

# Forecasting Global Aircraft Emissions

## ⌘ Problem definition

- Combine airline schedules, flight profiles, and aircraft performance data?
- Consistent approach for base case, forecasts, and scenarios?

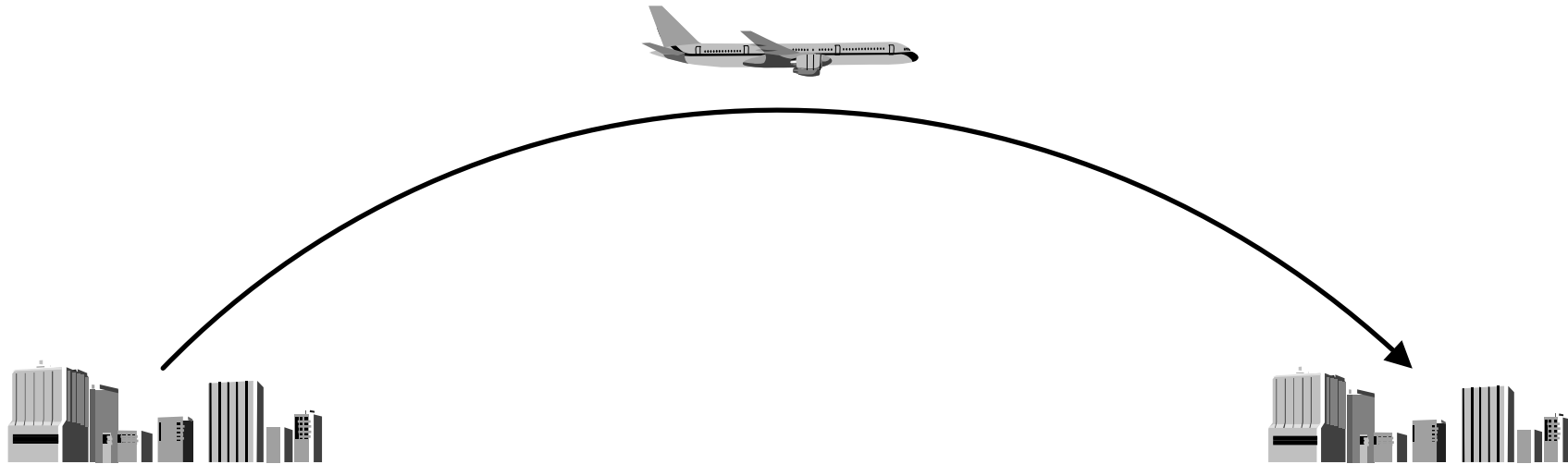
## ⌘ Method

- Sequential or iterative development?

## ⌘ Tools

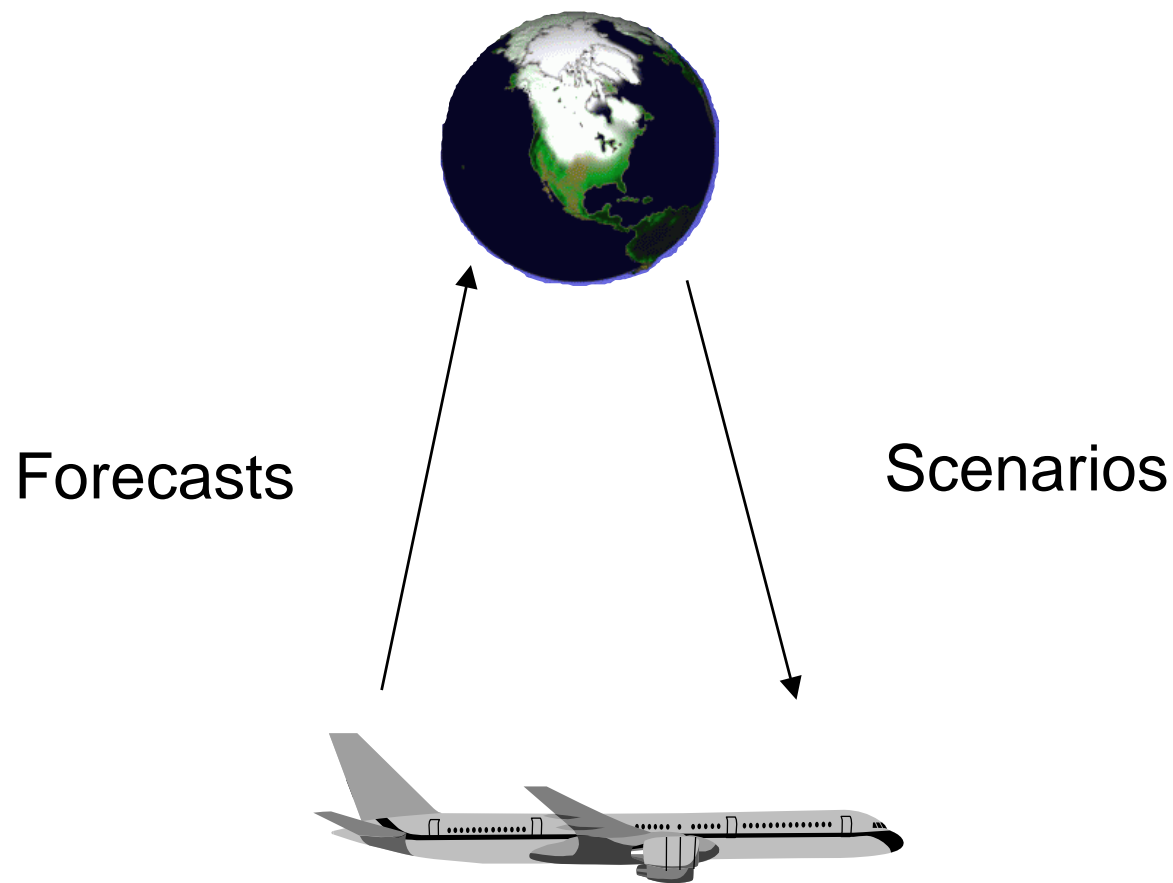
- Spreadsheets, databases, or programs?
- Windows or Unix?
- Line-commands or GUI (graphical user interface)?

# Problem definition (1): Description



- ⌘ Airline schedules: ANCAT MDB (movements database)
- ⌘ Flight profiles: PIANO
- ⌘ Aircraft performance data: PIANO/ICAO

# Problem definition (2): Prediction



⌘ Data and constraints exist on a number of different levels

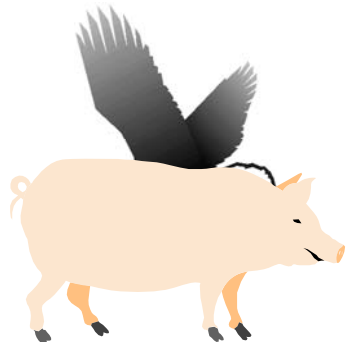
# Method (1): Sequential development

## The Plan

- (1) Integrate ANCAT MDB
- (2) Integrate PIANO output
- (3) Integrate ICAO LTO
- (4) Forecast tool
- (5) Scenario tool
- (6) Deliver a working model

## The Outcome

- (1) Integrate ANCAT MDB
- (2) Integrate ANCAT MDB
- (3) Integrate ANCAT MDB
- (4) Integrate PIANO output
- (5) Integrate PIANO output
- (6) Deliver half a model
- (7) Request new contract  
for a scenario tool
- (8) Go to (1)



# Method (2): Iterative development

## The Plan

- (1) Build rudimentary but complete system: simple realisation of ANCAT MDB, cut-and-paste PIANO results, basic ICAO formulae, skeletal forecast and scenario tools
- (2) Talk to customer; tighten it up
- (3) Talk to customer; tighten it up
- (4) Talk to customer; tighten it up
- (5) Talk to customer; tighten it up
- (6) Deliver a working model

# Tools (1): Seductive spreadsheets

- ⌘ Easy to make, difficult to unravel, impossible to adapt
- ⌘ Perfect for a quick numerical experiment
- ⌘ Unsuitable as the basis of a flexible policy tool or for calculations between levels

# Tools (2): Dangerous databases

- ⌘ Easy to make, even easier to generate a monster!
- ⌘ Perfect for data storage and manipulation, where all the data and constraints exist on the same level
- ⌘ Unsuitable for calculations between levels

# Tools (3): Perilous programs

- ⌘ Easy to propose, not-so-easy to create or use
- ⌘ Perfect for calculations between levels
- ⌘ Unsuitable for the manipulation of data and constraints which exist on the same level



# Tools (4): The best of all possible worlds

- ⌘ A database for data storage and same-level query
- ⌘ A program for calculations between levels
  - Constraints on different levels, aggregation, disaggregation, gridding
- ⌘ Database => Windows
- ⌘ Program => a GUI (graphical user interface)

# Summary

## ⌘ Problem definition

- Calculation using schedules, profiles, performances is non-trivial but known
- Frequent interaction required to determine modelling priorities

## ⌘ Method

- Iterative development

## ⌘ Tools

- Database + program
- Windows
- GUI