NextGEN

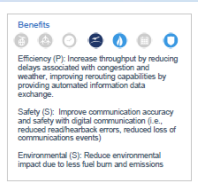
Trajectory Operations and Data Communications

Presented by Steve Bradford

FAA

FAA "Master Plan" Development Process

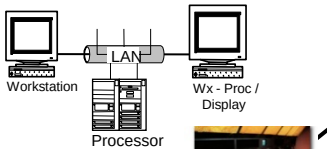
Desired Benefits



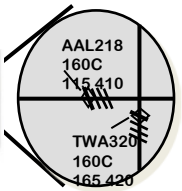
Operational Improvements

Concept SHALLS

Operational Increments

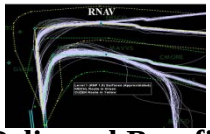


Systems



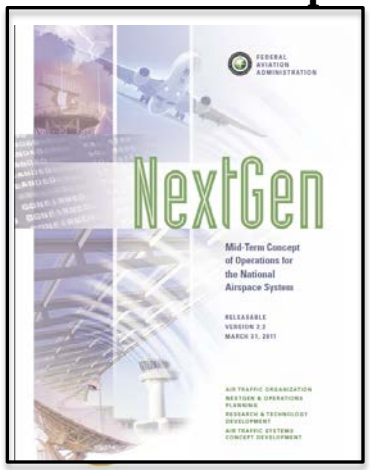
Procedures

Roles & Responsibilities

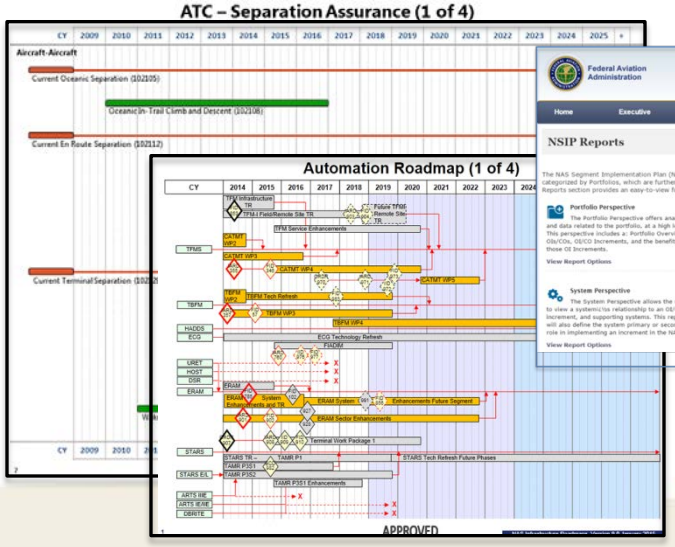


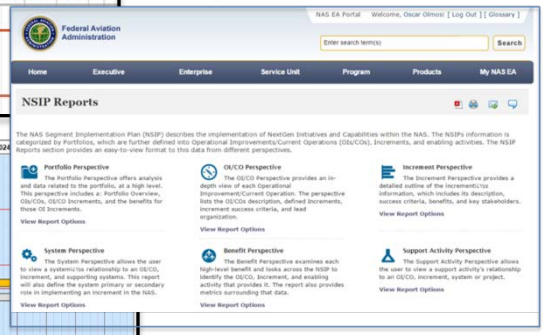
Delivered Benefits

Mid-Term Conops



EA/NSIP 2015





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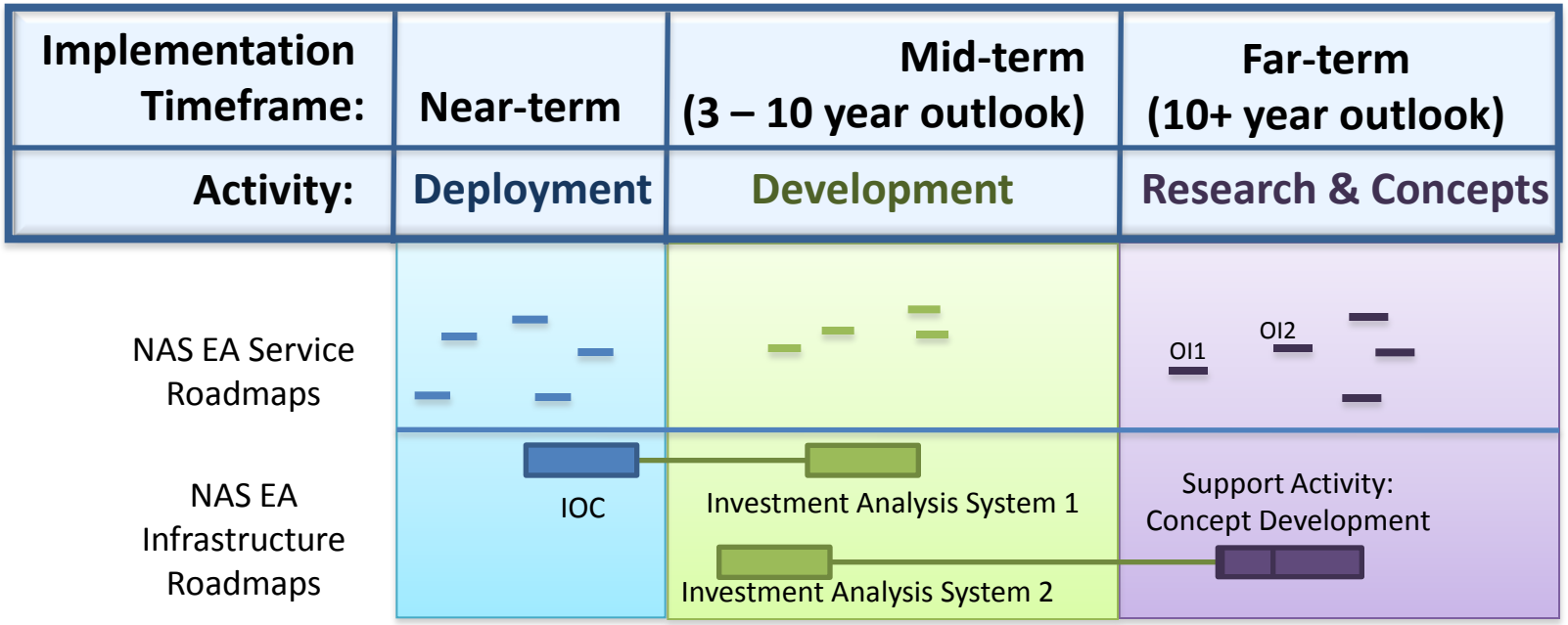
FAA NextGen Planning: Implementation Timeframes

The implementation timeframe for new NAS services and Infrastructure are dictated by the nature of current and future activities



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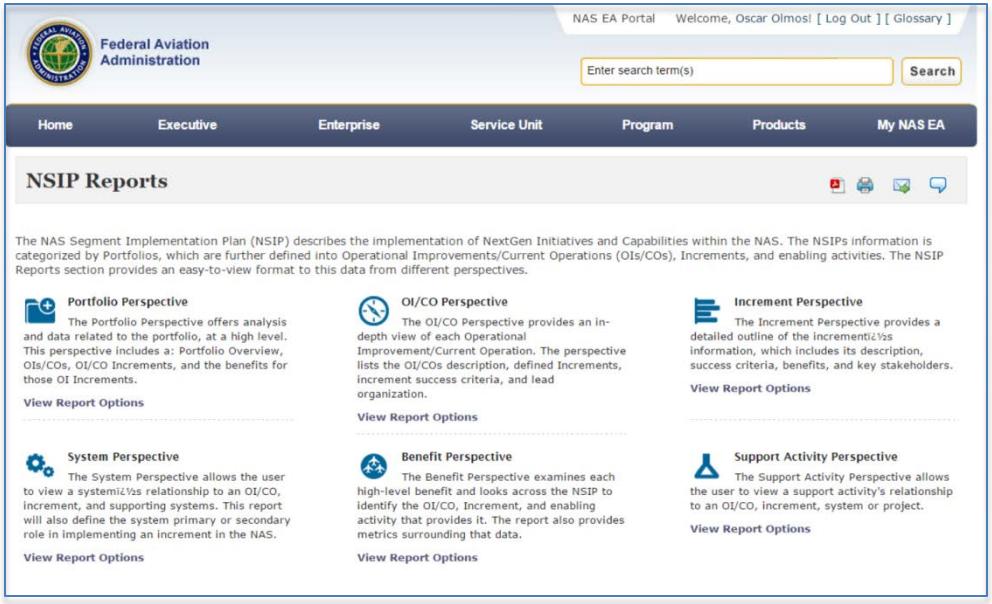
NSIP: NAS Enterprise Architecture Integration

- **Objective**: Integrate Portfolios, Increments and their relationships with the NAS EA, creating a consistent view for all stakeholders on NextGen plans and implementations

- **Benefits:** Common data source now used between EA and NSIP (reduces number of data calls and improves quality assurance); increased corporate access to information, i.e., Portfolio details, OI and increment timelines, etc.

- Detailed information on NSIP 2015 is available on the NAS EA Portal: **https://nasea.faa.gov**



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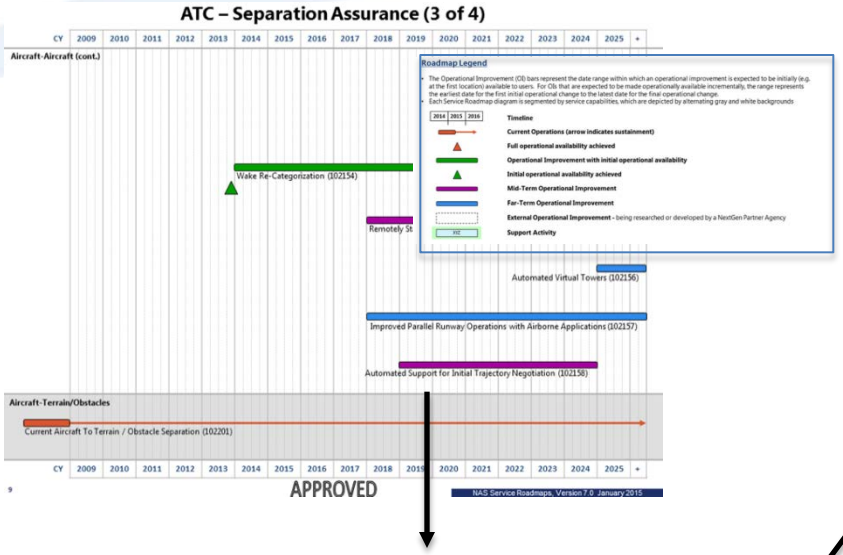
NSIP: Content Overview

NAS EA Service Roadmaps: Operational Improvements



Success Criteria

Success Criteria

2019

Operationally available at selected airspace and key site locations Initial Operational Capability (IOC).

Benefits

Benefits

Efficiency (P): Increase throughput by reducing delays associated with congestion and weather, improving rerouting capabilities by providing automated information data exchange.

Safety (S): Improve communication accuracy and safety with digital communication (i.e., reduced read/hearback errors, reduced loss of communications events)

Environmental (S): Reduce environmental impact due to less fuel burn and emissions

NSIP Operational Increments

B [102158-01] Initial En Route Data Communication Services (2019)

Increment Overview

Altitude clearances with altimeter setting information and airborne reroute clearances via Data Comm will allow flight clearances to be delivered to aircraft. The use of Data Comm increases the productivity of controllers with the consequential effects of increasing sector capacity and throughput. Transfer of communications and initial contact via Data Comm will allow the FAA to more efficiently manage aircraft entry into and exit from en route sectors. This capability will reduce system errors and pilot deviations due to missed or misunderstood communications via voice, thereby enhancing system safety.

This Increment allows for the usage of Data Comm for transfer of communications between ATC sectors, change of altitude clearances, reroutes and altimeter settings and limited functions for controller initiated routes including Direct-to-Fix and Crossing Restrictions.

System Dependencies

B [102158-01] Initial En Route Data Communication Services (2019)

ERAM (P): ERAM will require functional and interface modifications to support the initial set of En Route Data Communications services. ERAM will interface with the Data Comm Network Service (DCNS) via the NAS Enterprise Security Gateway (NESG) for the exchange of En Route Data Comm messages with participating aircraft.

TDLS (S): TDLS will undergo functional modifications to transition from local to national login running at all TDLS towers associated with ERAM sites

DCNS (P): DCNS will interface with ERAM via the NESG for the exchange of en route Data Comm messages with participating aircraft

FTI (S): FTI provides network transport and NESG services for ground communication between ERAM, TDLS, and DCNS.
Avionics Enablers: FANS 1/A+ and VDL Mode 2

Primary Systems
- DCNS Data Communications Network Service
- ERAM En Route Automation Modernization

Secondary Systems
- FTI FAA Telecommunications Infrastructure
- TDLS Tower Data Link System

NSIP 2015: 122 Alpha and Bravo Increments

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Implementing Capabilities to realize TBO vision

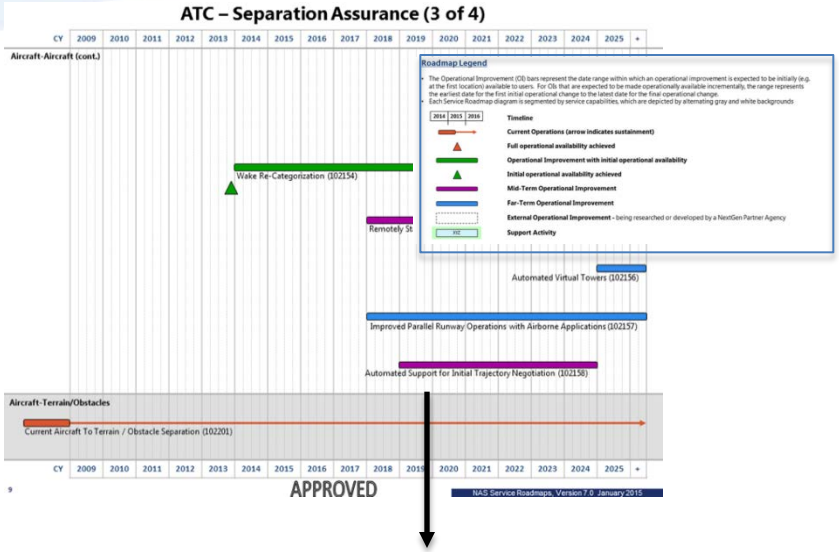
Infrastructure Element	Rationale
CATM WP5	• CTOP and use of Trajectory Option Set (TOS) for airborne flights • Strategic Flow Management Application • UFPF
TBFM WP4	• Enhanced Adjacent Center Metering • Path Stretch • Advanced Interval Management (A-IM) • Enhanced Arrival-Departure Scheduling
TBFM WP5	• TBFM scheduler to utilize precise trajectory information that is downlinked via EPP to develop more stable and feasible schedules
Data Comm S1P2	• Full En Route Data Comm services
TFDM Future	• Provide access to surface/arrival data for FF-ICE
ERAM Future Work Package	• Allocation of functions be[illegible] • [illegible]roval of User Request[illegible]ries • [illegible]ical Conformance Verification • FMS Offset (closed trajectory)
ATOP WP2	• Allocation of function to support "User Trajectory Planning" between ATOP and TFMS/CATM • New DSTs to support TBO • Accommodation of B2 Final
SWIM Segment 3	• Airborne access to SWIM to facilitate exchange of flight information
Surface Traffic Management	• Airport Configuration Planning • Surface Scheduling Improvements • Surface Capabilities including Taxi Routing and Surface Conformance • Ground-Based support for flight deck Surface Trajectory Based Operations (STBO)
AIMM Segment 3	• Integration of SAA and Digital NOTAMs with NAS automation systems and Digitized static airspace constraint information in LOAs/SOPs

NAS EA Investment

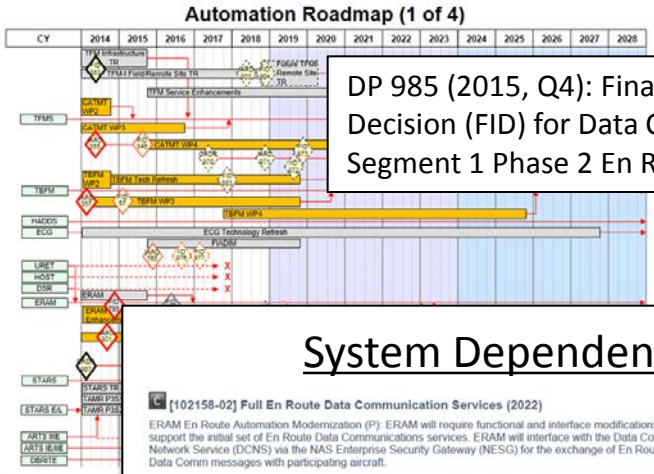
NSIP Increment

Implementing Capabilities to realize TBO vision

NAS EA Service Roadmaps: Operational Improvements



NAS EA Infrastructure Roadmaps/NSIP



DP 985 (2015, Q4): Final Investment Decision (FID) for Data Communications Segment 1 Phase 2 En Route Services Full

System Dependencies

[102158-02] Full En Route Data Communication Services (2022)

ERAM En Route Automation Modernization (P): ERAM will require functional and interface modifications to support the initial set of En Route Data Communications services. ERAM will interface with the Data Comm Network Service (DCNS) via the NAS Enterprise Security Gateway (NESG) for the exchange of En Route Data Comm messages with participating aircraft.

FTI FAA Telecommunications Infrastructure (S): FTI provides network transport and NESG services for ground communication between ERAM, TDLS, and DCNS. Additional services are provisions to support the Data Comm services.

DCNS Data Communications Network Service (S): Provisioning for air to ground services through DCNS to allow Data Comm delivery to and from aircraft avionics.

Primary Systems
- ERAM En Route Automation Modernization

Secondary Systems
- DCNS Data Communications Network Service
- FTI FAA Telecommunications Infrastructure

NSIP Operational Increments

[102158-02] Full En Route Data Communication Services (2022 - 2025)

Increment Overview

Data Communication services will be provided to deliver additional clearances for Tailored Arrivals and control instructions for speed and heading changes. Data Communication will also be available for sending beacon codes, advisory messages, and stuck microphone messages. These services will assist controllers in managing aircraft more efficiently, leading to increased productivity of controllers with the consequential effects of increasing sector capacity and throughput. This capability will reduce system errors and pilot deviations due to missed or misunderstood communications via voice, thereby enhancing system safety. Automation tools will assist controllers with the generation of more complex clearance and other Data Comm messages.

Support Activity Analyses

- Prototype CHI for En Route Services
- Develop end-to-end operational scenarios and trials for testing
- Conduct system performance and loading analysis

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Transformation of Methods

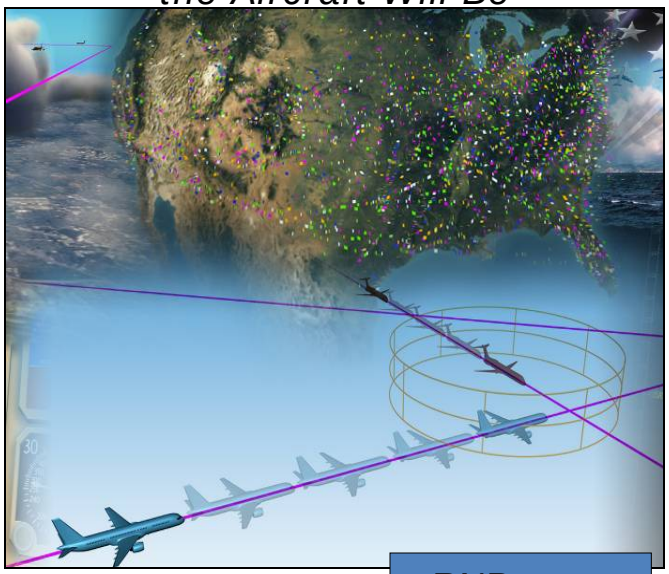
Procedural Based Control:
Control on Where We Think the Aircraft Is

- Landmark Navigation
- Radio Beacons
- Position Reports

Surveillance Based Control:
Control on Where We Know the Aircraft Is

- VOR/DME
- RADAR

Trajectory Based Control:
Control on Where We Know the Aircraft Will Be*



- RNP
- ADS-B
- DataComm

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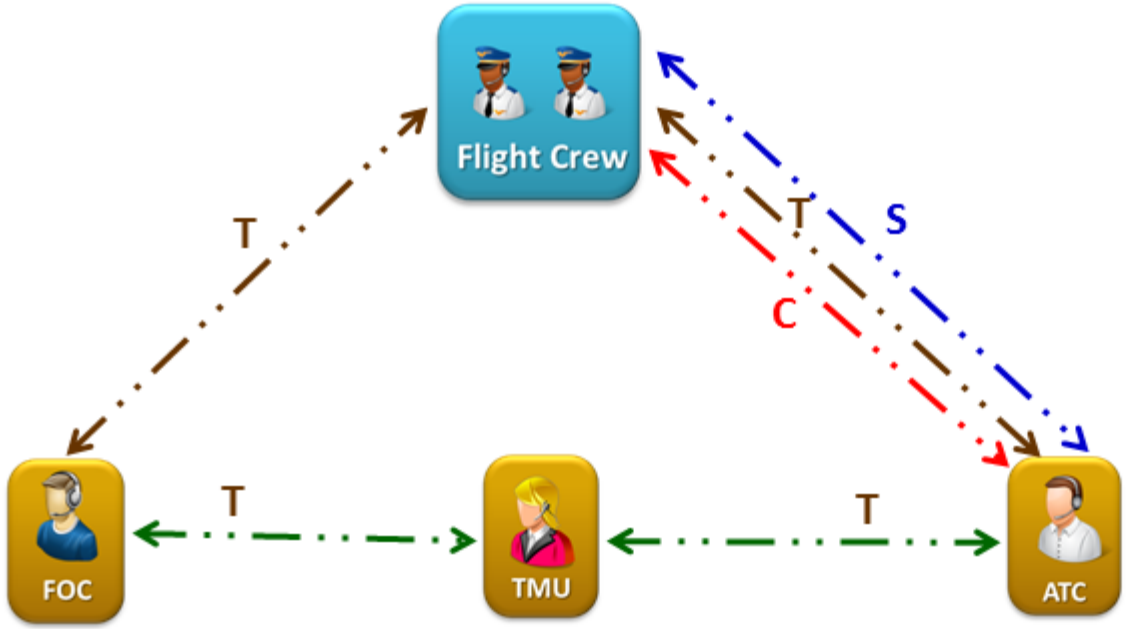
* Shared Trajectory

Historical Interactions: Between Stakeholders w/o automation

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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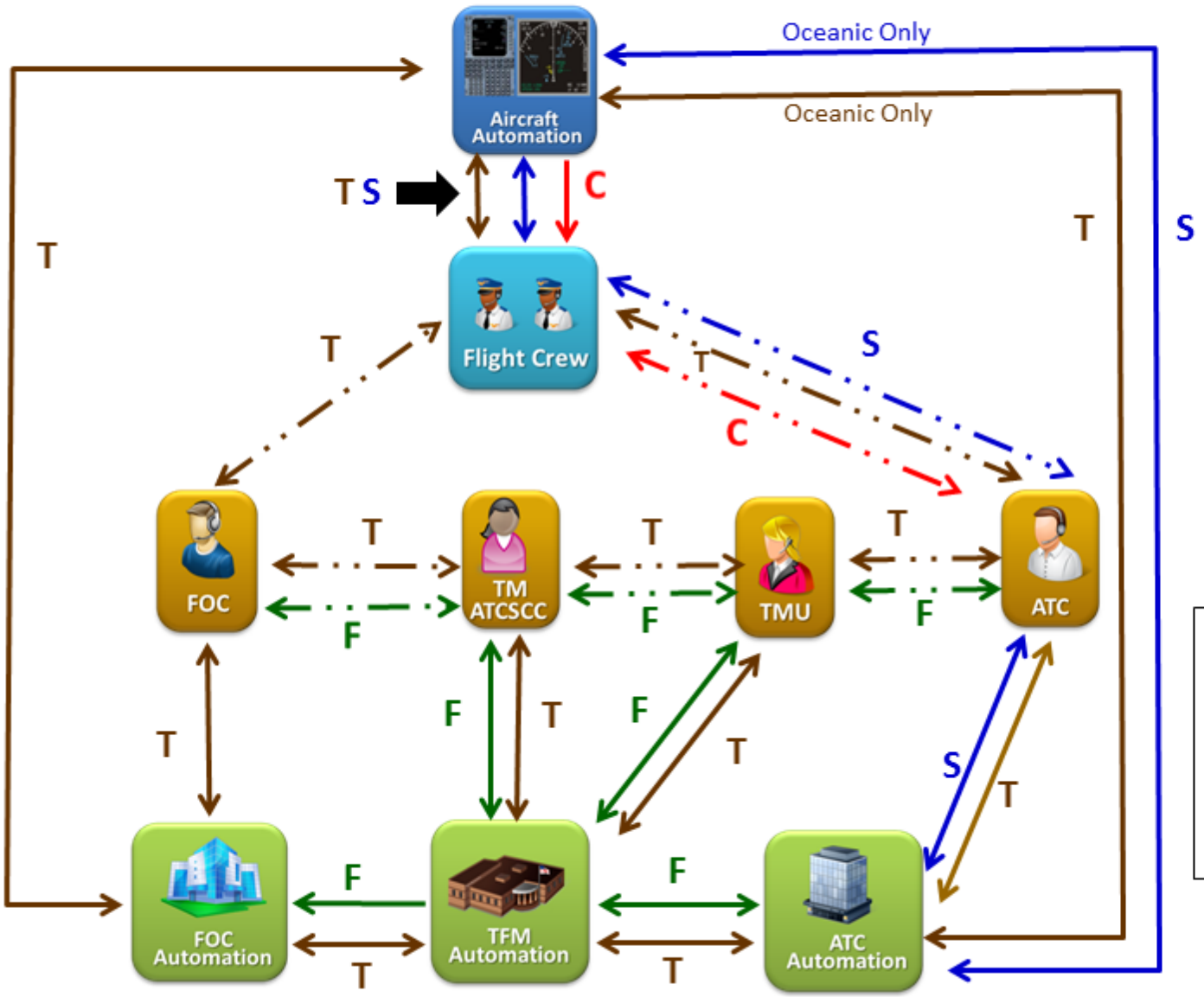
Present Day Interactions: Between Automation and Stakeholders



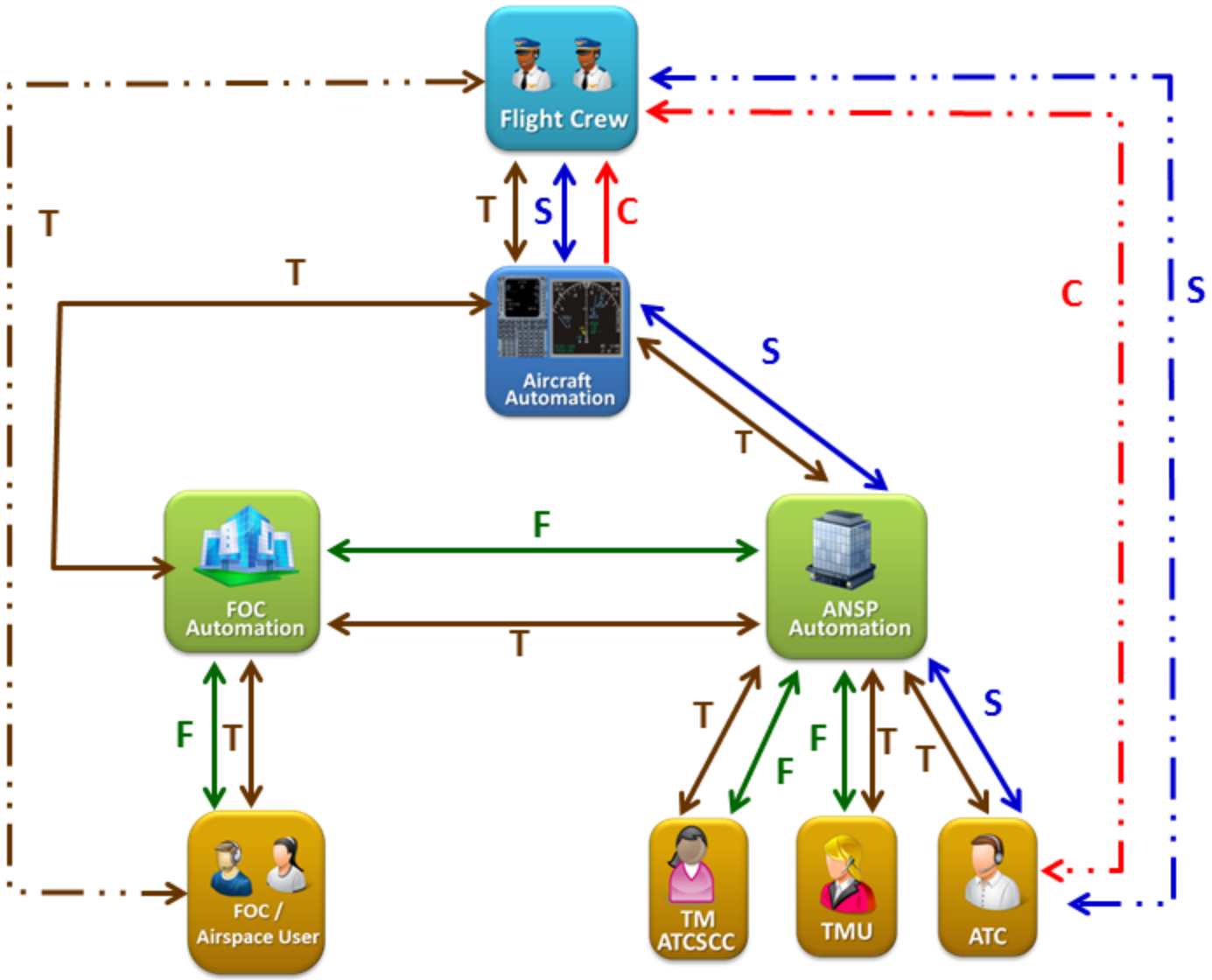
F	Flow Management
T	Trajectory Management
S	Separation Management
C	Collision Avoidance

Voice	← · · →
Data	⟷

Definitions:

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

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)

Information requirements in support of TBO

- Information exchange
  - Shared Environment (AIM, WX, Constraints)
  - Shared Trajectory (synchronized representations)
  - Shared Adjustments

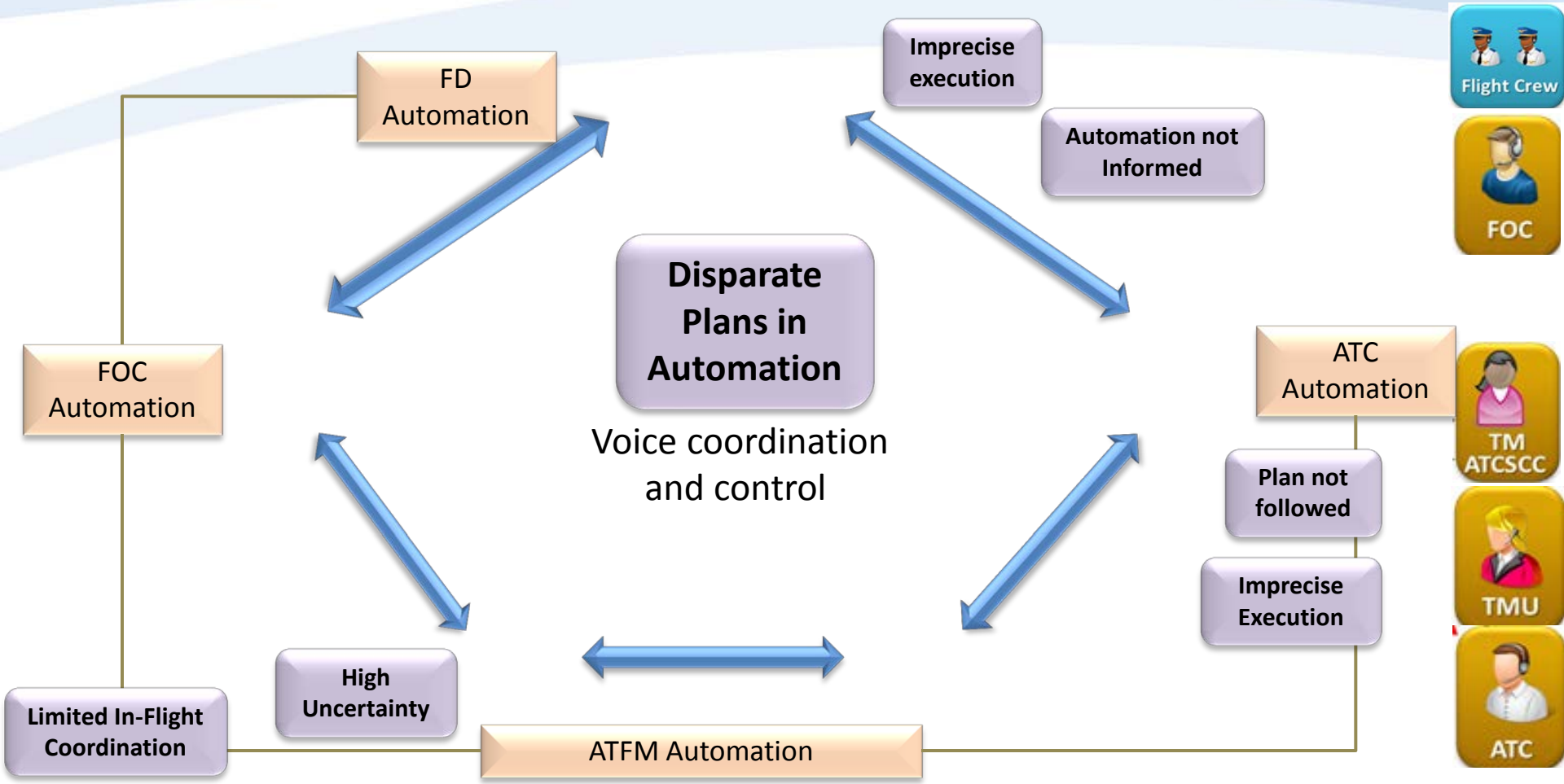
Required for Data Distribution

- Network
  - Cross-boundary coordination/distribution
- Information Protocols for
  - Publish/subscribe
  - Command and control – logon/address
- Connectivity
  - Ground-ground
  - Air-ground link(s)
- Messaging
  - Datacomm
  - AAtS

Communication of Data is Multi-Layer

- Harmonization efforts
  - Messages
    - **SC214/WG78,** FIXM
  - Pipelines
    - VDL-2, L-Band, Aeromacs, Satcomm,
  - Protocols
    - ATN evolution
  - Network

Air Transportation – Coordination Today



Multiples Participants Control a Flight All Affect the Trajectory

Transform to Trajectory-Based: Decision-Making, Control and Coordination

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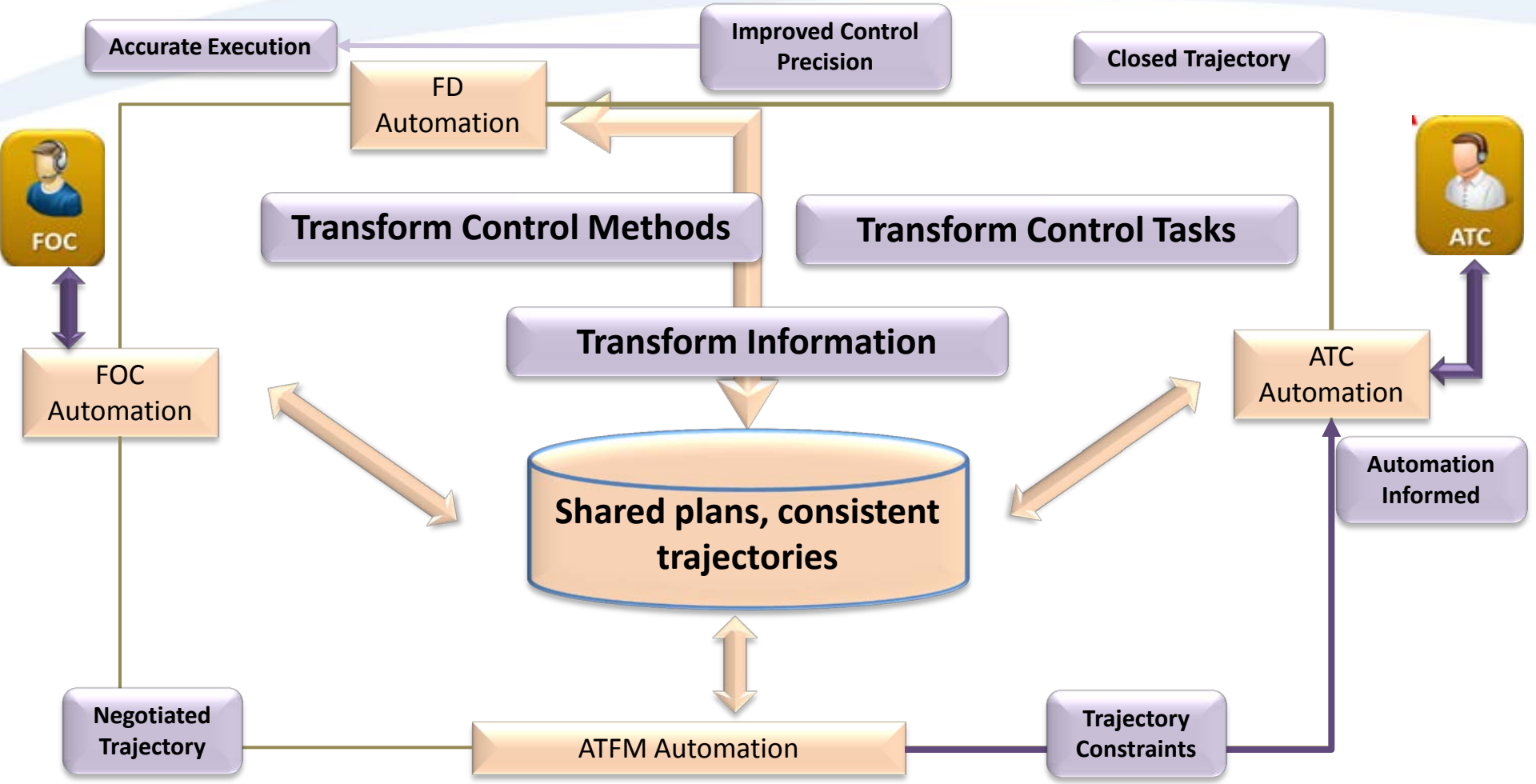
TBO Transformations



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Thank You

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