



AIR TRAFFIC MANAGEMENT TECHNOLOGY DEMONSTRATION (ATD-1) – CONCEPT TO OPERATIONS

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Performance-Based Navigation



Performance-based navigation (PBN) procedures are a foundational element of NextGen.

PBN benefits include:

- improved fuel efficiency and reduced environmental impact
- shorter, more direct flight paths
- repeatable, more predictable flight paths

PBN equipage rates for air carriers are high

PBN procedures continue to be developed world-wide

Air Traffic Management Technology Demonstration #1 (ATD-1)



FIM

Flight Deck Interval Management for Arrival Operations



CMS

Controller-Managed Spacing in Terminal Airspace



TMA-TM

Traffic Management Advisor (TMA) with Terminal Metering

Terminal Sequencing and Spacing (TSS)



FIM Flight Deck Interval Management for Arrival Operations

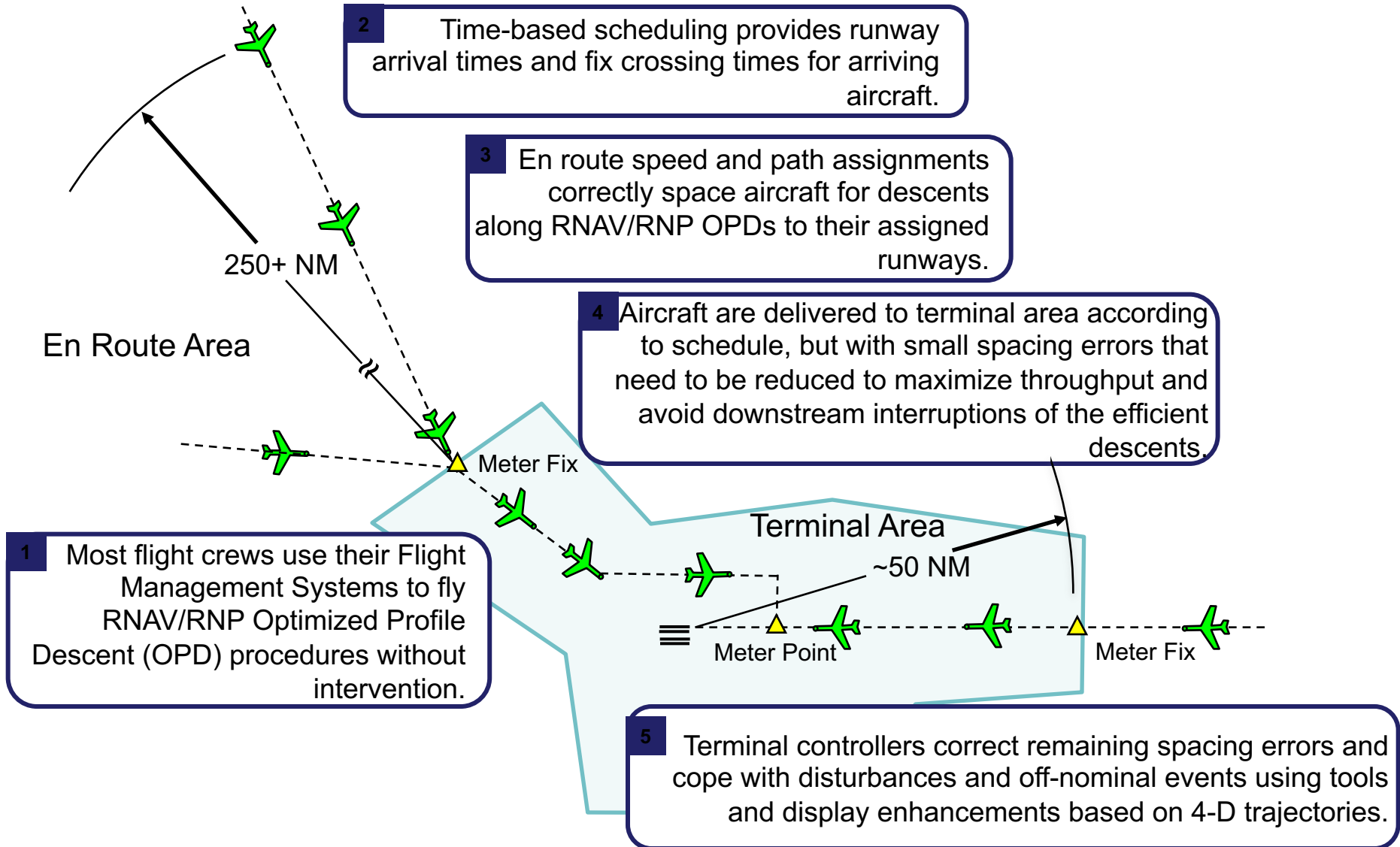


CMS Controller-Managed Spacing in Terminal Airspace



TMA-TM Traffic Management Advisor (TMA) with Terminal Metering

Operational Scenario



Simulation Overview



- Sixteen large-scale, human-in-the-loop simulations

- Entire arrival operation
- Multiple airports and configurations
- Mixed equipage
- Realistic wind conditions and errors
- Realistic traffic demand
- Experienced controllers

Simulation Designations

CMS for ATD-1: CA-1, CA-2, CA-3, CA-4, CA-4.1, CA-5.1, CA-5.2, and CA-5.3

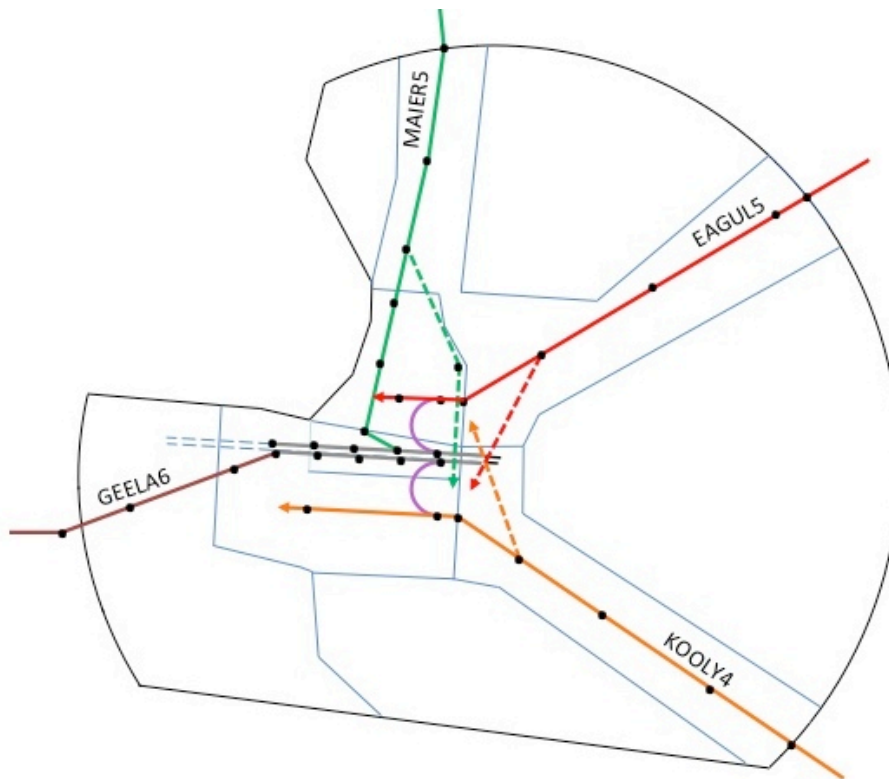
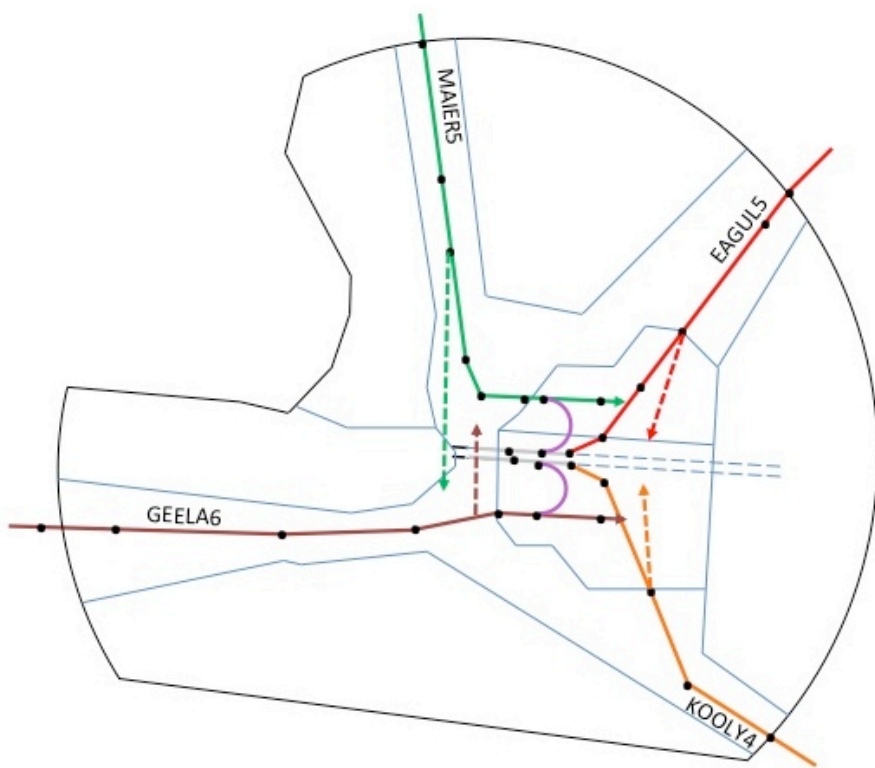
Full Integrated ATD-1 Test: FIAT-1, FIAT-2, FIAT-3, FIAT-4, and FIAT-5

Joint NASA/FAA Simulations: REACT, TSS-1, TSS-2, and OIA (post-publication)

- Four phases: systems integration, concept refinement, performance evaluation, and operational integration
- FAA and MITRE independently conducted five additional TSS simulations



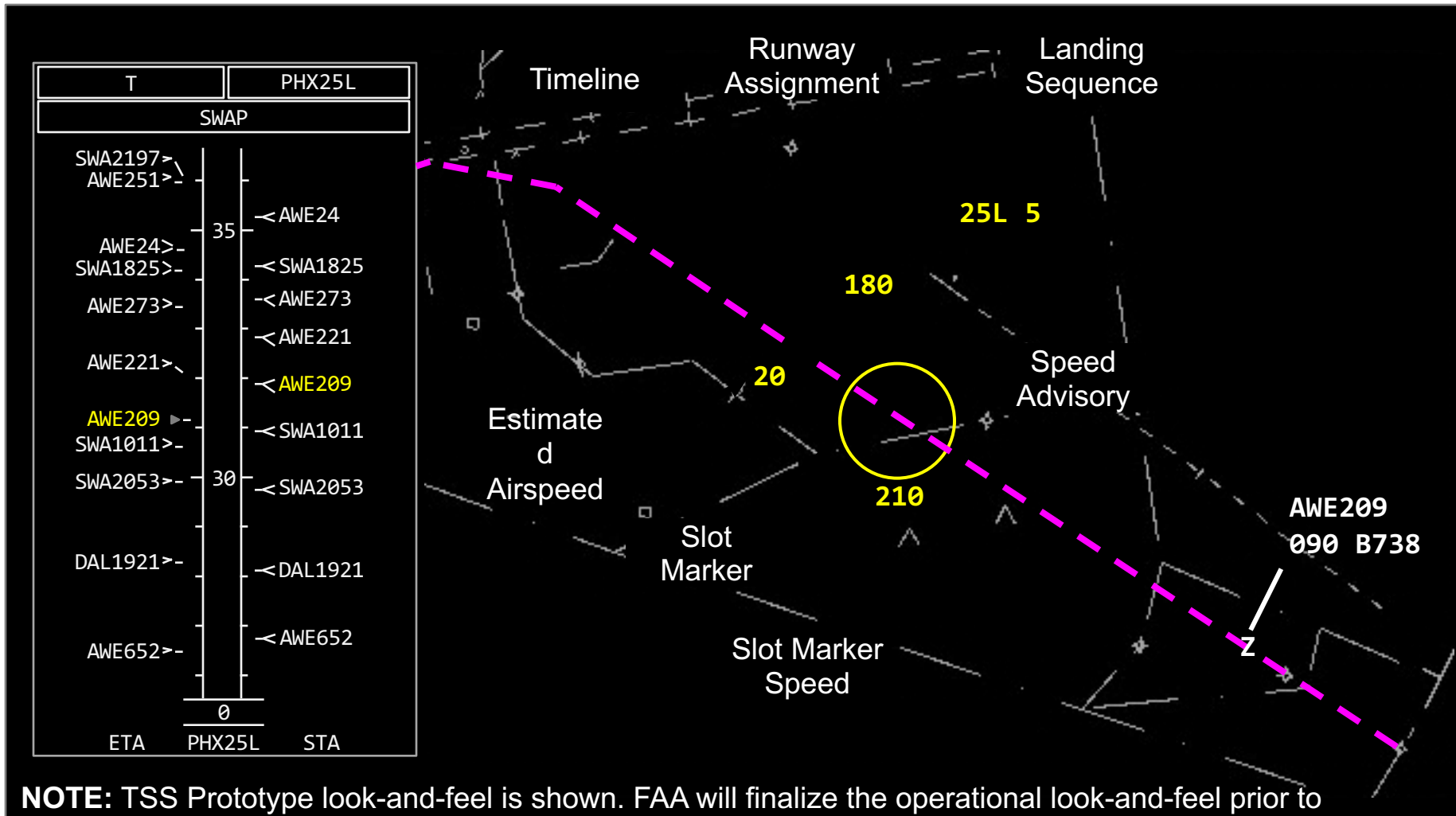
Modeled PBN Arrival Procedures



PHX West Flow Operations

PHX East Flow Operations

Display Aids for Terminal Air Traffic Controllers



Measures of Performance



- Six measures of performance evaluated for each simulation
 - PBN success rate
 - Inter-arrival spacing error
 - Controller acceptability
 - Controller workload
 - Excess in-trail separation
 - Number of controller-to-pilot instructions
- Two key performance parameters compared across simulations
 - PBN success rate
 - Inter-arrival spacing error

Transitioning to WJHTC



- Operational Hardware
- Different target generator: TGF
- New Human Factors Tools
- Data Collection Objectives

Transitioning to WJHTC



<i>System</i>	<i>Data Collected</i>
TBFM	Aircraft flight plan Aircraft state Slot marker information STAs and ETAs for all aircraft Airspace adaptation Initial Runway matrix and buffer settings Trajectory Synthesizer output showing trajectory computations Mouse-clicks and keyboard input in TGUI and PGUI*
ERAM	Controller entries* GIM-S advisories and controller accept/reject messages*
STARS	Binary log files (required STARS for playback, not used in analysis)*
TGF	Aircraft flight plan and sim station configuration Aircraft state data and intent data Sim pilot command input Winds along flight path
Voice Comm	Audio .wav files for all sectors and TMCs* Push-to-talk times for all sectors and TMCs