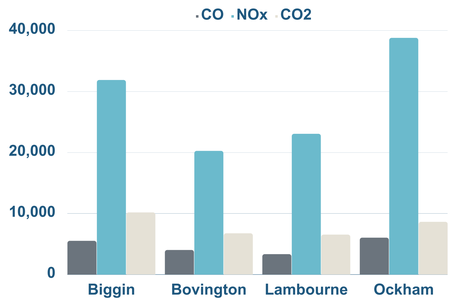
How To Change The World: Reducing CO2 and NOx Emission through Improved Air Traffic Management

London 1 Team 3

UCL

The Problem and Background

Airports are amongst the greatest contributors to pollution in London. Our problem is focused on Air Traffic Management, in four holding stacks Bovington, Lambourne, Ockham, and Biggin. Implementing Single European Sky help mitigate these emissions and improve air quality.



Design Objectives

60% Heathrow Net Zero Plan: NOx and PM2.5

20% Air and noise pollution

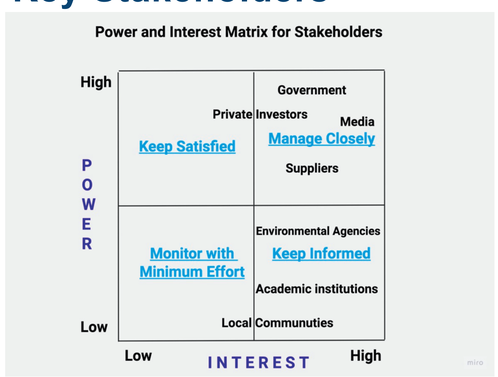
15% Premature Health

30% Health Complaints

Criteria

Construct an AI system of real-time data analysis, prediction models, decision support mechanism, automated traffic management.

Key Stakeholders



Solution:Air Traffic Management (ATM)

Expert opinion:

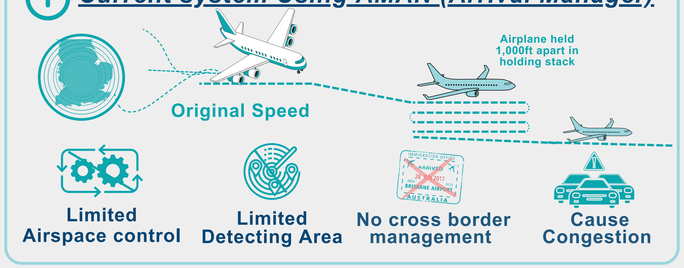
- ***Dr. Ulrich Scholten, CEO of SkyRadar***:

"Dynamic trajectories promise bringing CO2 emission down by 20%, its just a procedural issue. Automation and interoperability."

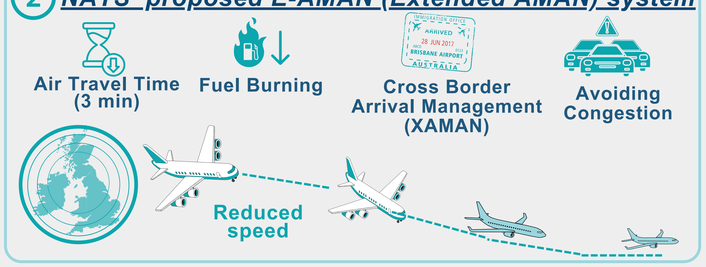
- ***NATS press office 2016:***

"Between the start of the operational trial in April 2014 and the start of permanent procedures in late 2015, NATS recorded a reduction of holding stack times by up to a minute for LHR inbound flights subject to XMAN activity. This saves airlines annually around 4,700t in fuel or 15,000t of CO2 and reduces noise for communities underneath the stacks."

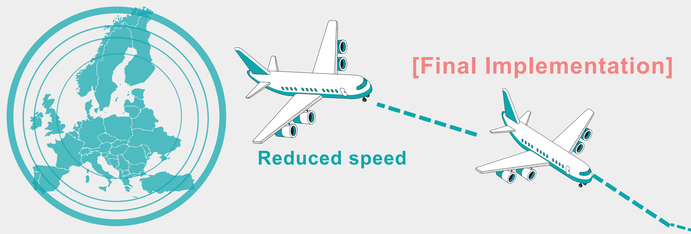
1 *Current system Using AMAN (Arrival Manager)*



2 *NATS' proposed E-AMAN (Extended AMAN) system*



3 *Our proposed super extended AMAN system incorporated with SES (single European Sky)*



- Further increased reach of arrival management across whole of Europe
- Long hall planes from the across continent can quickly be incorporated into arrival management system
- Use AI outside of E-AMAN space to prevent overworking ATM personal
- Increased reach allows for planes to slow down and descend even earlier to optimal speed and altitude
- Aim to eliminate need for holding stack, except for emergency
- Implement NATS' "perfect flight" test
- Reduce fuel consumption over Europe and London by 62%

AI system Design

- Follow the design methodology of "top down":

Communication statelite
Support aviation communication in remote areas. Normally used for areas with weak radio. such as ocean.

Server-Computing data

Airplane sensors
Collecting data from the sensors installed on each plane

Radio System
Ground communicators contact with pilots, convey instructions or data (humidity, wind speed, etc).

Local ATC center
Has a specific AI system and has a significant amount of high-quality data for training algorithms and models every time.

More virtual ATC centres

- Highly dynamic and time-critical domain.
- Each AI system has the link to other ATC centres.
- Specific communication channel to get data from third-party, e.g. weather.

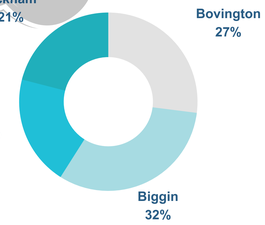
Funding

- Heathrow Airport
- Private Equity Firms
- UK Nations and Regions: 32 chambers of commerce support Heathrow Airport
- Air Traffic Management Firms
- UK Government

Engine Usage and Fuel Consumption

- To incentivise the use of SAF (sustainable aviation fuel).

80% CO_2



Summary of addressed UN goals

3 GOOD HEALTH AND WELL-BEING
8 DECENT WORK AND ECONOMIC GROWTH
13 CLIMATE ACTION

- Aviation aims to halve its net CO2 emissions by 2050, using 2005 as the baseline.
- NATS (National Air Traffic Management) assesses the eco-friendliness of planes by grading each flight through a "3-dimension inefficiency score" leading to a carbon free performance.
- Every improvement in air traffic management will directly have a positive effect on climate action.
- In the long-term, reduction in CO2 emissions will improve human health and lead to economic growth.

SkyRadar