# Tower
# Flight Data Manager

# (TFDM)

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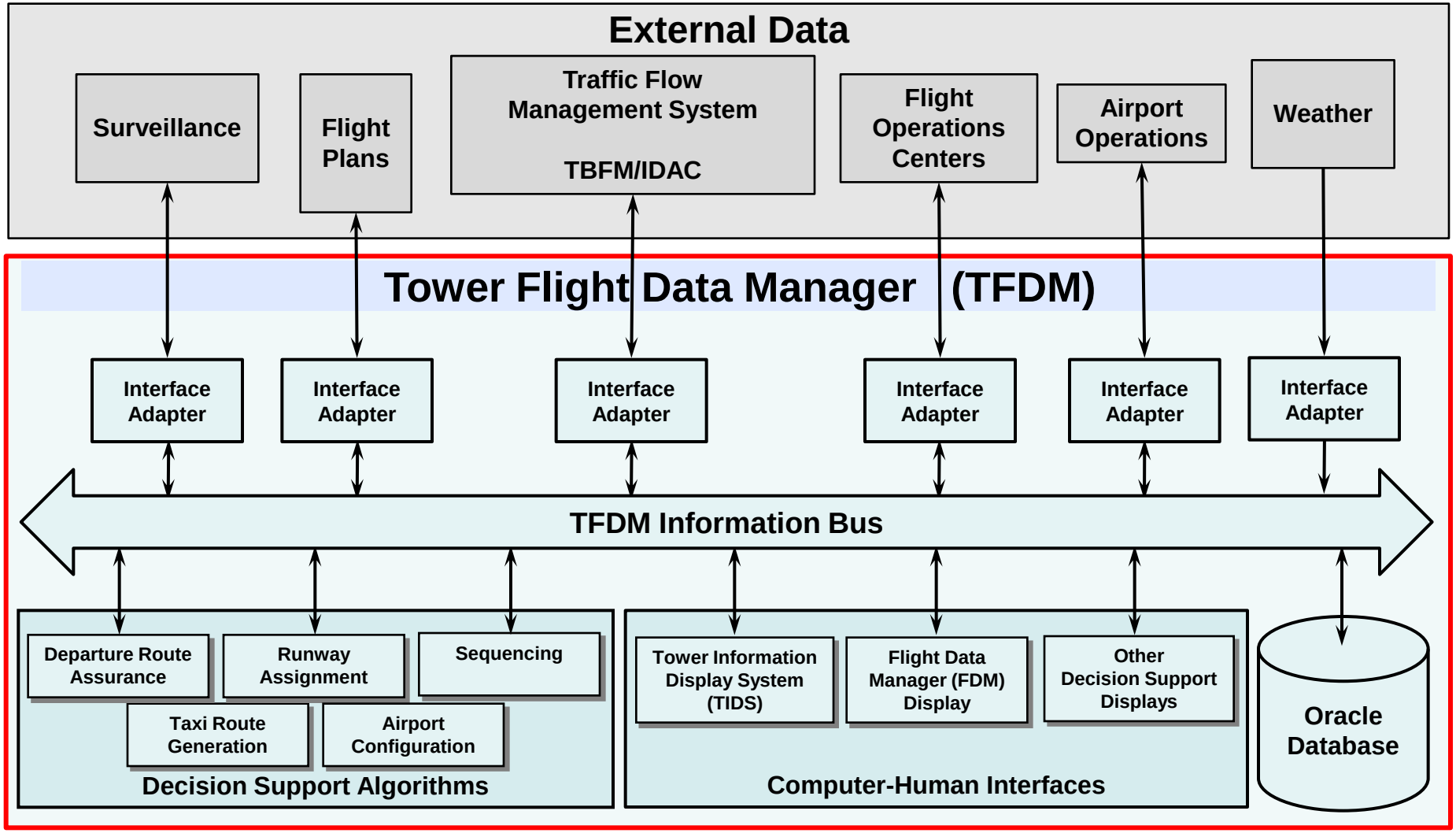
# Outline

- TFDM Overview
- Concept Coordination Activities
- Laboratory Simulations
- Field Demonstrations
- Summary

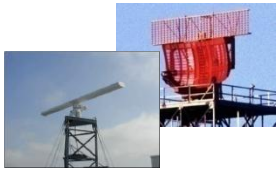
# Tower Flight Data Manager (TFDM)

- Objective: Concept development for NextGen tower automation
  - Integrated tower systems
  - Electronic flight data management
  - Surface trajectory-based operations (STBO)
  - Integrated arrival, departure and surface operations (IADS)
- Participating Organizations
  - ATO-T, Systems Engineering
  - ATO-P, ATO-R
  - Lincoln Laboratory
  - Metron Aviation
  - **Mosaic ATM**
  - **MITRE/CAASD**
  - **Adacel**
  - **MIT**
- Enables Staffed NextGen Tower operations
  - Joint prototype and demonstration activities

# Tower Flight Data Manager (TFDM) System

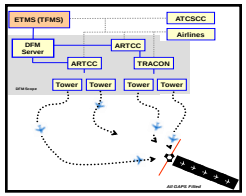


# Tower Flight Data Manager (TFDM)
# High Level Operational View

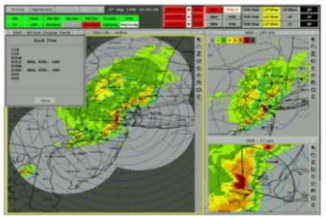


Terminal and Surface Surveillance

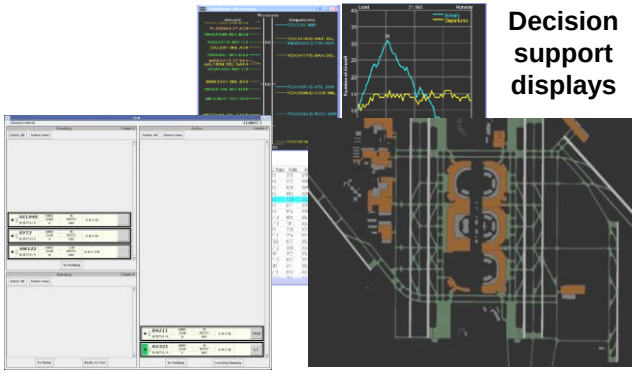
Flight Plan Data




Flow Constraints



Weather



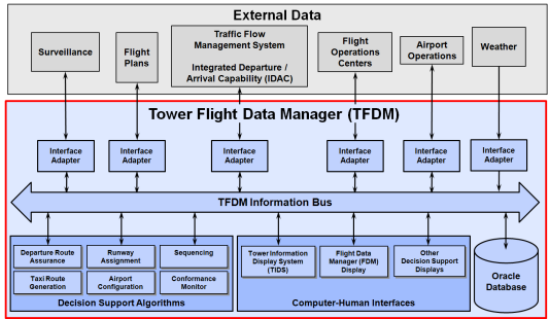
Flight data management

Surveillance Display

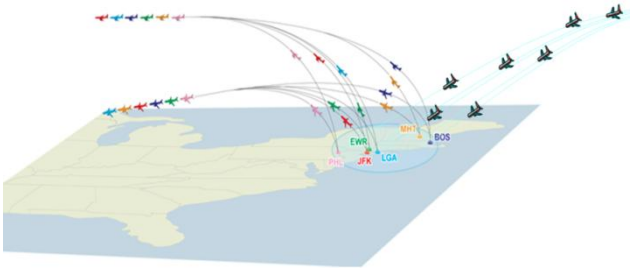
Decision support displays

## Arrival / Departure Management Tool

- Pushback & taxi control
- Taxi conformance & safety
- Arrival/Departure sequencing
- Departure route assurance
- Runway configuration and load-balancing




Net-Centric Infrastructure




## Operational Users

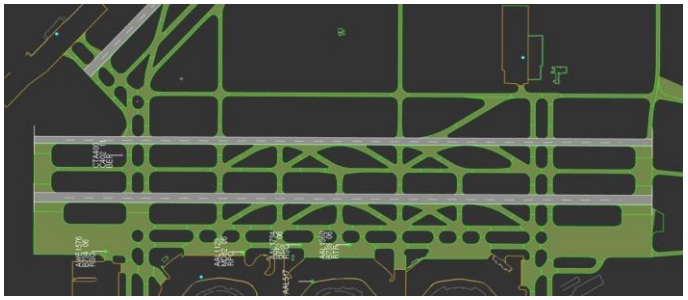
**Controllers**
- Flight data
- Clearance
- Ground
- Local

**Terminal Control**

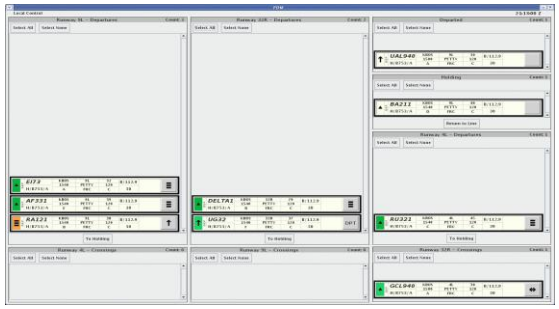
**Airline and Dispatch**

**Airport Authority**

# TFDM User Displays



Tower Information Display System (TIDS)



Flight Data Manager (FDM) Display

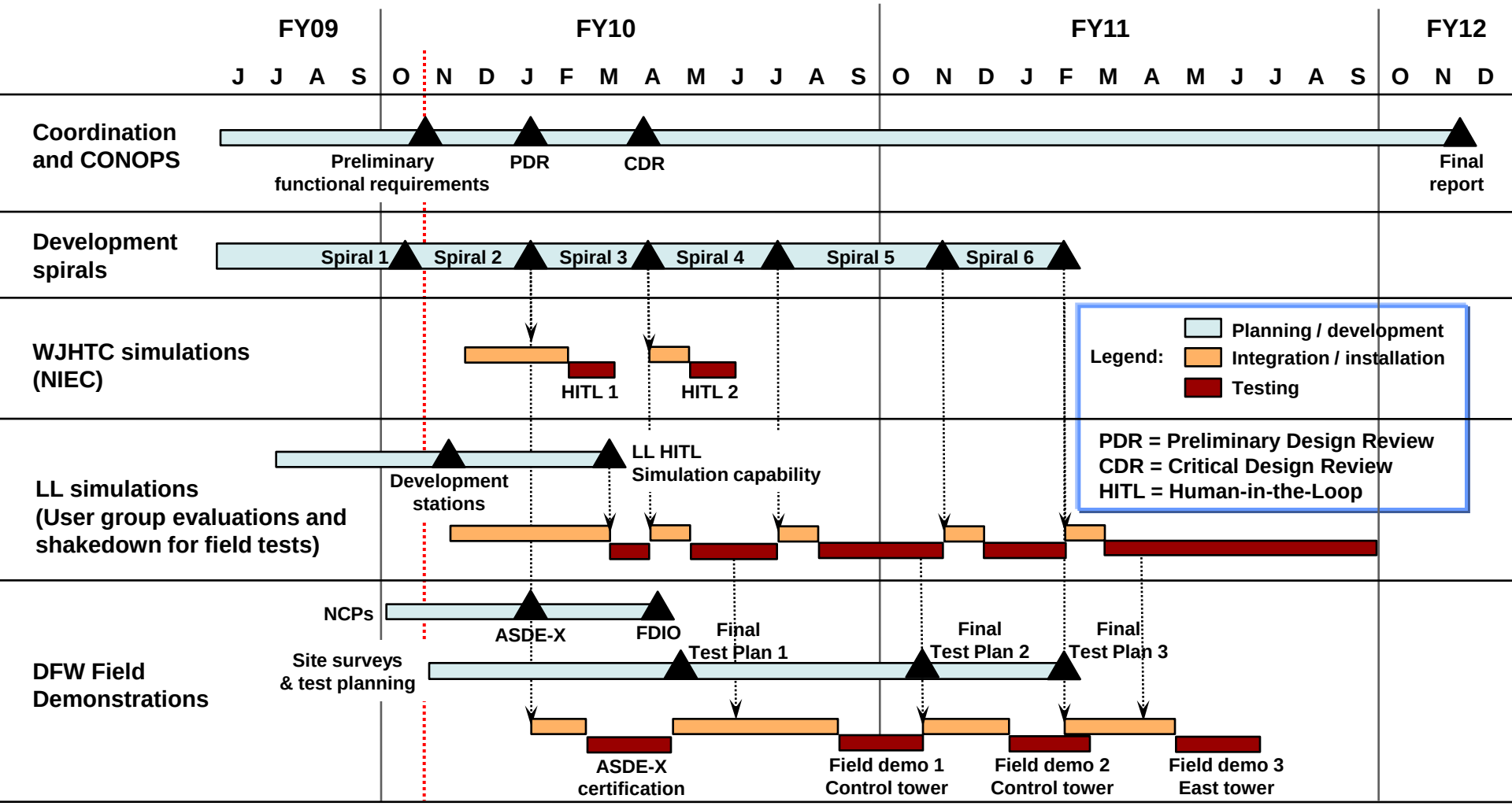
Decision Support Tools (DST)

- Tower Information Display System (TIDS)
  - Surface traffic situation, taxi routing, airport status
- Flight Data Manager (FDM) Display
  - Flight strips showing aircraft state data, queues
- Decision Support Tool (DST) Displays
  - Airport configuration control, demand management, weather impacts
- Adapted / customized / consolidated across several tower user positions
  - Ground, local, supervisor, clearance, flight data

# Key A/DMT Objectives

| Capability | A/DMT Objectives |
|---|---|
| Taxi Route Generation | • Prevent gridlock, minimize taxi time and fuel burn<br>• Monitor conformance to taxi routing<br>• Pre-empt and resolve runway incursions |
| Sequencing and Scheduling | • Better manage pushback and takeoff times<br>• Optimize sequence of aircraft weight classes<br>• Maintain flexibility to modify sequence if needed |
| Runway Assignment | • Robustly assign aircraft to runways<br>• Balance taxi time and departure queue length |
| Departure Routing | • Ensure route is clear of weather at required time<br>• Develop and rapidly coordinate reroutes<br>• Inject departure into slot in overhead traffic stream |
| Airport Configuration | • Allocate arrivals / departures to maximize throughput<br>• Anticipate need to reconfigure to efficiently reallocate aircraft |

# Program Milestones



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# TFDM User's Group

- Charter
  - Validate TFDM-A/DMT concepts of operation
  - Evaluate CHI concepts
  - HITL and operational test participants
- Commitment
  - 3 day meetings every other month beginning 3-5 Nov 2009
- Initial participants via SPARC process
  - Ed Donaldson (MCO)
  - Steve Osborne (SoCal)
  - Laura Ragan (LAS)
  - Steve Batchelder (PHL)
  - Steve Baker (MCI)
  - Dan Creedon (PCT)
  - Mike Amato (Houston ARTCC)
- Seeking to expand group to include controllers, airline representatives and tech ops personnel

# Collaborating Technical Organizations

| Organization | Role | Select Leveraged Technologies/Capabilities |
|---|---|---|
| Lincoln Laboratory | • Program management<br>• System engineering<br>• Prototype development<br>• Human-in-the-loop tests<br>• Field demonstrations<br>• FAA support | • TFDM information Management Framework<br>• Route Availability Planning Tool (RAPT)<br>• Corridor Integrated Weather System (CIWS)<br>• Integrated Terminal Weather System (ITWS)<br>• Runway Status Lights System (RWSL) |
| Metron Aviation | • Concept engineering<br>• Simulation environment elements<br>• Interfaces to external systems<br>• FAA acquisition process support<br>• Safety Risk Management process<br>• Algorithm development and integration | • Surface Management System (SMS) - optimizes gate assignment, surface traffic coordination, runway allocation<br>• Departure Flow Management (DFM) tool - automates departure clearance processes<br>• Jupiter Simulation Environment (JSE) - air traffic simulation capabilities to evaluate decision support tools |

# Collaborating Technical Organizations (cont.)

| Organization | Role | Select Leveraged Technologies/Capabilities |
|---|---|---|
| Mosaic ATM | • Algorithm development and integration | • Surface Decision Support System (SDSS) used in Memphis, Orlando, and Louisville evaluations<br>• Surface Operations Data Analysis and Adaptation (SODAA) tool |
| Adacel | • Tower simulation environment<br>- Simulation control<br>- Aircraft dynamics and control<br>- Out-the-window visualization | • High-fidelity tower simulation systems for airports and research organizations (e.g., NASA, Boston Logan, DoD, Boeing, Airbus) |
| MIT Campus | • Airport runway configuration, arrival/departure sequencing algorithms, Reduced Surface Emissions | • Stochastic systems, optimization, queuing theory, transportation systems |

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# TFDM Laboratory Simulations Overview

- Initial HITL simulations scheduled at WJHTC NIEC
  - Data collection relative to SNT concepts
  - February and May 2010
  - Initial TFDM ConOps and user interface validation
- Ongoing simulation, test and refinement activities planned at Lincoln Laboratory using Adacel MaxSim4 ATCT simulator integrated with TFDM prototype
  - Commence March 2010
  - Software development and testing
  - External systems information exchange emulation
    - ERAM
    - TFMS/TBFM
    - NNEW
    - FOC
  - HITL “dry runs” of TFDM operations concepts and field demonstration activities

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# DFW Demonstration Objectives

- Refine and validate TFDM/SNT concepts in a high-density airport operational environment
- Demonstrate NextGen integrated tower architecture
- Evaluate ASDE-X capability to support operations without OTW
- Refine and validate decision support tools
- Refine and validate user interface prototypes
- Refine and validate information exchange and collaborative decision making processes with TRACON, en route, traffic flow management and airline

# DFW NextGen Towers Tests

| April 2009 | March 2010 | August 2010 | December 2010 | May 2011 |
|---|---|---|---|---|
| Prototype ASDE-X Evaluation | Production ASDE-X Evaluation | Supplemental SNT Demonstration | Flexible SNT Demonstration | TFDM Demonstration |
| • Data collection<br>• Flight check aircraft<br>• Center Tower | • Data collection<br>• Flight check aircraft<br>• Center Tower | • Shadow demo<br>• Flight check aircraft<br>• Center Tower | • Shadow demo<br>• Flight check aircraft<br>• Center Tower | • Operational demo<br>• East Tower Displays |

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- TFDM concept development, requirements definition, prototype implementation and system test activities underway
  - Substantive collaborative with other FAA and research organizations developing NextGen airport operations concepts
- Near term milestones include initial capability demonstrations and HITL tests at WJHTC NIEC and Lincoln Laboratory
- TFDM user's group coordination commencing near term
  - Concept of operation validation
  - Decision support capability and user interface refinement and validation
- Shadow mode and operational tests commencing at DFW late FY 2010