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
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www.nasa.gov
Operational Scenario

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

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.

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

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

CMS - Controller-Managed Spacing in Terminal Airspace

TSS - Terminal Sequencing and Spacing

TMA - 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 Look-and-Feel is shown. The FAA will finalize the operational look-and-feel prior to deployment.
Movie segment from 1:45 to 5:08
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

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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Illustration of PBN Conformance

Operations without TSS  Operations with TSS

25 nautical miles