BI dashboards.

Safety Intelligence

Our performance is such that we must adopt new measures to understand how safe we are. We must redefine safety to mean 'as many things as possible go right', not just 'as few things as possible go wrong'. We will continue to learn from incidents but also define new measures of performance which allow us to anticipate risk.

People Create Safety · Safety Intelligence · Tailored & Proportionate · Challenging & Learning · The Future of Safety in ATM

Business Intelligence Data Warehouse (BI DW)

NATS Analytics has 5 teams, one of which is Safety. We share many data sources between teams, thus a benefit to creating a "one stop shop" of our data. The Business Intelligence (BI) **data warehouse** (DW) was created to reduce repeated effort for extracting, transforming and loading data – also improving the ability to consistently join information together.

This is a huge SQL database with **systems data** back to 2010 in many cases. It includes radar data, FPLs, safety nets alerts, RT occupancy, information on Watches/staffing, weather, delays, environmental 3Di, etc.

Once **TCAS** data is available for NATS, this will be added to BI DW.

Note that **RAT**/other reported event details are currently contained in a separate database, but can still be linked to dashboards.

BI dashboards

Automated dashboards can be created from data in BI DW, event databases or other common file types.
Our team mainly use Microsoft PowerView, as the format suits our internal customers and can be quickly refreshed with new data. PowerBI being trialled.

Benefits of PowerView dashboards:
- Data can be accessed widely and quickly by internal staff for safety intelligence;
- Format looks similar to PowerPoint and can be used by customers in meetings (either live or by exporting);
- Customers know what format to expect each time;
- Customers can filter data, so can answer many queries for themselves.
- PowerView links to data rather than saving it, so file size is small.
- Analysts spend minimal time refreshing, thus more time for interpretation and investigating.

Example BI dashboard

Safety nets monitoring, until recently, has been every 6 months. Now via dashboard can identify emerging trends much quicker. Most recent version used to **support 3 operational changes** to safety nets.

The examples shown here are for Short term conflict alert (**STCA**) and then Vertical Displacement Advisory Tool (**VDAT**). We would produce similar dashboards for the TCAS ASMT data.

Also working on linking R code for **Statistical Process Control** (SPC) to the dashboards, making it even easier to show which changes are statistically significant.

Example dashboards were shown in the presentation on 25 April.

Tipping points, intervention, Sage & Bode?

Time saved by using BI dashboards has been used by our team to work on projects such as these:

- **Sage** project – testing 24 hypotheses for what is driving changes in the RAT score for events;
- Since traffic increasing, what are **tipping points** for amount of traffic and events within certain parts of airspace;
- **Bode** project – implementing a machine learning algorithm for whether we expect certain types of events within our Terminal Control (TC) operation based upon weekly updates of weather/events/etc;
- Focus is on **applying knowledge and safety intelligence** from dashboards, studies, etc – all to predict/prevent/mitigate events BEFORE they occur.

Next priorities for our team

1. Working with Eurocontrol to get **TCAS ASMT v4** operational for NATS, thus able to supplement the information given to the Investigations teams following an event and show trends;
2. The follow-on to BI DW is an even bigger database (**DSRA**) which can take unstructured data and has "**Big Data**" tools included with it. We expect this to be operational at the end of 2017. One important aspect is ability to *flexibly interact* with the data via tools;
3. Event **prediction** and mitigation, focussed on the highest risk areas of the operation.
4. Using all of the items above to improve safety and handle forecast increases in traffic, whilst also meeting our **RP2** safety targets.

Further questions?

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