System Oriented Runway Management: A Research Update

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System Oriented Runway Management (SORM): A Research Update

- Definition
- Challenge
- Development
- Evaluation
- Plans
System Oriented Runway Management (SORM)

Decision Support Tool to assist air traffic personnel in the management of airport runways

– Runway configuration selection process
– Orchestration of traffic across runway configurations
The Runway – A Constrained Resource

A resource used for arrivals, departures and taxiing

- airport “operator” owns and maintains it...
- Air Traffic Control “controls” it...
- aircraft operators/flying public use it...

and....

everyone has a vested interest in the efficient use of it...
The Runway Management Challenge…

- Winds
- Traffic demand
- Terminal traffic flow
- Environmental considerations
- User requirements
- User preferences
- Capacity limiting factors
- Spacing between parallel runways
- Airspace restrictions
- Surface restrictions
- Dedicated vs. dual use runways
- Balancing by aircraft type
- Availability of Land and Hold Short Operations (LAHSO)
- Staffing issues
- Metroplex
Runway Management based on “System” requirements

Airport surface operations

System Oriented Runway Management

Airspace Operations (arrivals & departures)

Traffic Flow Management
Three SORM Components

• **Strategic Runway Configuration Management (SRM)**
  – Forecast airport/Metroplex configuration and capacity to support Traffic Flow Management

• **Tactical RCM (TRCM)**
  – Plan schedule of airport configurations to advise on configuration decisions

• **Combined Arrival/Departure Runway Scheduling (CADRS)**
  – Assign flights to runways and schedule flights on those resources
SORM Information Flow

Airport Traffic Control Tower
Traffic Managers and Supervisors

Terminal Radar Approach
Control Traffic Management and Supervisors

Airline Operations Centers

SORM

Airport Operations Centers
**Conceptual User Interface**

- **Wind:** 150/6
- **Plan X**
- **Plan B**
- **Plan IFR-1**
- **Time:** 1830Z
- **AAR:** 87
- **AAR:** 95
- **AAR:** 72
- **Wind forecast:** 1900Z – 2130Z. Southeast @ 12 - 17 kts
- **Configuration Optimization**
  - Mode: Local
- **Current Wx:** VFR
- **Approach In Use:** Visual
- **Constraining Factors:**
  - Winds: N/A
  - Rwy Conds: Rwy 4R, BA poor
  - Noise: NA
- **Rwy Status:** All Open
- **Alert**
Phased Development of Capabilities

**Single airport:**
John F. Kennedy International Airport (JFK)

**Metroplex:**
New York Metropolitan Area

- John F. Kennedy International Airport (KJFK)
- Newark International Airport (KEWR)
- LaGuardia Airport (KLGA)
- Teterboro Airport (KTEB)

Distances:
- 10nm
- 11nm
- 9nm
- 18nm
To be practical to deploy, TRCM software must be common at all airports.
RCM Applications for Simple Runway Configuration

Los Angeles International Airport (LAX)
Initial evaluation of TRCM capability

• Aggregate strategy for assigning departure runways is used
• Consideration of several variables is required to determine strategy
• Ultimate decision is the integration of benefits versus required coordination
Orlando International Airport

10,000 ft. (~7 min.) longer taxi from Ramp 1 to 35L than 36R
TRCM at Orlando Results

- Tradeoff between taxi time and runway delay
- Traffic recorded October 13, 2010 from 1055Z to 1155Z
- Actual runway assignment was *taxi for direction*
- TRCM advised *taxi for convenience* for entire time period
  - Taxi for convenience results in slightly longer runway delays but significantly shorter taxi times

<table>
<thead>
<tr>
<th>Metric</th>
<th>Taxi for Convenience (TRCM)</th>
<th>Taxi for Direction (Actual)</th>
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<tbody>
<tr>
<td>Total Delay (38 flights)</td>
<td>16.5 min.</td>
<td>41.4 min.</td>
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<tr>
<td>Avg. Delay / Flight</td>
<td>26 sec.</td>
<td>65 sec.</td>
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<tr>
<td>Avg. Travel Time / Flight</td>
<td>20.4 min.</td>
<td>21.1 min.</td>
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</tbody>
</table>

TRCM saves 24.9 min. over 38 flights
Chicago Metroplex

Arrivals on Rwy 16 Circle to land Rwy 34 at PWK affect departures on Rwys 32L/R ORD.

Arrivals on Rwy 13C at MDW affect departures on Rwy 22L at ORD.

ORD – Chicago O’Hare International Airport

MDW – Chicago Midway International Airport

PWK – Chicago Executive Airport
Metroplex Model

JFK/LGA Interaction

System Model

- RCP Capacity Data
- Dynamic Conditions
- Operational State
- RCP Interaction Calculation
- Airport System Module
- Metroplex RCP Combination and Implementation Time Recommendations
- Metroplex RCP Ranking Module
- Airport-level RCP Ranking Module
- Metroplex RCP Combinations
- Airport-level RCP Rankings
- RCP Capacity Corrections
- Initial Metrics
- Updated Metrics
- RCP Expected Delay Times
- Updated Airport-level RCP Rankings
Potential Benefits

• Increase airport throughput within bounds of existing constraints
• Improve system stability and predictability
• Facilitate improved surface and airspace operations
• Minimize noise/environmental impacts
Benefit Assessment

2025 Demand for Los Angeles area airports

• Results shown are for individual Los Angeles area airports
  – Benefits are expected to be greater for integrated metroplex
  – In general, RCM provides larger benefits at airports with more configuration choices

• RCM seeks to minimize total Time In TRACON (arrivals + departures) which may result in increases for some flights
Benefits Assessment

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Percentage reduction in Time In TRACON calculated for each technology relative to the baseline
Technology Transfer

Integrated Arrival/Departure/Surface (IADS) Research Transition Team (RTT)

Tactical Runway Configuration Management Decision Support Tool

Runway Configuration Management for Metroplex operations
SORM Research Plans

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<tbody>
<tr>
<td>Single Airport</td>
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<tr>
<td>Version 1.0</td>
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<tr>
<td></td>
<td>Metroplex</td>
<td>Integrate with surface and airspace tools</td>
<td>Integrate wake spacings</td>
<td>Evaluate mature DSTs with NAS Tools</td>
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<tr>
<td></td>
<td>Version 1.0</td>
<td>Develop User Interface</td>
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<td>Metroplex</td>
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Summary

System Oriented Runway Management (SORM)

• Focuses on runway configuration planning and assignment (single and metroplex)
• Initial assessment suggest benefits for aggregate taxiing strategies
• Assessment of “total time in TRACON” indicate benefits for RCM, CADRS
• Provides greater predictability, efficiency gains, operational flexibility
• Aids decision making in an ever increasingly complex arena
Questions?