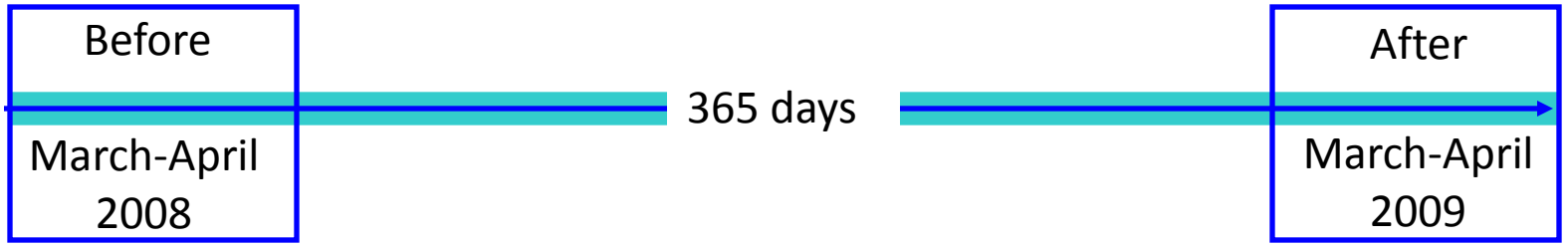
PROBLEM CONTEXT

- Airlines seek to improve efficiency of airport operations
  - Lowered costs
  - Improved customer satisfaction
  - Reduced environmental impact
- Use of automation technology to locate, track, and manage aircraft and ground service equipment assets in real-time
- Improved operational efficiency in ramp area
  - Arrivals: ground crew is ready to meet airplane
- Opportunity for coordination between ramp and movement area operations

STUDY GOAL

- Quantify changes in ramp area operational efficiency before and after deployment of an automation system
  - Before: March – April 2008; 23 days
  - After: March – April 2009; 23 days



Surveillance data available
automation service not "live"

Surveillance data available
automation service is "live"

- Assess changes in taxi-in duration in ramp area under airline control
  - Use aircraft type and specific factors for fuel burn and emissions
  - Estimate fuel burn and emissions quantities (HC, CO, NO_x)

FACTORS AND ASSUMPTIONS

- Factors to be considered
  - Traffic load differences (before vs. after)
  - Weather (VMC vs. IMC)
  - Airline use of Aerobahn (COA vs. non-COA)
  - Visibility (day vs. night)
  - Fleet mixture changes

- Assumptions of static conditions from 2008 to 2009
  - No labor disputes or changes
  - No difference where aircraft enter or exit from ramp
  - No dependence on airport configuration
  - No changes in operations (e.g., departure hand-off or infrastructure (e.g., runway closure, construction)

OBJECTIVES

- Assess influence of visibility (weather, time-of-day) on taxi-in durations
- Assess influence of UAL use on taxi-in durations
- Assess influence of UAL's use of airport surface surveillance system on the operations of other airlines (not using the airport surface surveillance system)
- Account for changes in demand between 2008 (before) and 2009 (after)

Assumptions

- $35/min operating cost for airlines
- $42/hr passenger time value
- $1/kg fuel
- 1 engine used for taxiing in ramp area

Outcome

- Assessment of impact of use of surveillance to manage arrivals in airline ramp area
- Presentation of results
  - Problem statement
  - High-level results

Artifacts

- Tables of results
  - Comparing before/after conditions
  - Comparing effect of weather/visibility conditions
  - Comparing effects of use of airport surface surveillance system by UAL and non-UAL airlines
  - Comparing changes in fuel burn and emissions
  - Monetary savings to airlines and passengers

- Figures
  - Histograms of ramp area taxi-in duration data
  - Plots of mean and standard deviation of ramp area taxi-in duration per day vs. date for different conditions (e.g., before/night vs. after/night)

Web Resources

- www.aspm.faa.gov
- http://en.wikipedia.org/wiki/Atlantic_Southeast_Airlines#Destinations
- http://en.wikipedia.org/wiki/United_Express_destinations#Operated_by_Atlantic_Southeast_Airlines
- http://en.wikipedia.org/wiki/SkyWest_Airlines#United_Airlines
- https://en.wikipedia.org/wiki/Airbus_A320_family#Specifications

ICAO Call Signs

- Major airlines at IAH
  - ASQ; Atlantic Southeast; regional carrier for UAL
  - UAL; United airlines
  - SKW; SkyWest; regional carrier for UAL
  - AWE; USAirways
  - AAL; American Airlines

Data Provided

- Ramp area taxi-in duration data
  - Landing time, taxi-in duration in ramp area, aircraft type, call sign, tail number
- FAA Registry data
- ASPM traffic operations data
  - Use for arrivals and departures per hour
- ICAO emissions database
  - Use for determination of fuel burn and emissions based on aircraft engine type

Suppose you want to map…

- Aircraft type to engine type and thence to fuel burn/emission
- Given that the aircraft type is, A320-214, determine engine types
- https://en.wikipedia.org/wiki/Airbus_A320_family#Specifications
- Note that the A320-214 has engine types of CFM56-5B4 or 5B4/P or 5B4/2P
- Choosing one from the ICAO database, you note…
  - CFM56-5B4 or 5B4/P or 5B4/2P appear on lines of 88, 92, and 90, respectively.
- You note the following columns containing these data:
  - Fuel burn (kg/s), column CF
  - CO emissions (g released per kg fuel burn), column AM
  - HC emissions (g/kg) in column Z
  - NOx emissions (g/kg) in column AZ
- In the case where there are a range of values for several engine types (as above), choose a mid-point of values