SPADE-2
Supporting Platform for Airport Decision-making and Efficiency Analysis – Phase 2

SPADE-2 2nd User Group Meeting
Overview of the SPADE-2 Platform

List of SPADE-2 Use Cases

- UC1: Airport Capacity Management
- UC2: Match Capacity and Demand
- UC3: Airport Airside Analysis
- UC4: Fleet Characteristics Impact on Airport Operations
- UC5: Airport Capacity Utilization
- UC6: Airport Capacity Determination
- UC7: Airport Capacity vs. Airport Performance and Environment
- UC8: Taxiing Methodology
- UC9: Impact of New Procedures and Equipment
Airport Capacity Management (UC1)

- **Objective**
  - Assess the impact of changes in airport infrastructure, operational procedures, and traffic volume or distribution

- **Types of Analysis**
  - Analyses are built around key Frequently Asked Questions (FAQ) that deal with the following types of changes in:
    - Operational Procedures / Requirements (e.g., security procedures, service times, disciplines, separation minimums)
    - Traffic (e.g., fleet characteristics, traffic peaking, traffic growth)

- **Performance Indicators**
  - Capacity
  - Delays
  - Level of Service
  - Noise
  - Third Party Risk
  - Financial/Costs and Benefits

- **Tools Integrated**
  - MACAD: Airside Capacity and Delays analysis
  - SLAM: Terminal Capacity, Delays, and LoS analysis
  - FLASH: Flight Schedule Generator
  - TRIPAC: Third Party Risk Assessment
  - CBM: Cost-Benefit Model
  - INM: Integrated Noise Model

- **Basic / Indicative Categories of Input**
  - Demand characteristics, patterns, and traffic profile
  - Airport Topology and capacity / infrastructure characteristics
  - Operational and Service characteristics

- **Basic / Indicative Categories of Output**
  - Airside capacity per airport element (i.e., runways, taxiways, apron)
  - Airside delays by source and airport element
  - Landside / terminal usage patterns and delays per facility
  - Level of Service provided to passengers according to IATA standards
  - Noise contours (ind. risk contours, group risk)
  - Detailed and aggregate costs and benefits per flight

Match Capacity and Demand (UC2)

- **Objective**
  - Provide a generic analysis for airport strategic planning problems:
    - What is the airport performance for a business as usual strategy?
    - What is the airport performance for alternative strategies?
      - Build a new runway
      - Manage demand

- **Types of Analysis**
  - Analyses are built around key Frequently Asked Questions (FAQ)
    - What is the airport’s baseline performance?
    - What is the effect on airport performance after expanding the runway system?
    - What is the effect on airport performance after the implementation of a demand management strategy?

- **Tools Integrated**
  - ABS-FSG: the ABS Flight Schedule Generator for generating future flight schedules
  - ABS-ACD: the ABS Airport Capacity Delay model for analysis of airside capacity and delay and landside capacity
  - INM: Integrated Noise Model
  - TRIPAC: Third Party Risk Assessment Tool
  - CBM: Cost-Benefit Model

- **Basic / Indicative Categories of Input**
  - Daily flight schedule
  - Target year and traffic growth characteristics (for generating a future flight schedules)
  - ATM system performance (e.g., separation standards)

- **Basic / Indicative Categories of Output**
  - Airside runway capacity and average airside delay
  - Noise impact (contours, grid points)
  - Third-party risk (individual risk contours, group risk)
  - Detailed and aggregate costs and benefits per flight
Airport Airside Analysis (UC3)

- **Objective**
  - Assess the effects of changes in infrastructure/procedures from an airport airside perspective in order to highlight the airport zones that will be more congested or generate the largest delays.

- **Types of Analysis**
  - The user can choose to:
    - Analyze one single airport layout and how traffic increases affects its performance.
    - Compare how traffic increases affect two alternative airport infrastructures and/or procedure / configurations.

- **Performance Indicators:**
  - Capacity
  - Flow, demand, and delay
  - Safety (in terms of bottlenecks)
  - Noise

- **Tools Integrated:**
  - SIMMOD: Capacity and Delays analysis
  - INM: Integrated Noise Model
  - Luciad ATC Playback: Visualization tool of aircraft movements and safety-related indicators

- **Basic / Indicative Categories of Input:**
  - Traffic profile (offline)
  - Traffic increment (online)
  - Airport topology and infrastructure characteristics (offline)

- **Basic / Indicative Categories of Output:**
  - Airport capacity indicators
  - Flow, demand and estimated average delay trend
  - Airside delays per cause and type of node (air or ground)
  - Noise contours and levels
  - Delays per trajectory (within the simulation playback)

Fleet Characteristics Impact on Airport Operations (UC4)

- **Objective**
  - Assess how potential changes in fleet characteristics (e.g., aircraft type, city pair, airline, flight schedule) will affect airport operations.

- **Types of Analysis**
  - Analyses are built around two Frequently Asked Questions (FAQ):
    - What effect will a change in flight schedule…
    - What effect will a change in aircraft type…
    - Have on:
      - Capacity (airside), efficiency, noise, as well as costs and benefits.

- **Tools Integrated:**
  - TAAM: Total Airspace & Airport Modeller, a fast-time simulation tool for detailed airside performance analysis
  - RAMSPLUS: ATM simulation tool (as alternative to TAAM)
  - TRAFGEN: Traffic generator, an analytical tool to generate flight schedules
  - CBM: Cost-Benefit Model
  - INM: Integrated Noise Model
  - ESTOP: Runway Occupancy Time Estimator Tool

- **Basic / Indicative Categories of Input:**
  - Pre-stored data:
    - Aircraft/Performance database
    - Airport layout
    - procedures
  - User Input:
    - Flight schedules (Traffic generator)
    - aircraft type

- **Basic / Indicative Categories of Output:**
  - Total number of movements handled
  - Calculated costs and benefits for different stakeholders (i.e., airlines, airport), or different categories (i.e., per time period, per aircraft type)
  - Average airside delays
  - Noise footprint
Airport Capacity Utilization (UC5)

- **Objective**
  - Analyse the impacts of changes in external factors (e.g., airline alliances) and/or minor changes in terminal infrastructure or allocation rules (e.g., check-in, stands).

- **Types of Analysis**
  - Analyses are built around three Frequently Asked Questions (FAQ):
    - What is the effect of changes in airline alliances or the introduction of new Schengen countries?
    - What is the effect of changes security / check-in procedures?
    - What is the effect of changes in check-in / stand allocation rules?
  - With view to capacity, passengers / baggage throughput, as well as costs and benefits.

- **Tools Integrated**:
  - TAAM: Total Airspace & Airport Modeller, a fast-time simulation tool for detailed airport airside performance analysis
  - SAMANTA: Airport Simulation and Capacity Management
  - CBM: Cost-Benefit Model

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Airport Capacity Determination (UC6)

- **Objective**
  - Assess the impact of changes in traffic or operational usage of airside elements (e.g., cloning traffic, closing or opening runways, changing weather).

- **Types of Analysis**
  - Analyses are built around three key Frequently Asked Questions (FAQ):
    - Assess the impact of traffic changes
    - Assess the impact of operational use of airside elements (e.g., runway configuration, taxiing speeds, separations)
    - Assess the impact of changes in weather conditions (e.g., wind speed and direction, visibility, temperature)

- **Performance Indicators**:
  - Capacity
  - Delay (airside)
  - Level of Service

- **Tools Integrated**:
  - TAAM: Total Airspace and Airport Modeller
  - TRAFGEN: Traffic Generator
  - CAST: 3D Visualisation Tool

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Airport Capacity vs. Performance (UC7)

- **Objective**
  - Analyze the impact of airport optimization (in terms of capacity or noise) on airport performance.

- **Types of Analysis**
  - Analyses are built around five key Frequently Asked Questions (FAQ):
    - What is the maximum environmental (noise) capacity of the airport?
    - What is the impact of a noise optimised flight schedule?
    - What is the impact of adding new flights?
    - What is the maximum airside capacity of the airport?
    - What is the impact of an airside optimised flight schedule?

- **Performance indicators:**
  - Capacity (airside and landside)
  - Level of Service
  - Noise
  - Third-party Risk
  - Financial Costs and Benefits

- **Tools Integrated:**
  - TAAM: Total Airspace and Airport Modeler
  - SIMMOD: Airport and Airspace Simulation Model (as an alternative tool to TAAM)
  - SAMANTA
  - TRAFGEN
  - INM: Integrated Noise Model
  - TRIPAC: Third Party Risk Assessment Tool
  - CBM: Cost-Benefit Model
  - LuciadATC Playback: Visualization tool of aircraft movements

- **Basic / Indicative Categories of Input:**
  - Airport scenarios (airside and landside): baseline and optimized
  - User Input:
    - Specification of additional flights:
      - At high level (e.g., through percentage increase) or
      - At detailed level (e.g., adding specific flights to a timetable)

- **Basic / Indicative Categories of Output:**
  - Airside capacity and delay
  - Terminal capacity and delay (passengers and baggage)
  - Noise
  - Third-party risk
  - Economical impact

Taxiing Methodology (UC8)

- **Objective**
  - Use the “taxiing methodology” (AENA) to optimize airport performance.

- **Types of Analysis**
  - The “taxiing methodology” can be applied:
    - to the airport baseline scenario
    - to alternative airport scenarios created by modifying traffic, operational use and/or weather conditions
    - with view to the following metrics:
      - Global Quality Factor
      - Secondary metrics

- **Performance Indicators:**
  - Capacity (airside)
  - Delays (airside)
  - Safety (number of conflicts)
  - Efficiency (Global quality factor)

- **Tools Integrated:**
  - TAAM: Total Airspace and Airport Modeler
  - TRAFGEN: Traffic Generator

- **Basic / Indicative Categories of Input:**
  - Pre-stored data:
    - Airport layout, operational procedures, traffic files
  - User Input:
    - Traffic changes (e.g., total number of flights, by call sign, by STD, STA, by origin/destination)
    - Operational usage of the airside elements (e.g., gates, taxi speed, taxi configuration selection, push-back)
    - Weather conditions (e.g., wind direction and velocity, temperature, visibility, cloud base)

- **Basic / Indicative Categories of Output:**
  - Global Quality Factor:
  - Secondary metrics:
    - Demand/flow ratio during the whole day
    - Number of ground conflicts
    - Average delays for departures
    - Average taxi time for arrivals (taxiing and delays)
    - Average taxi time for departures
Objective
– Assess the impact of implementing new procedures and airport equipment on investment cost, return on investment and operational benefits.

Types of Analysis
– Analyses are built around key Frequently Asked Questions (FAQ):
  • Impact of a change in the night slot regime
  • Impact of reduced separation minima
  • Impact of changes in aircraft turnaround time
– With view to airport capacity, efficiency, economy and environment

Performance Indicators:
– Capacity (airside & terminal)
– Delays (airside & terminal)
– Level of Service
– Noise
– Third Party Risk
– Financial Costs and Benefits

Tools Integrated:
– TAAiM: Total Airspace and Airport Modeler, a fast-time simulation tool for detailed airside performance analysis
– SAMANTA: a fast-time simulation tool for detailed analysis of passenger and baggage flows
– INM: Integrated Noise Model
– TRIPAC: Third Party Risk Assessment Tool
– CBM: Cost-Benefit Model

Basic / Indicative Categories of Input:
– Pre-stored data:
  • Baseline scenario
  • Predefined procedure, constraint, or equipment
– User Input:
  • Night regime schedule
  • Changes in separation minima
  • Changes in aircraft turnaround time

Basic / Indicative Categories of Output:
– Airside capacity and delay
– Terminal capacity and delay (passengers and baggage)
– Noise contours and levels
– Third-party risk
– Costs and benefits