Terminal Sequencing and Spacing (TSS)

John E. Robinson III
National Aeronautics and Space Administration
Ames Research Center

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)

CMS Controller-Managed Spacing in Terminal Airspace

TSS Terminal Sequencing and Spacing

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

FIM Flight Deck Interval Management for Arrival Operations
ATD-1 Overview

Movie segment from 0:00 to 1:32

Full video can be found at https://youtu.be/ngKazVQN4BI
NOTE: 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
Illustration of PBN Conformance

Operations without TSS

Operations with TSS

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

Jane Thipphavong
ATD-1 Project Manager
Jane.Thipphavong@nasa.gov

John E. Robinson III
Former ATD-1 Chief Engineer
John.E.E.Robinson@nasa.gov
Illustration of PBN Conformance

Operations without TSS

Operations with TSS