4DT Demonstration Project

•Presented by Natee Wongsangpaiboon, FAA ANG-C5

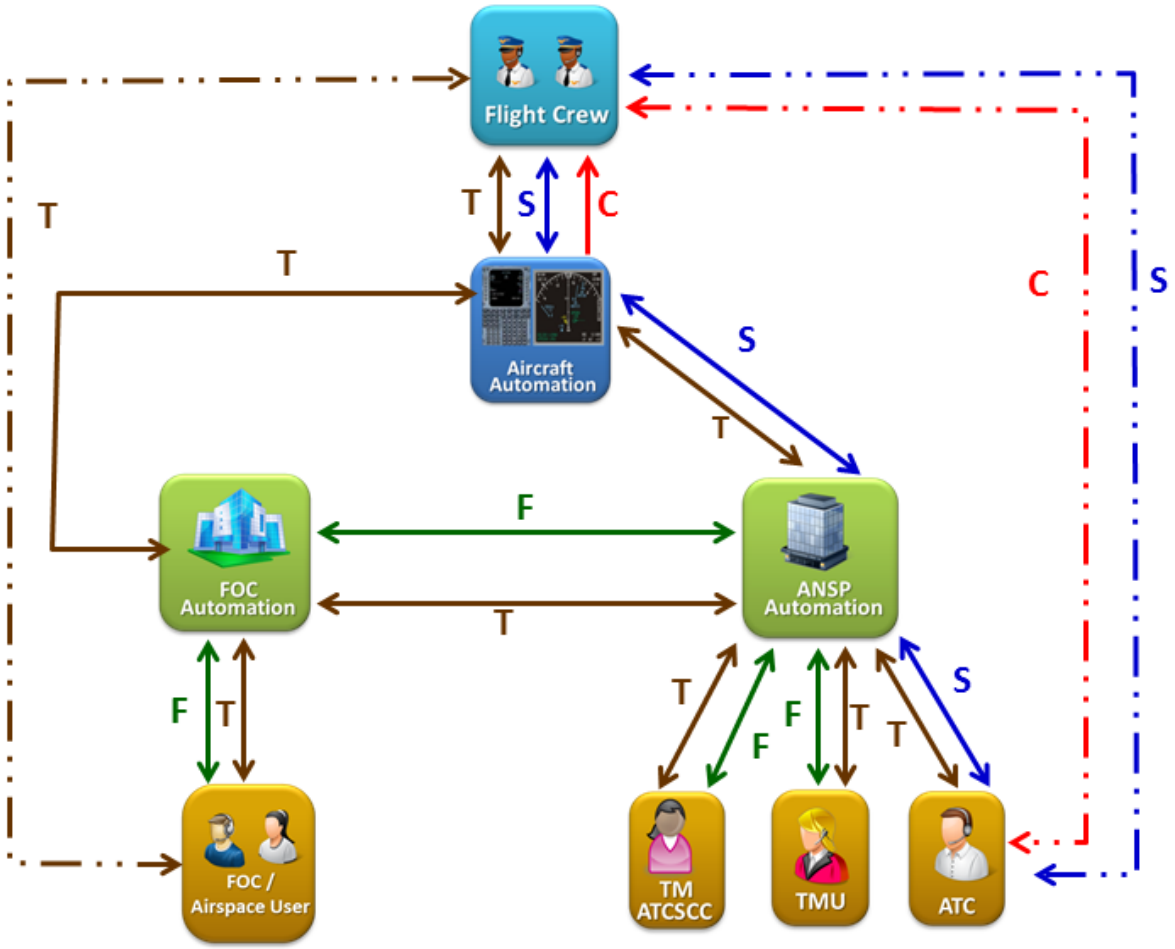
BACKGROUND

4DT PROJECT OVERVIEW

Today's Limitations

- Airspace management lacks flexibility for dynamic Ops
  - Planned re-routes (playbooks) & tactical vectoring
    - Cannot create new routes or new arrival schedules dynamically
  - Metering lost when deviating from structured path routes
    - Flows become inefficient & airspace capacity diminished
    - Once RNP procedure broken, difficult to maintain, or rejoin RNP routes
- Air Traffic Controllers lack tools to maintain efficient flow
  - Lack capabilities to enable precision routing
    - Limits options in impacted sectors, increases workloads
  - Controller cannot receive confirmation from aircraft
    - Aircraft cannot provide confirmation of intent
    - No way to confirm selected runway without voice confirmation

Future Interactions:
Between Automation and Stakeholders



F	Flow Management
T	Trajectory Management
S	Separation Management
C	Collision Avoidance

Voice	⟵ · ·⟶
Data	⟷

Definitions:

- **Voice:** Communications is by voice (person to person)
- **Data:** Communications involving automation tools (automation to automation or automation to person)

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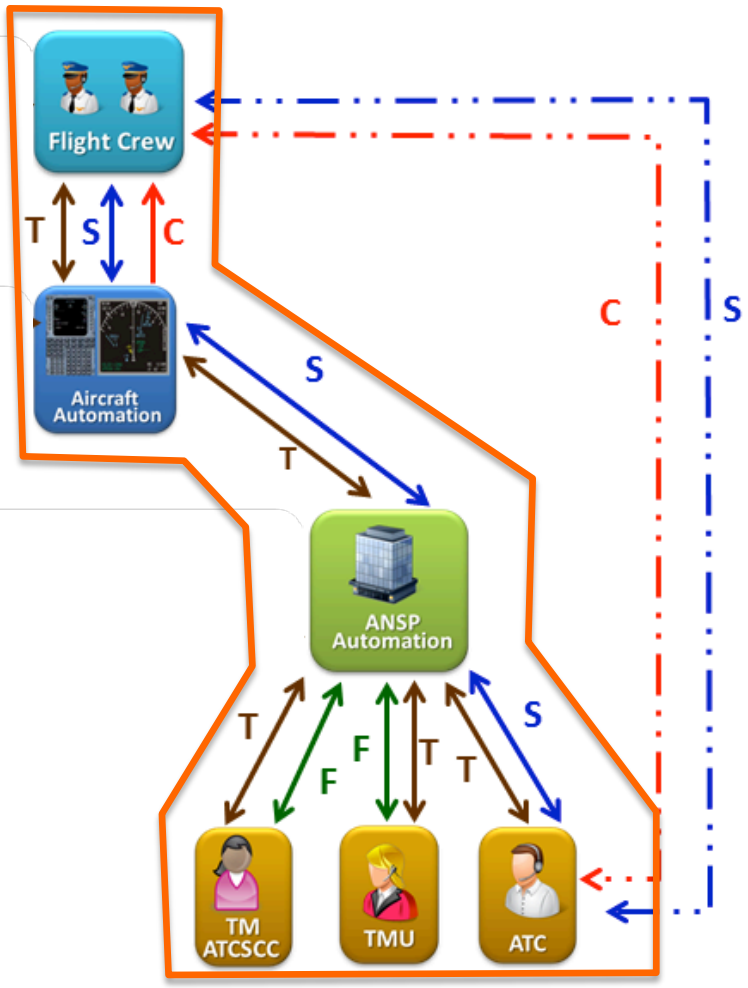
Future Environment with ATN B2

- Human centered environment supported by automation with interfaces for information exchange
- Dynamic operations using well-defined ad-hoc procedures maintaining fuel-efficient operations (e.g., OPDs)
- Metering will be maintained in constrained (e.g., weather) conditions using a combination of ad-hoc procedures and advanced aircraft capabilities.
  - Exchange of parameters between aircraft to increase confidence in meeting spacing requirements
  - Provide tools that enable traffic managers to maintain efficient traffic flow
- Provide NAS tools that enables aircraft to confirm their trajectory through automation for common situational awareness



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Demonstration Objective

Today's Limitations

Future Environment

Airspace management has limited flexibility for dynamic operations

The NAS has limited capabilities to meter traffic off published routes

Enabled by
- Technologies: CNS/ATM
- Operational Procedures

Dynamic operations with ad-hoc procedures maintaining efficient operations in constrained conditions

Advanced ANSP and aircraft capabilities will maintain metering through the use of ad-hoc routes

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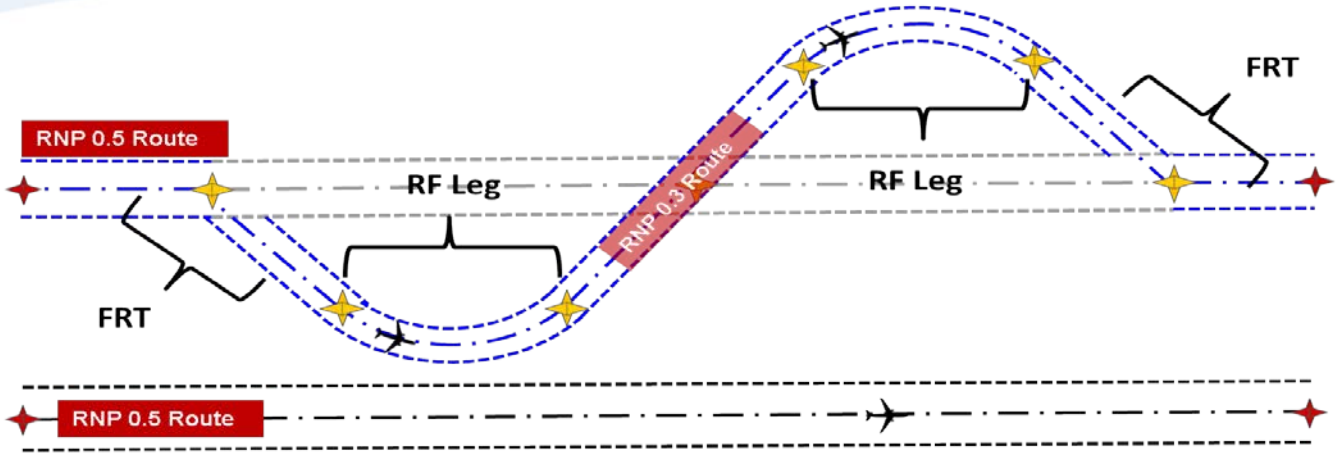
4DT Demo Components



- Dynamic RNP (DRNP)
  - DRNP is a datalink capability that allows for the uplink of full RNP procedures with altitude and speed constraints
  - Helps to maintain flow or capacity in or through a given airspace when a constraint has been introduced
  - Aircraft routes can be adjusted using RNP to move traffic streams closer together to maintain flow or throughput, in lieu of initiating flow restrictions, ground stops or other delay mechanisms

4DT Demo Components

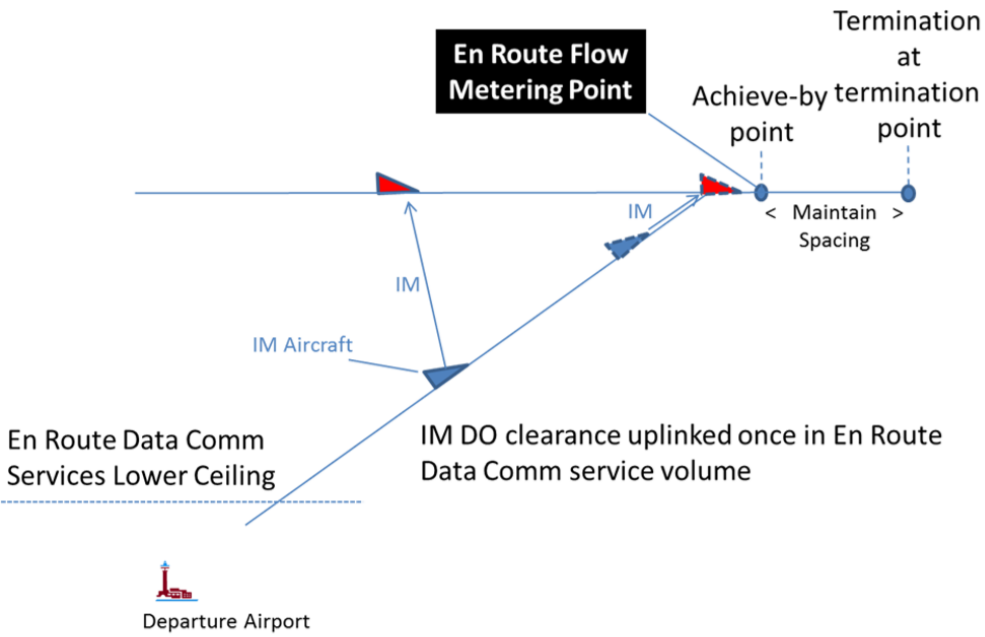


Figure 4-10 IM DO for Insertion into Overhead Stream Operational Overview

- Advanced Interval Management (A-IM)
  - Couples data communications and ADS-B advanced trajectory automation to allow for maximum throughput without a loss of flight efficiency
  - Uses guidance provided by the trajectory automation through data communications to exploit ADS-B Out information and enable more precise spacing between aircraft.
  - Aircraft avionics process ADS-B Out information from nearby traffic, enabling a more precise location of the aircraft to be used.

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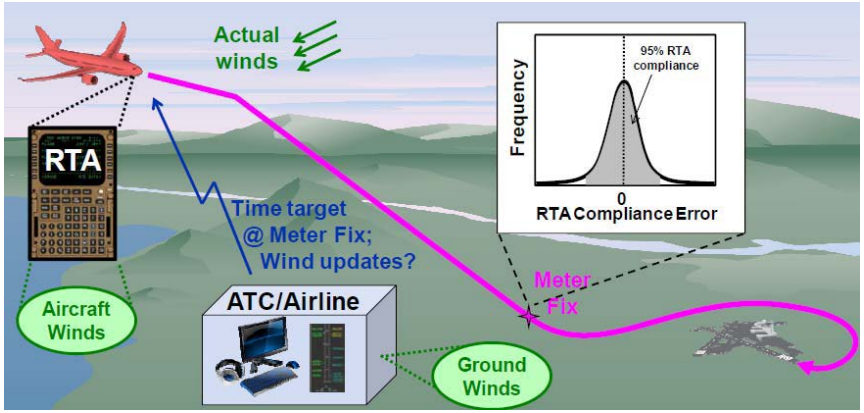
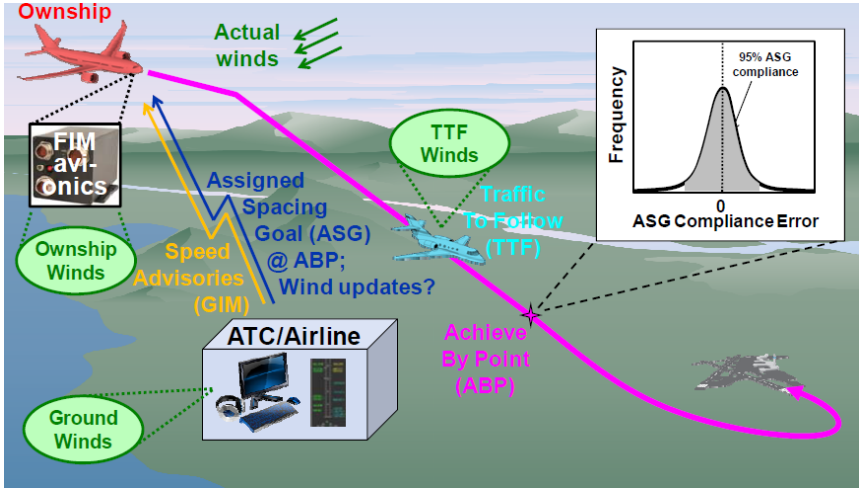
4DT Demo Components





- ATC Winds
  - Winds uplinked by ATC may provide improved interval management functionality potentially reducing separation standards

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INTRODUCTION

4DT PROJECT OVERVIEW

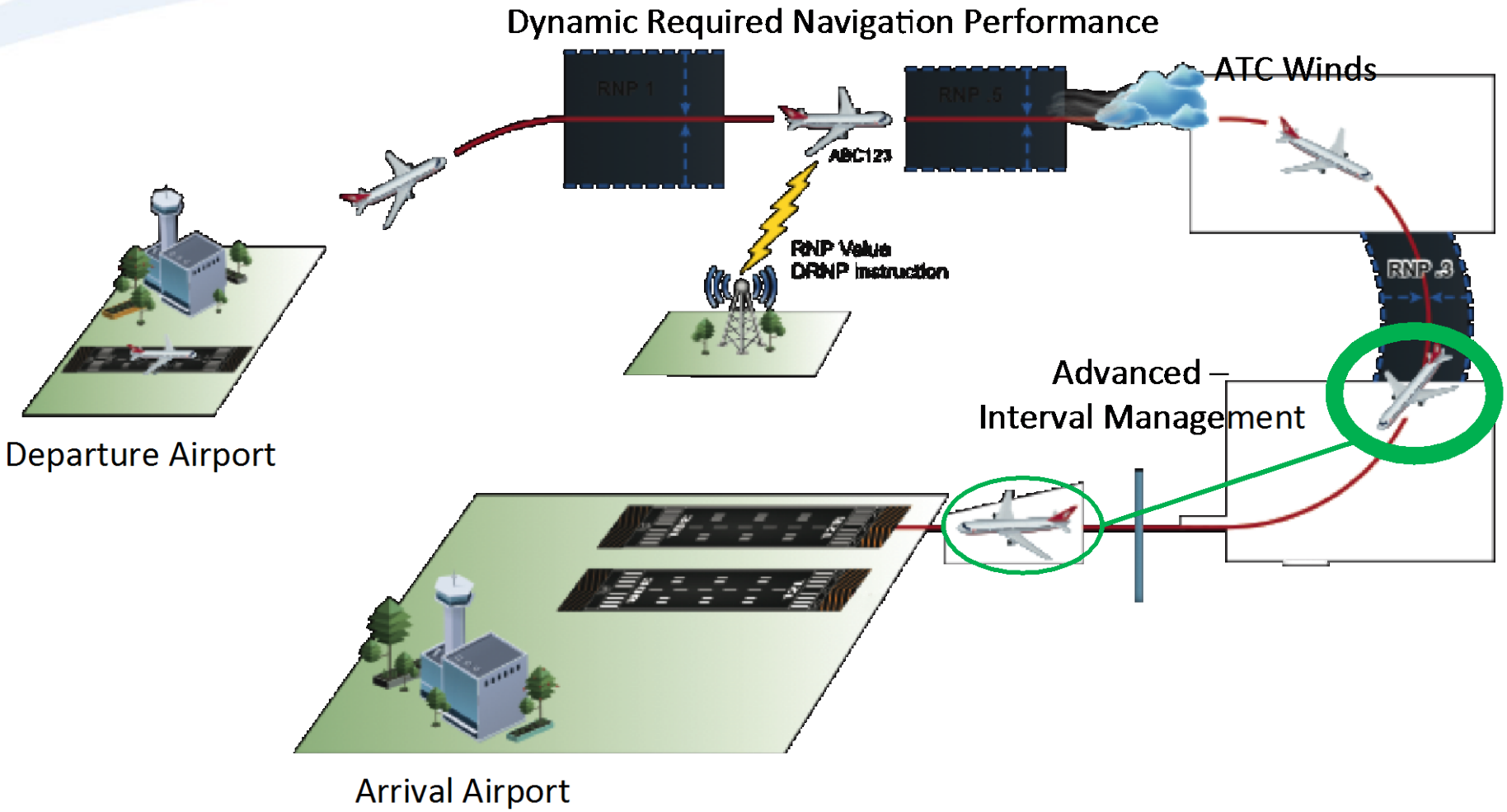
4DT Project Overview

- Project Objective:
  - Demonstrate the feasibility and investigate the value of advanced TBO services enabled by ATN-B2 technologies including: Dynamic-RNP, A-IM, and ATC Winds
  - Fully exercise technology through ATN B2 message set
- Expected Outcome:
  - Industry participation will support the demonstration exploring the operational and technical capabilities of ATN B2
  - Demonstrating the value of ATN B2 will support industry's business case for equipage and help to determine its feasibility
- Primary Customers:
  - Airline operators, aircraft and avionics manufacturers

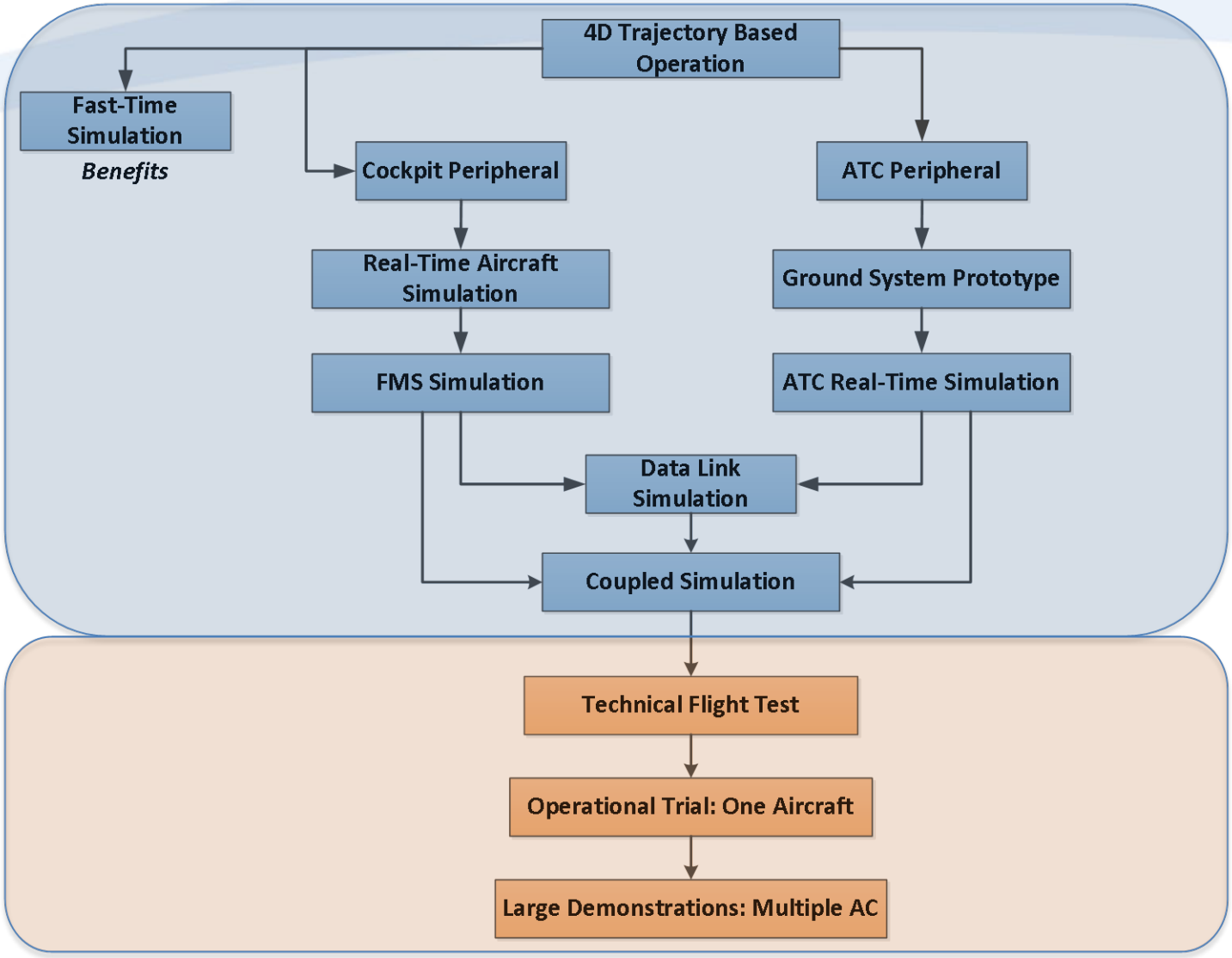
4DT Project Approach

- Stakeholders Collaboration
  - RTCA SC-186, SC-206, SC-227, SC-214
  - CDM Future Concepts Team (FCT)
  - Industry Participation
- Integration Focus
  - Develop Integrated Use Cases that deliver operational benefits

4DT Demo Operations View



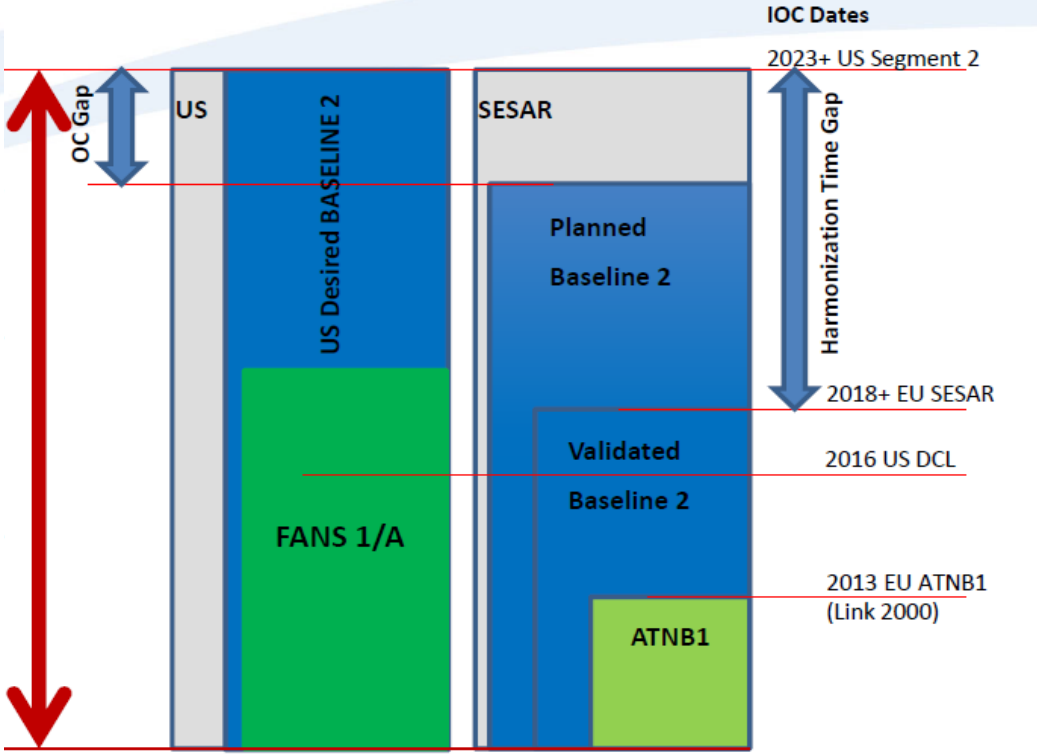
Sim/Demo Steps (notional)



FAA Legend: 4DT Demo Current Scope Optional NextGEN

BACKUP

US vs. EUR



Notes:
1 with ADS-C (Flight Path Intent)
2 with ATC winds
3 RNP by Leg Type; Variable Turns + ATC winds
4 Voice replacement only

Additional (US Desired) Baseline 2:
- 4 D Trajectory + Dynamic RNP[2 & 3]
- Advanced Interval Mgt[2]
- ATC Winds

Planned Baseline 2
- Tower and Airborne Clearance
- Flight Information Services (NOTAM, VOLMET, Hazardous Weather, RVR)

Validated Baseline 2
- 4D Trajectory[1]
- Interval Management Spacing[4]
- In Trail Management[4]
- Enhanced Clearance
- D- ATIS (text)
- D-Taxi clearance

FANS 1/A
- Partial 4D Trajectory
- Position Report
- Dep/Oceanic/En-Route Clearances
- Climb & Descent Procedure
- Position Reporting

ATN Baseline 1 (ATC COM)
- Information exchange/report
- En-Route Clearance Request/Delivery
- Communication Management
- Mic Check

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4DT Project Schedule

Planned Activities	FY14	FY15	FY16	FY17	FY18	FY19+
Assessment of ATN B2 standards, 4DT Concept, ground & a/c capabilities						
Demonstration use cases and operational scenarios definition						
System Architecture & Design for Demo						
Demonstration Execution Plan					Year 1 - Planning Phase	
Make prototypes to a/c, FOC, ATM automation, datalink systems					Year 2 - Demo Phase	
Safety assessment (if needed for piloted a/c)						
Ground Simulation/Eng. Check Point						
Demonstration of 4DT capabilities						
Reports & Recommendations						
Initial Benefits Assessment						

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4DT Project System View (Notional)