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Airport Planning Technology Evolution

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Some Topics For Discussion

- Role of new air traffic management technology in enhancing airport capacity
- Addressing the interests of the various stakeholders involved in deploying new ATM technology
- Role of simulation in airport planning

Role of New ATM Technology

- Near-term: Bring IFR runway capacity closer to VFR capacity
  - Delays increase dramatically when runway use is restricted under IFR conditions
    - Many existing major airports have closely spaced runways
- Longer-term: Increase both VFR and IFR capacity
  - Projected growth in traffic will increase demand at busy airports above current VFR capacity
  - Some capacity gains can be achieved by adding new runways but …
    - Options for new runways are limited by site constraints and community impacts
    - Construction costs can be very high

Considerations

- Safety
  - Increasing runway capacity implies reducing aircraft separations
  - Constraints
    - Wake vortices, ability to detect flight/taxi path deviations, controller/flight crew reaction time, aircraft capabilities
- Cost
  - Aircraft equipment
    - Need to leverage existing investments and provide incentives to encourage operators to install enhanced capabilities
  - Ground-based facilities, equipment and ATM staffing levels
    - Need to examine trade-offs between investment in …
      - *more concrete versus more technology*
      - *on-board capabilities versus ground-based equipment*
    - Implications for controller staffing levels

Potential ATM Technology Options

- Currently available
  - Precision Runway Monitor (PRM) supported procedures
    - Parallel runways separated by 3,400 ft to 4,300 feet
      - *Potential reduction to 3,000 ft separation*
    - Simultaneous Offset Instrument Approach (SOIA)
      - *Localizer Directed Approach (LDA) with angular offset*
      - *Can be applied to parallel runways separated by 750 ft*
      - *Benefits limited by ceiling and visibility requirements*
  - Required Navigation Performance (RNP)
    - RNP Parallel Approach Transitions (RPAT)
      - *Allows simultaneous approaches under marginal VMC*
  - Airport Movement Area Safety System (AMASS)
    - Monitoring of surface movement to detect runway incursions

Potential ATM Technology Options

- Future possibilities
  - Better track-keeping (reduced flight technical error)
    - Integration of enhanced GPS precision and FMS guidance
  - Synthetic vision
    - Enable flight crews to “see” nearby aircraft on cockpit displays
  - Automated separation
    - FMS guidance using ADS-B position of preceding aircraft
  - Improved wake vortex prediction
    - Avoid lost capacity resulting from unnecessary separations
  - Wake vortex alleviation
    - Provide economic incentives to reduce wake vortex intensity through aircraft design features

Addressing Stakeholder Interests

- Who are the stakeholders?
  - Industry (airlines, airports, aircraft manufacturers, etc.)
  - ATM service providers and regulatory agencies
  - Communities near airports (or under flight paths)
- What are their concerns?
  - Safety
  - Cost
  - Operational impacts
  - Environmental impacts
- How can they best be addressed?
  - Role of analysis and simulation modeling
  - Need for independent review and assessment

Role of Simulation in Airport Planning

- Need to address human factors and safety
  - Not the only issues to be considered but critical for the deployment of new technology or procedures
- Role and limitations of fast-time simulation
  - Typically used to assess operational and capacity issues
  - Can perform many runs to explore different aspects, but …
  - Assumptions of human response implicit in the models
- Role and limitations of human-in-the-loop simulation
  - Only real way to examine human factors and safety issues, but …
  - Necessarily runs in real time and needs participants with the relevant skills ➔ time consuming and expensive

Simulation in the Planning Process

- Need to choose the most appropriate tool(s) for the planning issues in question
- Integrating simulation into the airport planning process
  - Define the issues that need to be addressed
    - Stakeholders can help frame the problem
  - Determine the right balance of fast-time and real-time simulation
    - Cost-effectiveness considerations
    - Use of real-time simulation to define input assumptions for fast-time simulation experiments
  - Consider how to present the results to the stakeholders and decision-makers most effectively