A-CDM in New York KJFK
Runway Construction and Impact on Operations

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Delta Air Lines, B767 Pilot
Industry Chairman – U.S. Surface CDM Team
Topics for Discussion

• KJFK Construction – Minimize Operational Impact
  • Application of initial U.S. ‘Surface CDM’ (SCDM) principals
  • Optimize airport capacity
• A-CDM Implementation from the Pilot and Airspace User Perspective
• A-CDM Live Operations /Inconsistencies in Implementation
  • KJFK
  • LFPG
• Evolution of Parallel/Complementary Initiatives
  • EUROCONTROL A-CDM Programme
  • FAA U.S. Surface CDM Concept
• ICAO Aviation System Block Upgrades (ASBU)
• Global Harmonization / Interoperability
KJFK Departure Queue
2009.09.05
We Can Do Better!
KJFK Operational Challenges

In 2009

- Congested NY airspace with multiple airports and airspace confliction
  - KLGA is 10nm from KJFK
  - 1.3 million airport movements/yr
  - Multiple ‘satellite’ airports
  - 1-2 hour taxi outs “common” in 2009
  - Lack of Predictability on the airport surface
  - 114 airlines operate at KJFK
  - IATA Level 3 slot controlled

- 90 day runway re-surfacing effort
Airspace Users rely on predictability to operate:

- Better for customers (on time arrivals)
- Aircraft routing and network planning
- Marketing considerations
- Department of Transportation Tarmac Rule
- FAR 117 Rest Rules
KJFK Runway Construction 2010 - Objectives

• Minimize Operational Impact of Runway 13R/31L Construction
  – Open, transparent collaboration among all Stakeholders
  – Initiative led by the Airport Operator
• Maintain similar pre-construction throughput
• Mitigate delays
• Maintain or Improve the passenger experience
KJFK Runway Construction 2010 - Plan

- Promote Culture Change – Exit ‘First Come, First Served’ Paradigm
- Ration by Schedule (RBS) through Equitable Allocation of ‘Bucket’ Times
- Communicate and leverage strategic support from FAA
- Maximize airport surface efficiency by allocating TOBT based on departure rate, configuration, and fix loading
- Enable more seamless airport configuration changes by reducing airport surface congestion
The Solution:

1. Departure Metering  
   (manage demand/capacity)
2. Airport Surface Surveillance
3. ATC Coordination
3. Agreed Upon Process

*Basic elements of the U.S. S-CDM Concept*
KJFK Runway Construction 2010
Prototype software “retrofitted” for metering

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Ration by Schedule
## KJFK Runway Construction 2010

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KJFK Runway Construction 2010 – Success!

*KJFK Surface Metering Evolution from 2010 Construction Mitigation Plan to Full-Time Program at the request of airport stakeholders...*

- Continued Stakeholder Collaboration
  - Adjust parameters
    - TMAT (TSAT) window
      - Movement Area (taxi ways/runways) vs. non-movement (Apron)
  - Change procedures as needed
  - Exchange and review data
  - Transparency

- Advanced Technology to Support Operational Needs
  - Surface situational awareness
  - Slot substitution
  - Better management functionality

*Offer valuable lessons learned as US S-CDM concept matures*
KJFK Surface Metering Program 2013
2009: Before Surface CDM at JFK

- Lower difference between planned and actual
- Tighter distribution indicates a more predictable operation

2012: After an Evolving Surface Management Solution
Everyone wins with lower taxi times:
• Environment – noise and CO2
• Lower global fuel consumption
• Lower fuel costs for airlines

PANYNJ: Not accounting for throughput changes, estimated taxi-out time reduction is ~102K min for 2012 metering period
• Total gate-hold time ~ 100K min
• Airline benefit ranges from 2.4 to 4.9 minutes per flight
Transitioning to A-CDM Operations

As we are developing the US Surface CDM Concept of Operations in the US, European A-CDM implementation is occurring in parallel

• Pilot’s Perspective
  • *Eliminate the first come first serve mentality!*
    1. Who to call
    2. When to call
    3. TOBT vs TSAT
    4. Tie in to the Airspace (PBN)
    5. TSAT stability...difficult to predict my operations

• Airline’s Perspective
  1. Tie in to the Airspace (routing and airspace constraints, TFM)
  2. Slot substitution (DFLEX, UDPP, US CDM)
  3. Manage an on time departure

*Global Harmonization / Interoperability!*
A-CDM in Live Operations - KJFK

• Airport Operator Implemented A-CDM
  – Initial Program to Address Concerns Re Major Construction Project
  – Continued program to address capacity/demand imbalances

• Primary Objectives
  – Align with FAA’s maturing Surface CDM Concept
  – Provide Common Situational Awareness for All Stakeholders
  – Real-time and Historical Operational Performance Measuring and Analytical Capabilities
  – Improved Gate Utilization
  – Departure Queue Length Optimization to Reduce Delay and Environmental Impact
  – Improved Demand Predictions
  – Provide slot substitution
  – Maintain pushback (TOBT/TSAT) stability
A-CDM in Live Operations - LFPG

• Pre-Departure Sequencing Description Of Departure, Operational Procedure Definitions
  • A-CDM is a calculation and management system for an off block pre-departure sequence linked to Network Manager
  • At LFPG, A-CDM is called CPDS (Collaborative Pre-departure Sequence)
  • SOBT (Scheduled Off Block Time) is that time relating to Airport slot
  • ED (Estimated Departure) is that target time set by airline itself as off-block departure time
  • TOBT is translation by CPDS of ED
  • TSAT (Target Start-up Approval Time) is off-block departure approved time, calculated by A-CDM system

• General
  • A-CDM is about partners (Airport operators, ACFT operators/ground handlers and ATC) working together more efficiently and transparently in how they work and share data
  • Airport-CDM is implemented in Airport environment through the introduction of the following operational procedures and automated processes relative to CPDS
A-CDM in Operation - LFPG

- **Airport Operator Implemented A-CDM**

- **Primary Objectives**
  - Information Sharing
  - Collaborative Pre-Departure Sequencing
  - CDM in Adverse Conditions
  - Collaborative Management of Flight Updates

- **SESAR DFLEX Project Adds Evaluation of the Benefits of Slot Substitution**
Inconsistencies Among A-CDM Implementations

- “Owner” of Implementation
- Capabilities Comprising the Solutions
- Terminology
- Data Elements that are Required to be Exchanged
- Accountability
- Partner Training
- “Connecting the Dots” to ATFM Data
- Slot substitution concept

Limited Interoperability
ICAO Aviation System Block Upgrades and A-CDM

- Satisfies all of the Criteria for Block 0
  - Technology exists today
  - Demonstrations of A-CDM capabilities have been performed
- Need for Processes, Procedures, and Policies
  - Data
    - Ownership
    - Integrity
    - Standards
  - Communications
  - Training
  - Performance Measures
  - Accountability

*Technology is NOT the Challenge!*
EUROCONTROL Airport CDM Programme

- September 2000, Airport Operations Team (AOT) /5
- December 2000, AOT/6
  - Terms of Reference (ToR) for A-CDM Task Force (TF) were submitted for approval
- December 2001, ACDM TF/1 meeting (TF met twice per year until 2006)
- November 2006, ACDM TF/13 meeting (final meeting)
  - The number of TF participants increased to approximately 150 participants, making it difficult to continue to function as a WG
- Nov 2007, ACDM CG/1 Meets for First Time (forum for all Partners to exchange views, lessons learned, implementation status)
EUROCONTROL Airport CDM Programme (cont)

- 24 October 2011 Procedures Group
  - “Harmonise discrepancies concerning pilot procedures” (IATA)

- Outcome of the Work of the Various EUROCONTROL Groups
  - Operational Control document (OCD)
  - Functional Requirements Document (FRD)
    - Information Sharing
    - Milestone Approach
    - Variable Taxi Time Approach
    - Collaborative Pre-Departure Sequencing
    - CDM in Adverse Conditions
    - Collaborative Management of Flight Updates
Principles of US CDM

• Provide the Right Information to the Right People, At the Right Time
  • High quality data
  • Appropriate frequency
• Facilitate Common Situational Awareness Which Enables Partners to Optimize the Collective Response to an Operational Situation
  • Understand the situation (tactical and strategic perspective)
  • Informed decision-making
  • Leverage available resources of all Partners
• Provide the Capability for all Partners to Measure Performance
  • Individual Partner organizations
  • Across a network of airports
• Maximize Use of Available Resources Within Known Constraints

While US CDM is a philosophy, there is also a CDM organization with joint FAA A4A partnership
Airport CDM - U.S. Surface CDM

- A set of well defined capabilities and procedures, which facilitate proactive management of departure queues via continuous assessment of airport capacity and demand, which is expected to improve the safe and efficient management of traffic flows at airports
- Situational awareness
- Understanding of “real demand”
- Predictability of future capacity/demand imbalances
- A domain with far reaching tentacles
  - Traffic Flow Management
  - Weather
  - Time Based Metering
- Essential for Effective, Efficient ATFM
  - Full participation from all Stakeholders is essential
  - Different from ATFM
- ‘ATM on the Ground’

“Everything Starts and Ends at the Stand/Gate”

“Once You’ve Seen One Airport, You’ve Seen One Airport”
U.S. Surface CDM Initiative

• 1992, CDM begins as ‘FAA / Airlines Data Exchange’ (FADE)
• 1996, FADE becomes ‘Collaborative Decision Making’ (CDM) Initiative
  – CDM Stakeholder Group (CSG) established; Provides guidance and tasking to subgroups
  – Focus is on timely exchange of Air Traffic Flow Management (ATFM) data among ATM Stakeholders
• 2006, CSG formed the Surface CDM (S-CDM) WG
  – Identify and document “surface management” solutions in operation at U.S. airports
  – Identify the essential data elements that should be exchanged among ATM Stakeholders participating in a Surface CDM environment
• 2008, CSG formed the Surface CDM Team (SCT)
  – Further refine the essential data elements that should be exchanged among ATM Stakeholders participating in a Surface CDM environment
  – Develop the US Surface CDM Concept of Operations (ConOps) in the Near-Term
U.S. Surface CDM Initiative (cont’d)

- 2010, FAA Accepts US Surface CDM ConOps
- 2011, Commence Validation of US Surface CDM ConOps (S-CDM capabilities)
  - Improvement of individual and shared situational awareness regarding departure management via the sharing of real-time and forecast operational information which positions Stakeholders to understand the current status of the airport operation
  - Tactical management of airport surface movement and aircraft departure queues to avoid excessive taxi-out times and improve departure efficiency
  - Improvement of the management of arrival traffic flows to increase throughput and coordination of arrival and departure demand
  - Analysis, measurement and monitoring capabilities to position Stakeholders to objectively quantify airport operational performance, the impact of the specific airport operations on the ATM, and the performance of individual Stakeholder organizations
  - Global harmonization to ensure synergy with other countries and to adopt “best practices” from the respective models, which will facilitate future interoperability among the various international models
Timeline

ATMAC - PBN, TBFM, & Surface

2002
CSG formed the Surface CDM (S-CDM) WG

2005
Surface Data Exchange Trials at KDTW

2006
‘NGATS’ Recognizes Need for Improved Surface Efficiency

2007
CSG tasked Surface WG to write SCDM ConOps

2008
DOT Tarmac Delay Task Force

2009
RTCA NextGen Mid-Term Implementation Task Force Report (TF 5)

2010
DOT ‘NY77’ ARC Delay Reduction Commitments

2011
Future of Aviation Advisory Committee

2012
Industry/FAA Partnership for Phased Implementation of S-CDM

2013
OCIP for Surface Efficiency signed by NMB

U.S. S-CDM Timeline

Legend

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Approach to Initial Surface CDM Deployment

**Collaborative Partnership**
Defines overarching process across FAA domains and with full industry participation

**Provide Stakeholders with situational awareness (SSA)**

**Connect the gate to the airspace, enhance airport efficiency, and reduce environmental impact**

**Improve predictability : Foundation for Surface CDM!**

**Basic Surface Event Data**

**Queue Management**

**Link Surface & Airspace Ops**

**Surface Data Sharing and Integration**
ASDE-X, TFMS, TBFM, NTML, CDM ADL

A Low-Risk, “Do No Harm” Approach with a Foundation in Data Sharing
Validation of Surface CDM Concept

- Iterative approach in which each phase assesses each of the capabilities and any associated procedures described in the Surface CDM ConOps from multiple perspectives.

- Central to each of the respective CE phases are four interrelated perspectives that are applied to each phase:
  - Technical Feasibility
  - Policy Considerations and Impact(s) to Stakeholders
  - Performance and Operational Benefits
  - Operational Feasibility
U.S. Surface CDM Concept Validation

Vision
- Operational Need

Concept Engineering Phases
- Concept Analysis
- Concept Exploration
- Concept Development
- Concept Demonstration

Capabilities
- Implementation

Increasing Concept Validation and Maturity
- Assess current operations and technology
- Stakeholder collaboration
- Data collection
- Baseline analysis
- Forecasting
- Research planning

- Develop alternative concepts of operation
- Assess feasibility/benefits/risks/concept gaps
- Fast-Time simulation
- Stakeholder coordination

- Rapid prototype development
- Prototype integration
- Conduct HITLs
- Conduct stakeholder coordination
- Analyze HITL results
- Analyze feasibility, including safety, human factors, mixed equipage

- Laboratory demonstrations
- Standards development
- Integrate and assess interoperability
- Conduct operational trials
- Promote stakeholder involvement and acceptance
Stakeholders are Essential to Concept Validation

- **Airport Operators**
  - DRC updates Tactical & Strategic DMP Parameters

- **Military/Federal Agencies**
  - DRM notifies all stakeholders that DRC has affirmed a DRM-suggested DMP

- **Departure Reservoir Coordinator (DRC)**

- **ATCT**
  - Realtime updates Airport Departure and Arrival rates

- **ATCSCC**
- **ARTCC**
- **TRACON**

- **Ramp Control**
  - KC notifies PIC that Metering is in Effect

- **Flight Operations Center (FOC)**

**Information Flow Legend**
- Green: Between Stakeholders
- Blue: Stakeholder and DRC
- Purple: Stakeholder and Surface CDM Data Repository

Local stakeholders collaborate to choose DMP Parameter Values
S-CDM Queue Management – Only When Needed

• SCDM detects a demand/capacity imbalance and notifies all Stakeholders
  • The start of the Planning Horizon is set equal to the EOBT of the first flight that is predicted to enter the departure queue after the Target Queue Length is exceeded
Surface CDM – Measuring the Benefits

• Improved Predictability Reduces Variability, Improves Surface Flows
• Reduced Fuel Burn, Environmental Impact, Block Time
• Taxi time represents the most significant opportunity to improve predictability

Annual Figures

76.7 million hours of taxi-out time†
21.5 million attributable to taxi delays*
10.7 million recoverable through CDM data exchange‡

† Source Bureau of Transportation Statistics, 2011
* Lowther MITLL, 2009 ‡Howell MCR, 2003

• Shared Situational Awareness
  • Improved response to flights involved in weather events including ‘long on board’ and return to gate scenarios (associated with the DOT ‘Tarmac Rule’), diversion recovery, more timely reroutes
  • Real time evaluation of the impact of surface events (runway configuration changes, taxiway closures, snow removal, emergency response, etc.)
KJFK Metering Program Lessons Learned

Limited ATM/ATC involvement in program planning and execution reduces potential benefits to airlines and passengers

Comparison: KJFK Ground Metering Program (GMP) vs. Surface CDM Capabilities

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>KJFK GMP Limitations</th>
<th>Surface CDM Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data Acquisition</td>
<td>No connection to real-time ATM data. Inefficient and incomplete ATM status data collection via multiple, non-automated sources such as radio “chatter” and teleconferences</td>
<td>Real-time ATM data automatically fed from ATM and ATC on ATM restrictions (e.g., GDPs, MIT, route closures), aircraft release time (e.g., EDCTs), and en route aircraft arrival data</td>
</tr>
<tr>
<td>2. Analysis and Planning</td>
<td>Inference of ATM status based on information gleaned from multiple sources; judgment of expert Coordinator critical to good planning</td>
<td>Real-time, automated delivery of ATM status data to calculate accurate demand/capacity imbalances; DRC skills acquirable through training</td>
</tr>
<tr>
<td>3. Triggering</td>
<td>Pre-established schedule to run GMPs two-times daily, regardless of actual system imbalances, which are not always fully known</td>
<td>Automatic, continuous demand/capacity imbalance calculation enables DMP triggering on “as needed” basis</td>
</tr>
<tr>
<td>4. Execution</td>
<td>Limited understanding of ATM status data reduces ability to deliver right aircraft at the right time in the right number to the AMA to enable efficient ATC departure sequencing</td>
<td>Full picture of ATM status, including route closures, TMIs, and actual en route aircraft location enables ATM/ATC coordinated planning to use available airspace efficiently</td>
</tr>
</tbody>
</table>

Sources: (1) TFDM Acquisition Support: Performance Requirements Development and Market Assessment, Functional Assessment of Departure Metering at JFK International Airport, January 31, 2013
KJFK Model Today and Future FAA S-CDM

Actual Benefits
- Allows scheduling departure releases prior to aircraft pushing back, letting aircraft take delay at gate, reducing fuel burn, taxi time, passenger frustration, and airframe time
- Reduces overall departure delay time (gate + taxi time)

Expected Additional Benefits
- Integration with Air Traffic Management Systems will improve coordination with system-wide restrictions and traffic flow
- Provide ATC with the right mix of aircraft to build efficient departure schedule
- Electronic flight data (EFD) improves efficiency of communication and enables rapid and efficient departure queuing
Considerations for Global Harmonization

• For each region of the world where A-CDM is practiced, achieve interoperability in the Context:
  – Processes
  – Procedures
  – Policies
  – Technical solutions
  – Connectivity to ATFM

• Recognition of Investment Made by “Pioneers”/“Early Adopters”
• Phase/Stage of A-CDM Implementation at Various A-CDM Airports
• Criteria for Characterization as an A-CDM Airport
• Dynamics of an Airport Operation
• Concept of “Networked” and ”Coupled” Airport Operation
• Terminology
• Diverse “Owners” of A-CDM Implementations
Thank You