

Air Traffic Management and the Environment

Driving Airspace Efficiency

Ian Jopson

- > Background to NATS
- > Setting targets
- > Monitoring progress
- > Achieving results



En route ATC

Prestwick

Handles on average
2,500 flights/day

- Scottish Oceanic Control Centre
- Scottish Area Control Centre
- Manchester Area Control Centre
- Scottish Military Air Traffic Control

Whiteley

Corporate & Technical Centre



Turnover

FY11/12: 695m



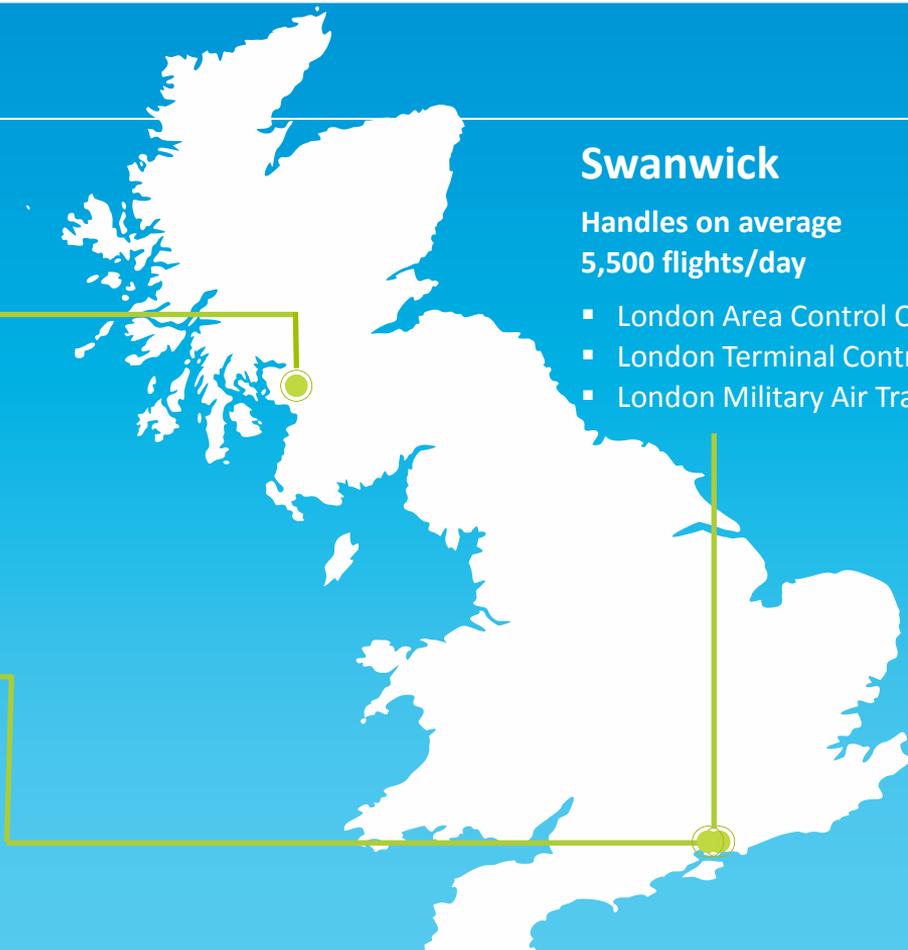
Employees

c.3400

Swanwick

Handles on average
5,500 flights/day

- London Area Control Centre
- London Terminal Control Centre
- London Military Air Traffic Control



NATS Services: UK Airports

Each UK airport chooses who supplies its ATC services. NATS Services has secured commercial contracts to provide air traffic services at 15 major UK airports and Gibraltar.

NATS Services provides supporting communications, navigation and surveillance infrastructure.

NATS Services provides commercial engineering and consultancy services around the world.



Turnover

FY11/12: 201m



Employees

c.1100

Providing services worldwide

Europe

Albania
Belgium
Denmark
Estonia
Germany
Gibraltar
Iceland
Ireland
Italy
Luxembourg
Netherlands
Norway
Romania
Slovakia
Spain
Turkey
UK

Asia/ Middle East

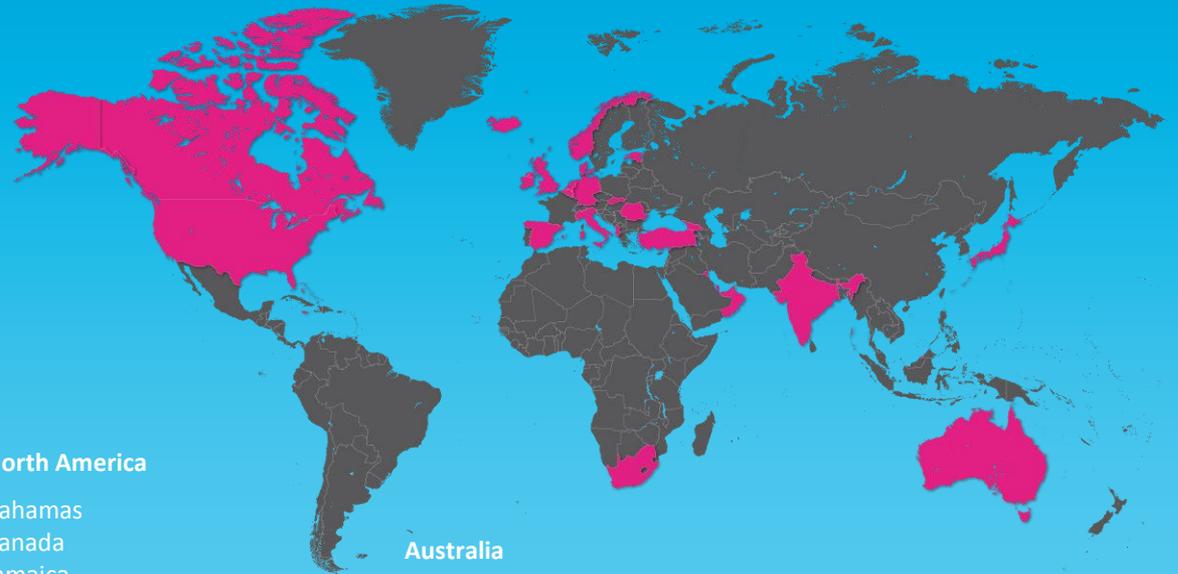
Bahrain
Brunei Darussalam
Hong Kong
India
Japan
Kuwait
Oman
Qatar
Singapore
UAE

North America

Bahamas
Canada
Jamaica
USA

Australia

South Africa



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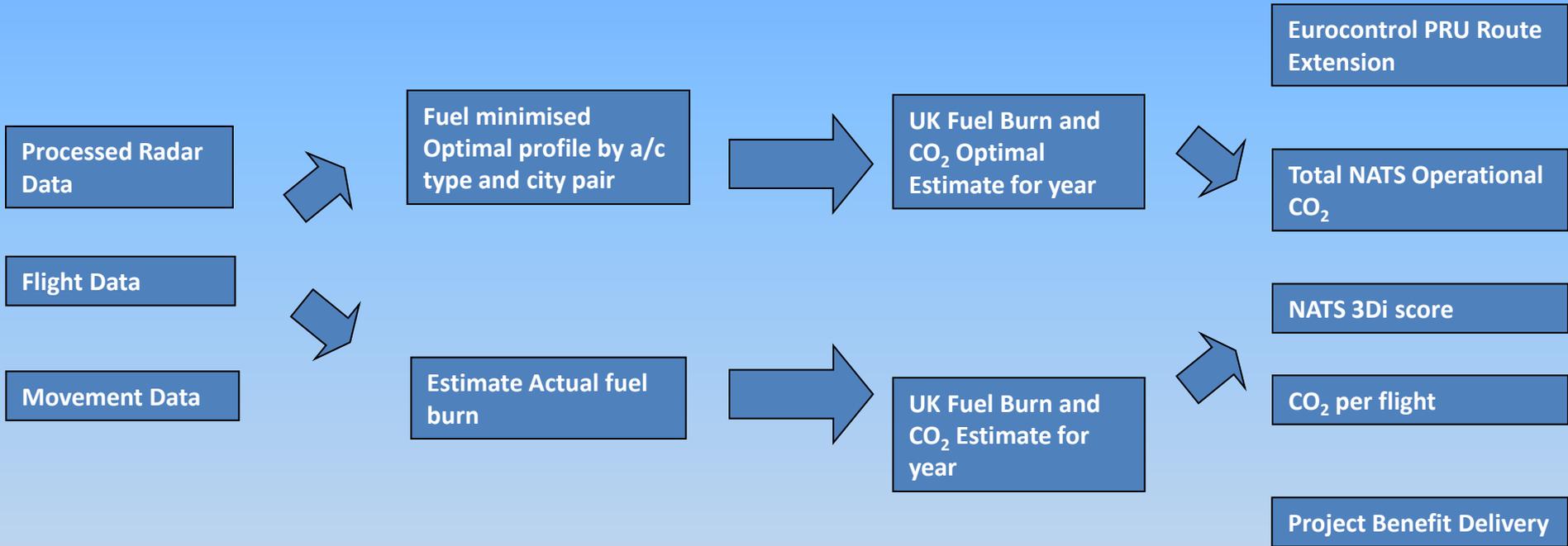




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Modelling CO₂ in Airspace



	TOTAL CO ₂ (MILLION TONNES)	CO ₂ PER FLIGHT (TONNES)	PROPORTION
DOMESTIC AIRSPACE	16.2	6.8	61.6%
NORTH ATLANTIC	8.6	23.5	32.8%
NATS AIRPORTS	1.5	0.8	5.6%
TOTAL	26.3		



World first 3Di



On January 1st 2012 NATS delivered another **world first** by becoming the first air traffic service provider in the world to be financially incentivised on the environmental performance of the service it provides.

This guide describes the new **cutting edge metric** that NATS has developed in consultation with airlines and the UK CAA to measure its performance. Flick through to find out how it is calculated and how NATS can deliver better environmental performance.



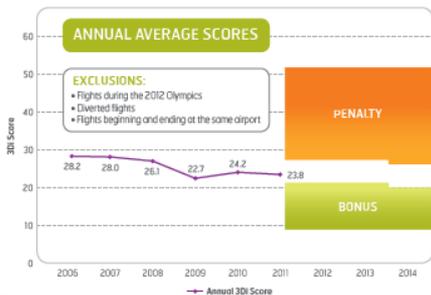
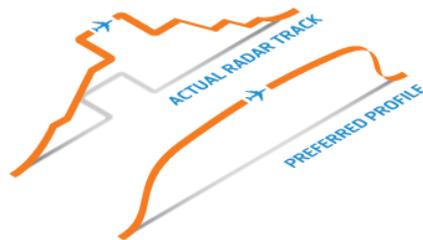
1) INTRODUCTION

The new NATS environmental metric is called the '3Di Score', which stands for 3 Dimensional Inefficiency Score. It compares the actual trajectory that aircraft take (from real radar data) with an optimal or active preferred flight trajectory that minimises fuel and CO₂ burn emissions. Or put another way, it measures how close to the 'perfect flight' NATS delivers its operations.

This preferred trajectory or 'perfect flight' includes a continuous climb, departure from ground to the airlines' requested cruise level, followed by a continuous descent back to the ground, with the full profile taking the most direct horizontal track.

By making this comparison between actual and optimum trajectories NATS is able to establish a clear indication of the environmental efficiency of the service it provides, track its performance over time, and set targets for improvement.

The 3Di score applies to the airborne portion of all flights whilst they are within UK airspace. NATS airports are separately targeting fuel and emissions reductions on the ground through their annual environmental action plans.



3) HOW THE SCORE IS INFLUENCED?

The 3Di score is mostly influenced by the underlying structure of NATS airspace.

Looking at the UK map of controlled airspace it is easy to see that aircraft are not always able to choose their most direct routes. In addition, because airspace is congested the vertical performance of aircraft is also significantly impacted to provide a safe and orderly service. The 3Di metric has been designed so that it drives behaviours in NATS to deliver long term improvements in flight profiles and related fuel burn and CO₂. The biggest improvements can only be delivered by changes to the design and operation of airspace and by improving access to shared airspace.

Our challenge will be to do this in the face of factors that affect the score negatively, such as the volume of flights within our network, limited runway capacity which leads to aircraft holding and bad weather. Adapting our operation to become more resilient to these external factors will help drive the score down.

Ultimately, the way NATS will influence the 3Di metric is by delivering more aircraft closer to the airlines' 'preferred flight' trajectories; more continuous climb and descent operations, reduced holding, fewer track miles and cruise levels at customers chosen flight levels.

2) HOW IS THE SCORE CALCULATED?

The 3Di score combines together the inefficiencies calculated within the horizontal and vertical dimensions of flight.

In the horizontal plane it compares the actual radar groundtrack against the most direct great circle track – within UK Flight Information Region (FIR). The difference between these two distances, which describes the 'additional miles flown', defines the inefficiency in the horizontal plane.

In the vertical plane the metric compares the actual vertical profile against the airlines preferred trajectory shown above. Vertical inefficiency then results from Air Traffic Control interactions has been simplified to periods of level flight that occur below the airlines' 'lost Requested Cruise Level (RCL)'. The vertical inefficiency is defined by the amount of flight time spent in level flight and the deviation from its RCL. Level portions of flight at low altitude are more fuel penalising than at higher levels.

In addition, the more time spent in level flight below the RCL, the more penalising for 3Di. Lastly, because aircraft performance and in particular fuel flow rates vary across the different phases of flight the metric applies different weightings for level flight occurring in climb, cruise and descent. All of these factors are then combined to give a single 3Di score.

Every flight, every day of the year from 1st January 2012, with only a few exceptions (see exclusions box left) will have a specific 3Di Score calculated. At the end of the year all the scores are combined to give a single annual average score for NATS. Scores run from 0, which represents zero inefficiency to over 100, with most flights typically having a score in the range between 15 to 35. Currently (Jan 2012) NATS 3Di scores are close to 24. If we reduce this below 21 we enter bonus territory (max bonus £2.4m for a 3Di of 9). If 3Di goes above 27 we risk penalty (max penalty £4.8m for a 3Di of 91). The performance scheme tightens by one point in the last year.

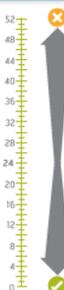
NATS

NATS is committed to working with its industry stakeholders to reduce fuel burn and CO₂ emissions in the drive towards environmental and economic sustainability.

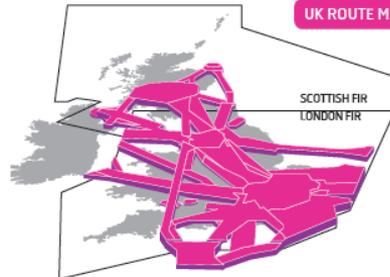
To find out more visit:
www.nats.co.uk



3Di Score



UK ROUTE MAP



OPPORTUNITIES TO IMPROVE 3Di

- Airspace design
- Controller tools
- Flow management techniques
- Changes to procedures
- Awareness training
- Flexible use of airspace
- Optimised co-ordination across sectors

FACTORS INFLUENCING THE SCORE

- Number of flights
- Traffic demand on sectors
- Weather
- Unusual events e.g. runway closure
- Runway capacity

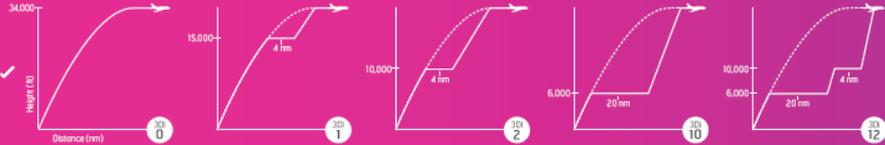
UNDERSTANDING HOW THE 3Di SCORE WORKS



DIAGRAMS ARE NOT TO SCALE Figures based on a 300nm flight with an RFL of FL340.

CLIMB

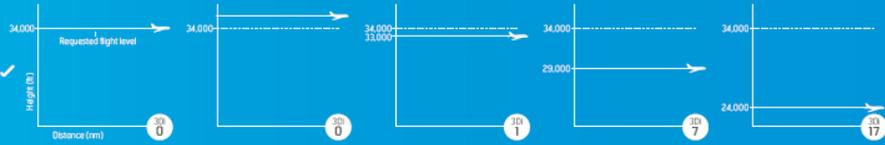
- A Continuous Climb Departure (CCD) from ground to cruise gives a 3Di score of zero
- Offering more CCDs and CCDs to higher levels will improve NATS score
- The climb rate/gradient does not affect the score, only periods of level flight



- Periods of level flight in the climb phase are counted as inefficiency
- The more time spent in level flight the worse the score
- The lower down in the climb that level flight takes place, the worse for the score

CRUISE

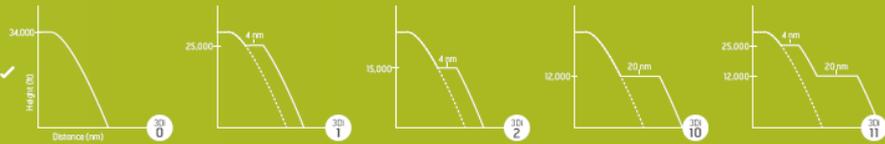
- Giving aircraft their last planned Requested Flight Level (RFL) gives a 3Di score of zero
- Giving aircraft levels above their RFL also gives a 3Di score of zero, a simplification of the metric. In reality giving aircraft levels above RFL on the pilots request will usually result in fuel savings
- The closer to the RFL, the better for 3Di



- The further below the RFL that the aircraft cruises the worse for 3Di
- The more time spent below RFL, the worse for 3Di

DESCENT

- A continuous descent from cruise to the ground will give a 3Di score of zero
- Offering more continuous descents and from higher levels will improve NATS score
- The descender rate/gradient does not affect the score, only periods of level flight



- Periods of level flight in the descent phase are counted as inefficiency
- The more time spent in level flight the worse for 3Di
- The lower down in the descent that level flight takes place, the worse for the score

HOLDING

- Absorbing delay by slowing down en-route is preferable to any level holding
- If aircraft have to hold, the higher the better as this will reduce impact on 3Di, fuel burn and emissions



- Because holding causes both vertical and horizontal inefficiency it strongly affects the score
- The more time spent holding the worse for 3Di
- The lower down in airspace that holding takes place, the worse for 3Di

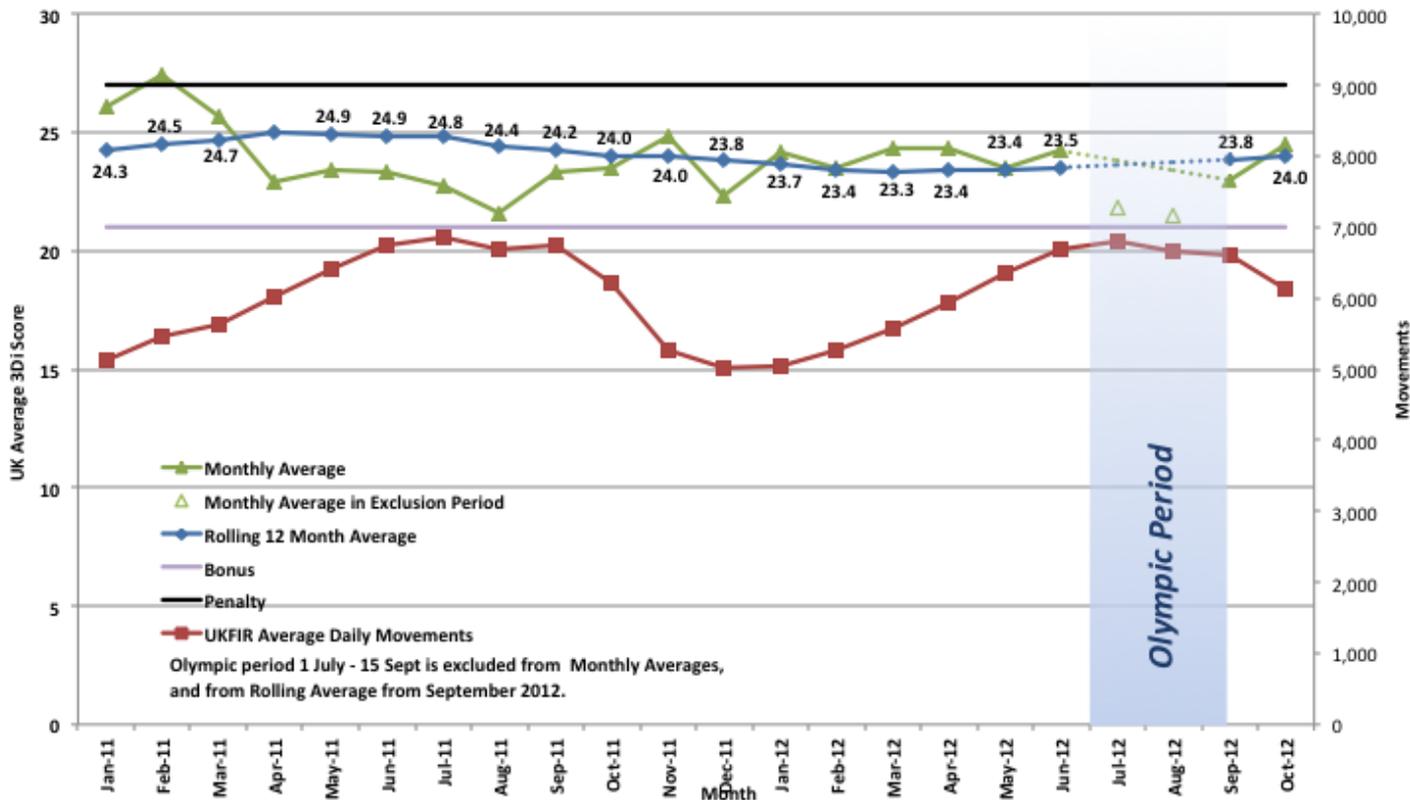
HORIZONTAL TRACK

- A 'great circle' route between airports or entry/exit points gives a 3Di score of zero
- Whilst flight planable directs are the ultimate aim, tactical directs will also benefit the score



- Additional track mileage compared to the direct 'great circle' distance is counted as inefficiency
- The more additional miles flown the worse for 3Di

UK Airspace Environmental Performance



ATC Unit Performance Data

	Total CO ₂ (million tonnes)	Total Movements	3Di Score
Swanwick Only	0.54	82,961	34.71
Prestwick Only	0.10	16,784	20.30
Both	0.43	49,674	17.97
Swanwick Only comparison to last month	↑ 0.011	↓ -1,956	↑ 2.38
Both comparison to last month	↓ -0.001	↓ -3,384	↓ -0.08

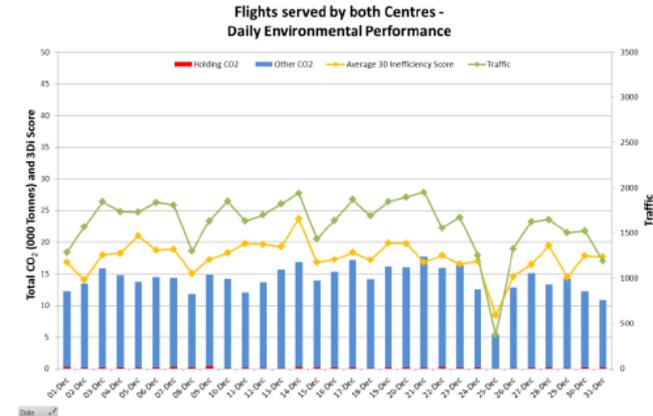
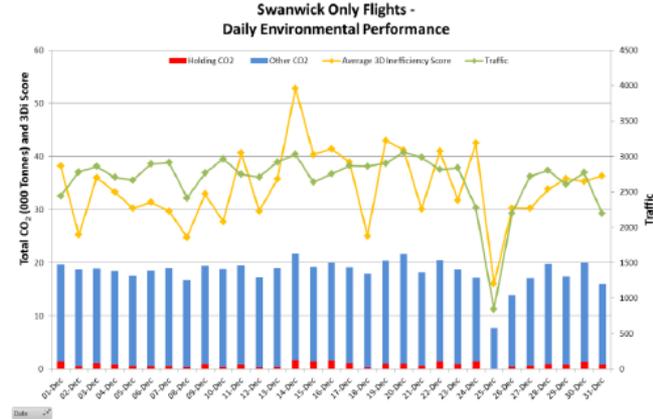
[no comparison to last year due to change in metric]

Significant Events in Dec 2011

- 8th – 17th - Bad weather causing cancellations and delays, especially in Scotland.

Significant Events in Dec 2012

- 5th – Snow cause Stansted to close for 3 hours (6-9am) and delays at Luton and Aberdeen.
- 13th –Irish Sea resectorisation.



Environment



Our strategy

We are implementing smarter and more responsive ways to reduce aviation's environmental impact and save fuel.

[Find out more](#)



Message from CEO

"In 2012 we delivered an entirely new environmental performance metric – a world first which took us three years to develop."

[Find out more](#)

UK flights handled

Jun 2012 **198,038**

May 2012 **194,534**

Apr 2012 **176,133**

Mar 2012 **170,039**

Feb 2012 **151,015**

Jan 2012 **154,302**



[@natspressoffice](#)

about 4 days ago

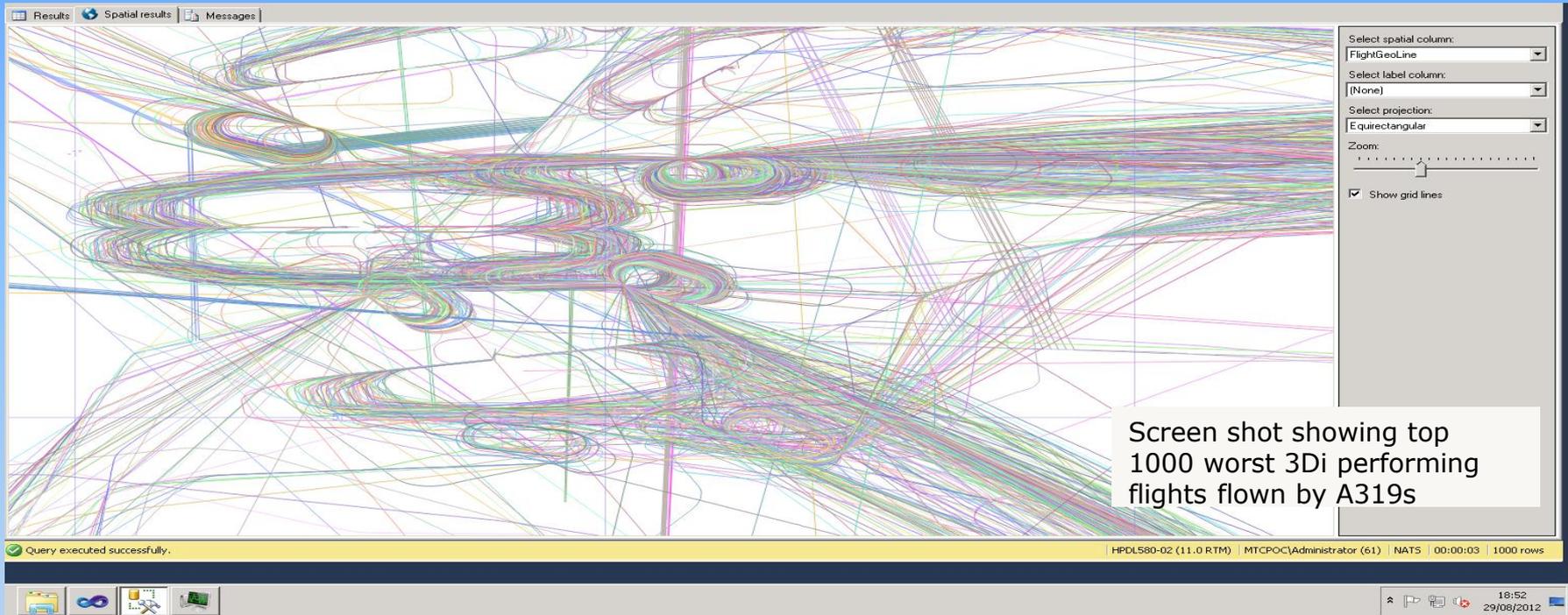
[@csaspeakersuk](#) We don't currently organise or hold conferences such as these

Near Real-time Performance Data

NATS

The screenshot shows a web browser window with the address bar displaying `http://msbi/NATS/SitePages/Home.aspx`. The browser tab is titled "NATS MSBI POC - Home". The website header includes the "NATS" logo, the text "NATS MSBI POC > Home", and a sub-header "Proof of concept site provided by Hitachi Consulting to demonstrate MSBI for NATS". A navigation menu contains links for "NATS MSBI POC", "General Dashboard", "3Di", "Self Serve Analytics", "Misc Views", and "Links". A search bar is labeled "Search this site...". The main content area features a heading "Welcome to the Hitachi Consulting MSBI Demonstrator for NATS." followed by a paragraph: "This demonstrator is designed to introduce NATS to the art of the possible in Microsoft Business Intelligence and provide an interactive talking point for further development and improvement of the system. for any questions please contact Andrew Sadler Stephen Rose / Sean Jones." Below the text is a large image of an airplane on a runway, overlaid with several yellow wavy lines representing data flow or performance metrics.

Near Real-time Performance Data



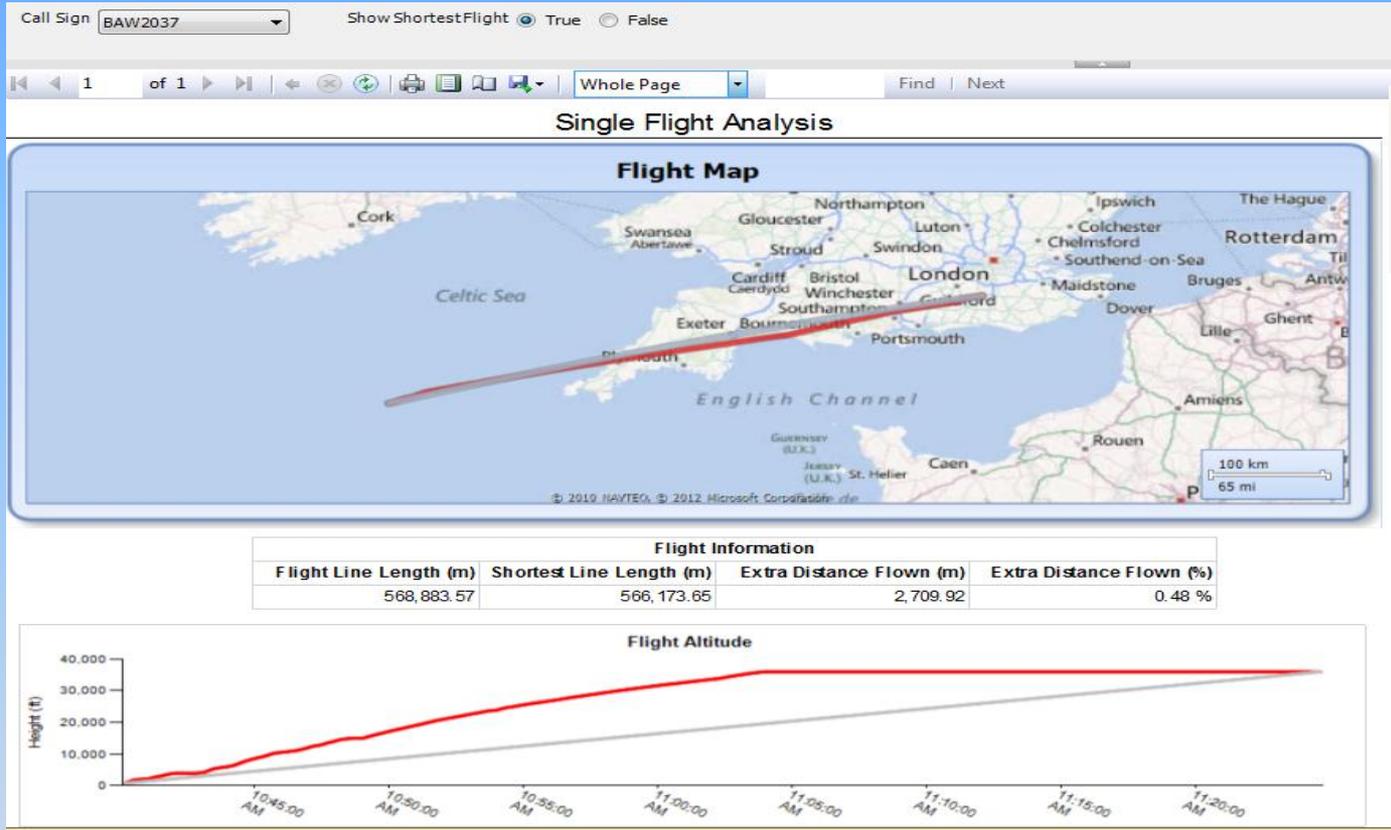
Near Real-time Performance Data

The screenshot displays the NATS MSBI POC Flight Info interface. On the left, a map shows the flight path from London to Dover, with a 3D profile overlaid in yellow and green. The profile indicates a climb to a cruise altitude followed by a descent. On the right, a table provides detailed performance metrics for the flight.

Aircraft	A319
Callsign	BAW715
Start Date	1/1/2012 2:59:23 PM
Fuel (kg)	1,275.81
Duration (mins)	34.06
Distance (nm)	105.11
FuelFlow (kg/nm)	12.14
3Di	74.30
Extra Miles flown	62.30
Extra Fuel (kg)	756.14
Fuel Saving (£ GBP)	£1,693.76
Climb Efficiency	0.00
Cruise Efficiency	0.00
Descent Efficiency	6.87
Vertical Efficiency	0.21

Screen shot showing the optimum 3Di profile and the actual track of a flight

Near Real-time Performance Data



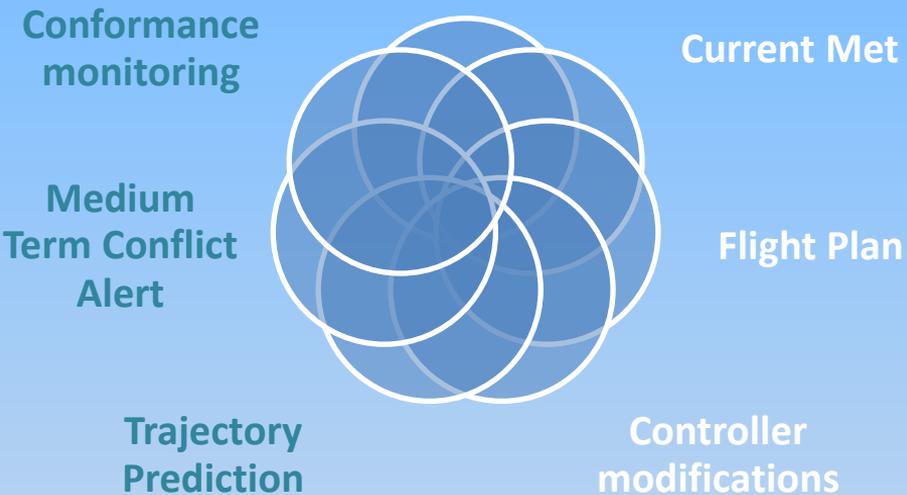
Screen shot showing the flight profile for a specific flight as compared against its optimum horizontal and vertical profile

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iFACTS

BADA Model

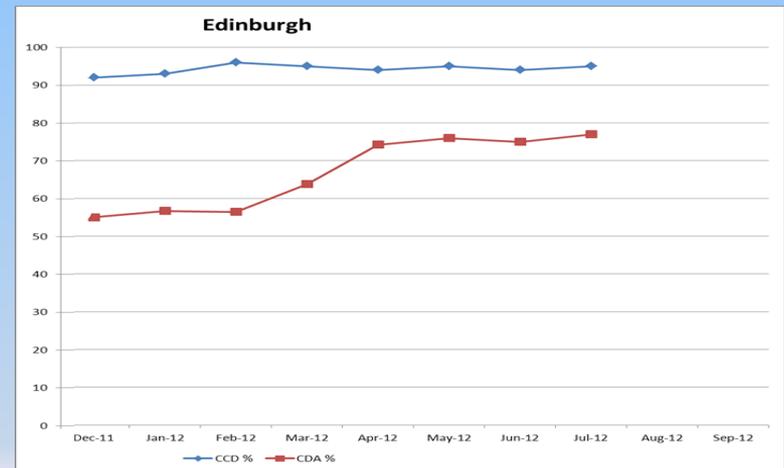
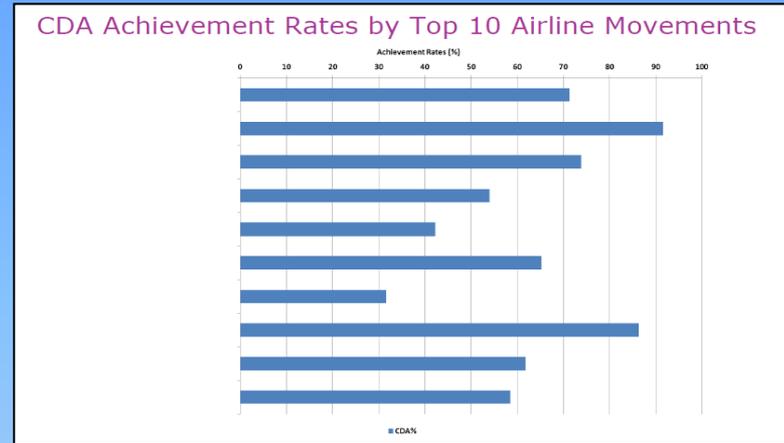


> saving 10,000t of fuel, worth £6 million a year



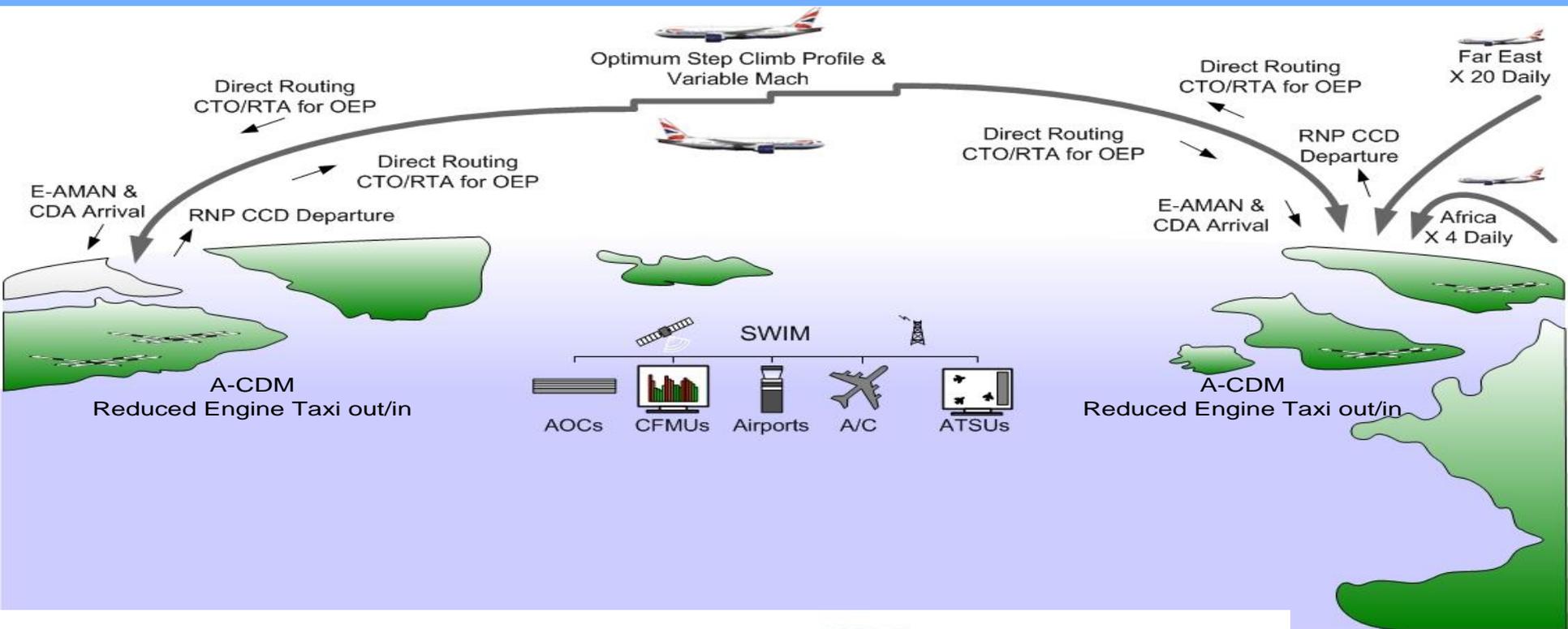
Flight Profile Monitor

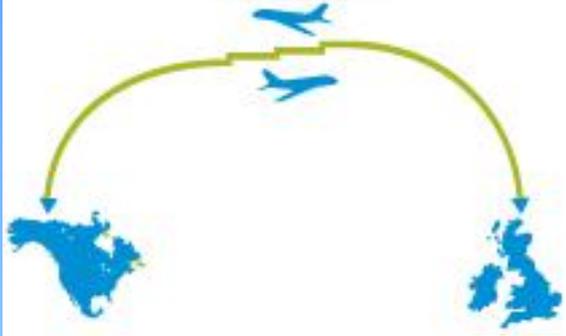
- > NATS bespoke tool launched 2011 to provide all NATS airports with data on continuous climb and descents.
- > One year trial with airlines at Edinburgh revealed significant variations in airline CDA achievement.
- > During the trial CDA improved 20%
- > Saving 160 T fuel, 510 T CO₂ , £104,000 and reduced community exposure to noise



TOPFLIGHT

NATS





World first
3Di



> 125 operational changes

Where are we now?

- > NATS is the only air traffic control organisation in the world with binding environmental targets
- > Aviation sustainability is core to NATS mission
- > Focus on use of technology and data to bring environmental performance data closer to the Operation
- > Environmental performance publically reported every quarter – as well as to our airline customers and regulator
- > Airspace change programmes for north and south of UK driven by data on environmental inefficiency
- > Operations rooms will soon have near real time environmental reporting

NATS

www.nats.co.uk/environment

