Terminal Sequencing and Spacing (TSS)

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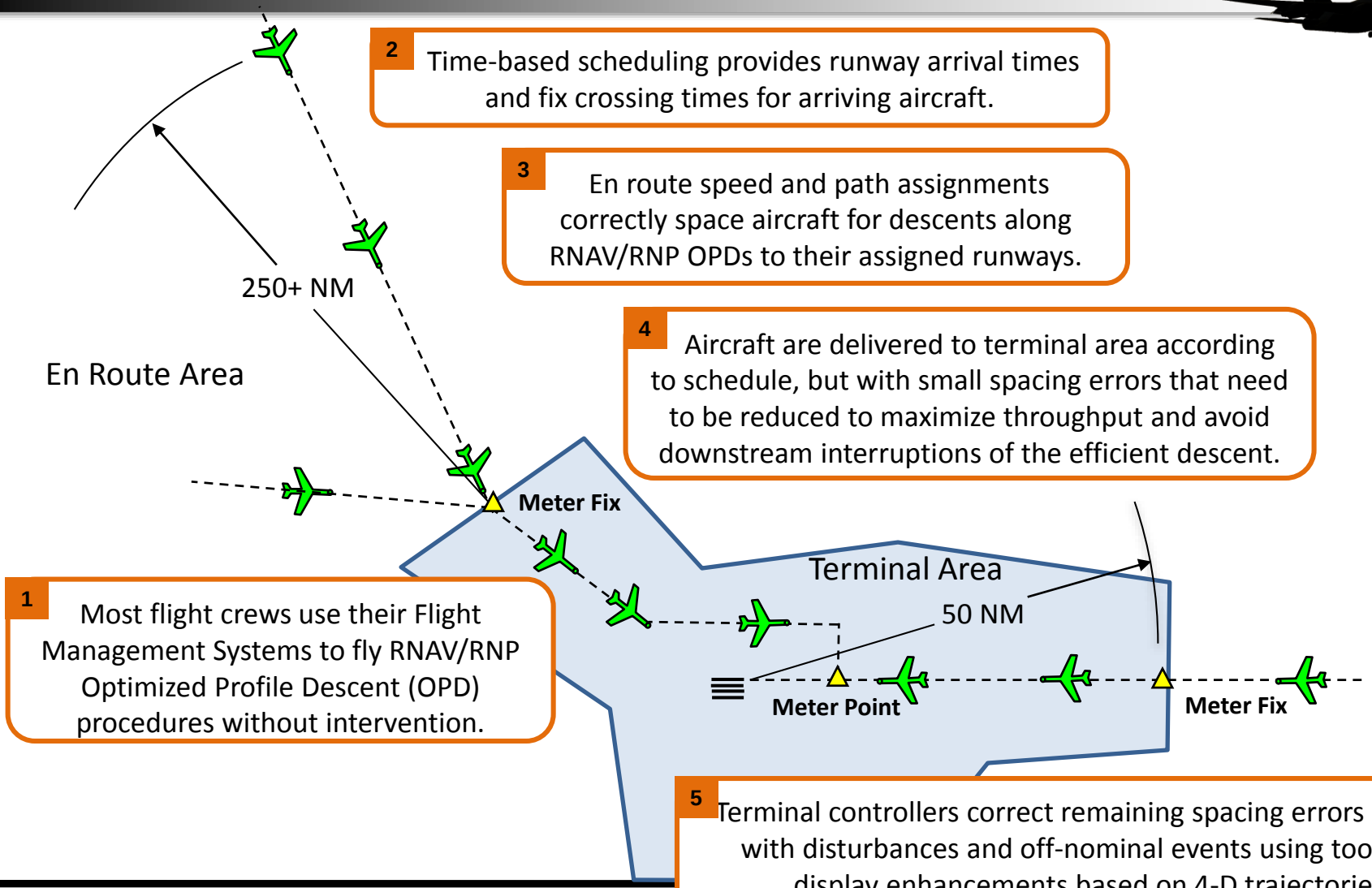
ICAO Block Upgrade Showcase and Symposium (BUDSS)
Demo 11: Improved Airport Operations through Departure, Surface and Arrival Management
May 19, 2015

Operational Scenario



2 Time-based scheduling provides runway arrival times and fix crossing times for arriving aircraft.

3 En route speed and path assignments correctly space aircraft for descents along RNAV/RNP OPDs to their assigned runways.

4 Aircraft are delivered to terminal area according to schedule, but with small spacing errors that need to be reduced to maximize throughput and avoid downstream interruptions of the efficient descent.

1 Most flight crews use their Flight Management Systems to fly RNAV/RNP Optimized Profile Descent (OPD) procedures without intervention.

5 Terminal controllers correct remaining spacing errors and cope with disturbances and off-nominal events using tools and display enhancements based on 4-D trajectories.

ATM Technology Demonstration #1 (ATD-1)

FIM Flight Deck Interval Management for Arrival Operations

CMS Controller-Managed Spacing in Terminal Airspace

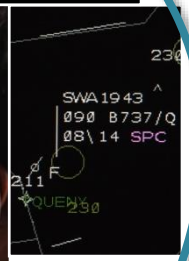
TMA-TM Traffic Management Advisor (TMA) with Terminal Metering

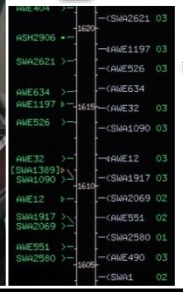
Terminal Sequencing and Spacing (TSS)

FIM Flight Deck Interval Management for Arrival Operations

TSS

CMS Controller-Managed Spacing in Terminal Airspace





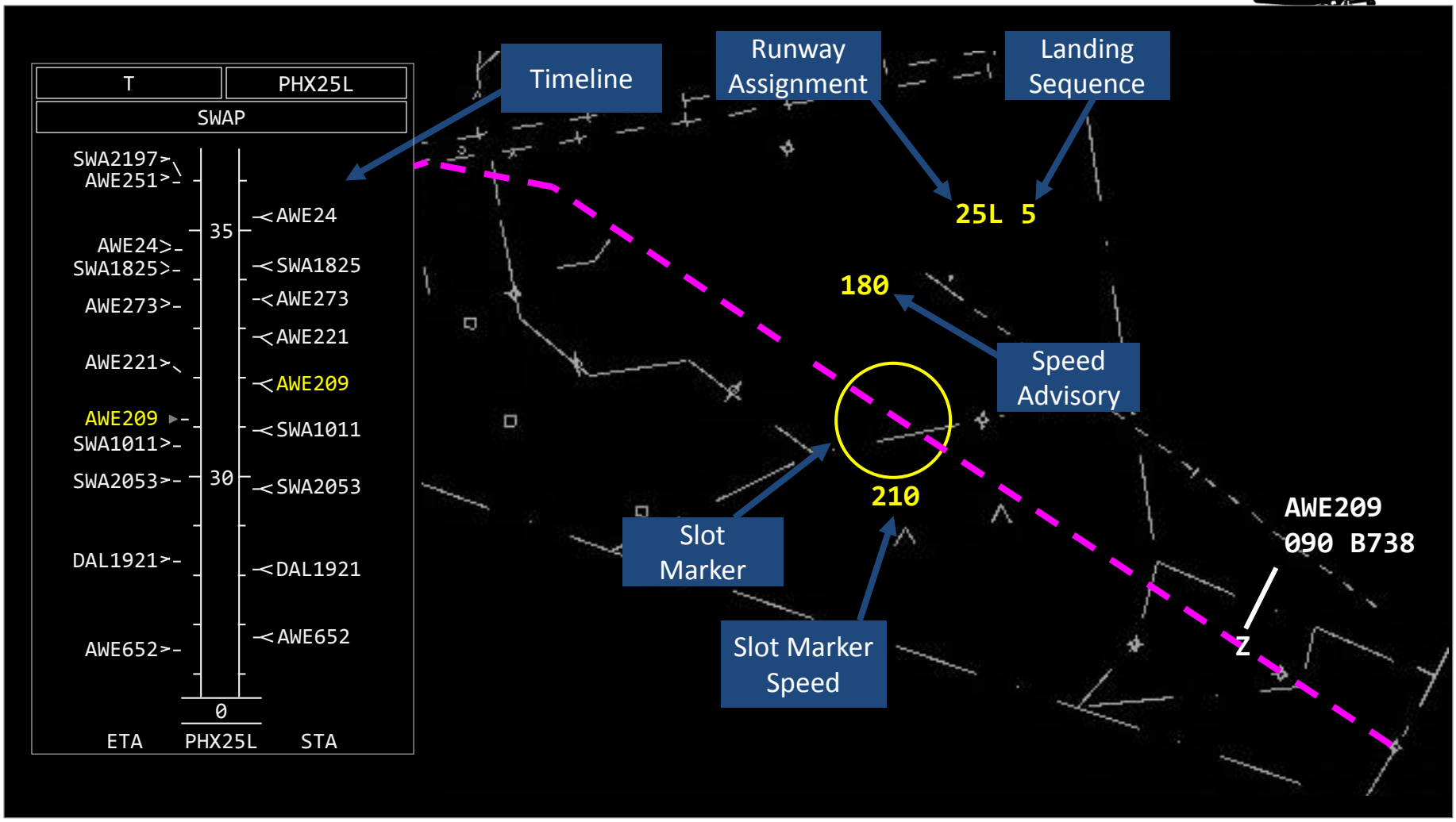
TMA-TM Traffic Management Advisor (TMA) with Terminal Metering

ATD-1 Overview

Movie segment from 0:00 to 1:32

Full video can be found at https://youtu.be/ngKazVQN4BI

TSS Prototype Capabilities



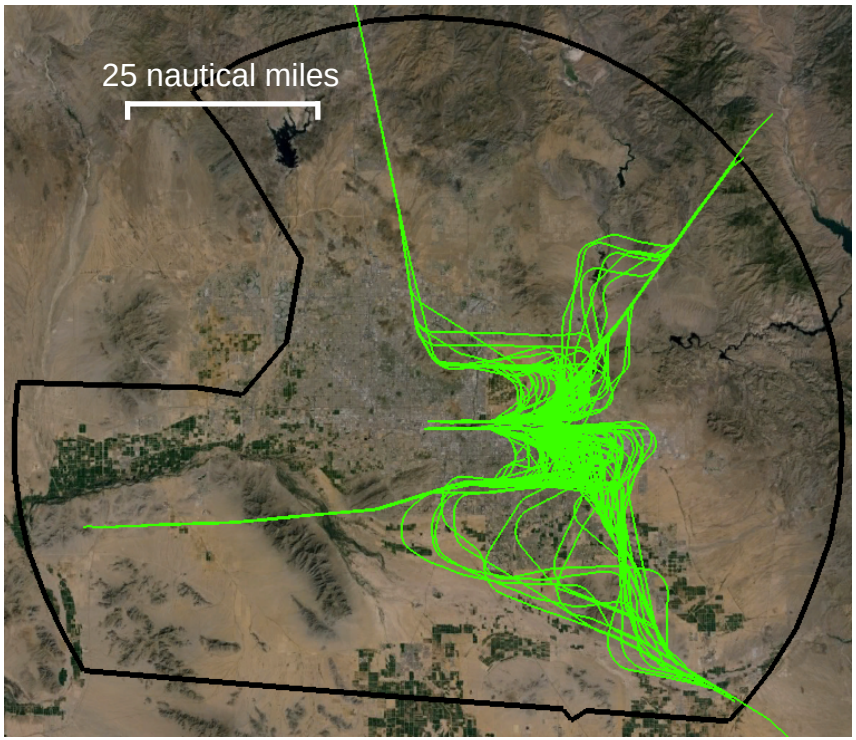
NOTE: TSS Prototype look-and-feel is shown. The FAA will finalize the operational look-and-feel prior to deployment.

TSS Description

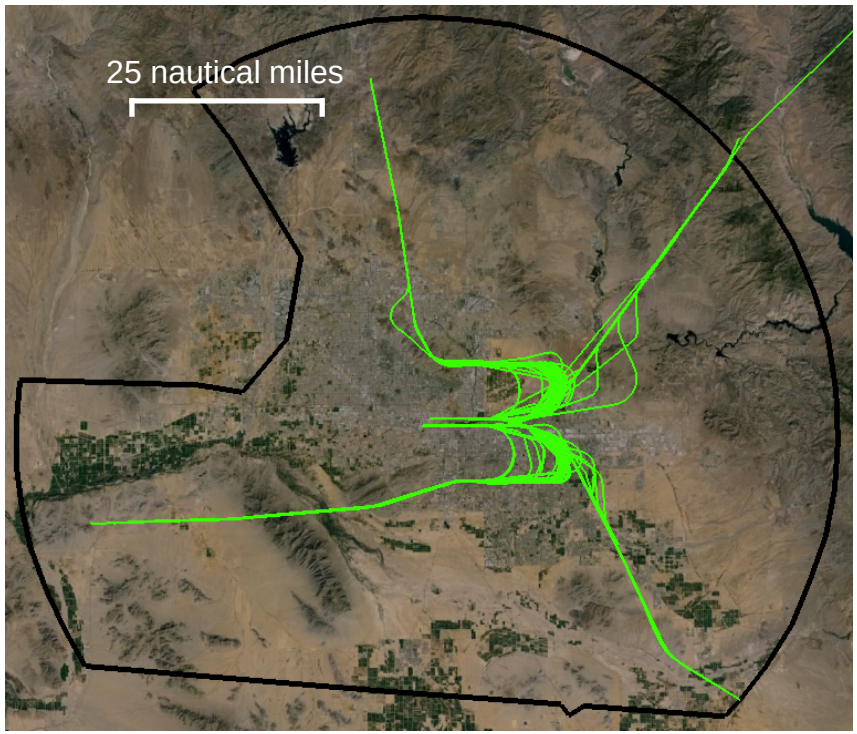
Movie segment from 1:45 to 5:08

Full video can be found at https://youtu.be/ngKazVQN4BI

Illustration of PBN Conformance



Operations without TSS



Operations with TSS

Reference: J. Thipphavong et al., "Evaluation of Terminal Sequencing and Spacing System for Performance-Based Navigation Arrivals," 32nd Digital Avionics Systems Conference, Syracuse, 6-10 October 2013.

Status of TSS Development

- NASA developed TSS prototypes from FAA systems:
  - Time-Based Flow Management (TBFM)
  - Standard Terminal Automation Replacement System (STARS)
- NASA transferred the Terminal Sequencing and Spacing (TSS) technologies to the FAA in July 2013
- NASA and the FAA evaluated TSS in twenty-four high-fidelity simulations
- NASA and the FAA are currently conducting another joint TSS simulation to mitigate operational deployment risks
- FAA is planning for an initial capability in the NAS in 2018

Reference: J. Robinson et al., "Enabling Performance-Based Navigation Arrivals: Development and Simulation Testing of the TSS System," 11th USA/Europe ATM R&D Seminar, Lisbon, 23-26 June 2015.

Concluding Remarks

- NASA transferred Terminal Sequencing and Spacing (TSS) technologies to the FAA
- As part of NextGen, TSS will enable routine use of fuel-efficient PBN procedures during all traffic conditions
- FAA is planning an initial capability in the NAS in 2018
- FAA booth will include full-length movie presentation, pamphlets, and playback of human-in-the-loop simulation recordings

Points Of Contact

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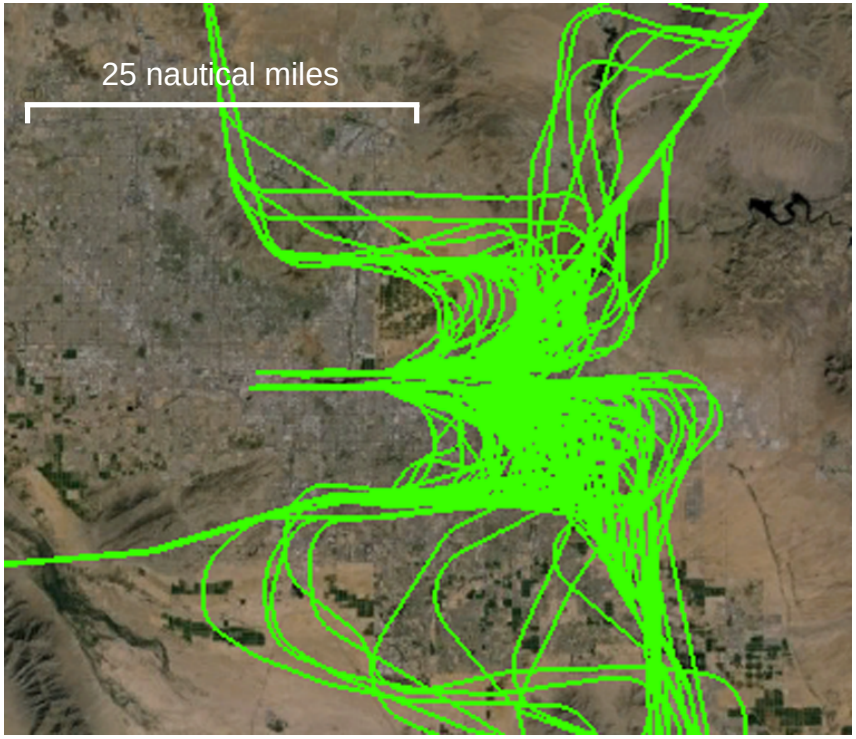
Alternative Slides

Illustration of PBN Conformance



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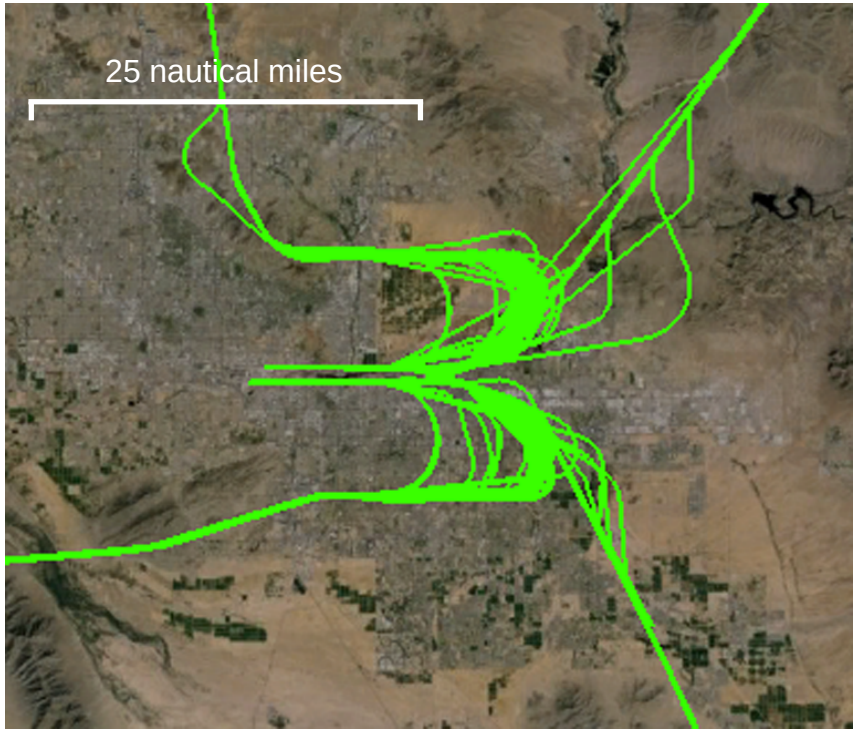

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