NAS Enterprise Architecture Conference

RayRaytheon
NetwCustomer Success Is Our Mission s

Application of Enterprise Architecture

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NASA Advanced Vehicles and Procedures

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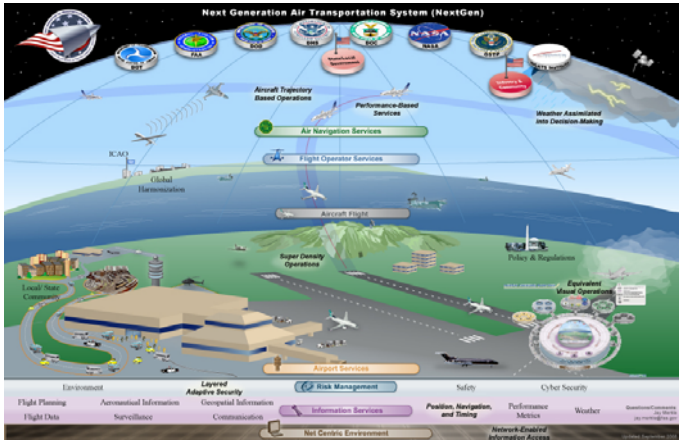

Supersonic Business Jets - The selling of time - travel for the fast-paced global economy

- ***Owner/Operator***
- ***Fractional Owner***
- ***On-Demand***

Very Light Jets - The selling of time and community access to air transportation

Un-crewed Aircraft Systems - eyes in the sky

Super Heavy Transport - Three classes without sacrificing market share. BWB/HWB – 20-30% gain in efficiency

Defining the Advanced Vehicle needs

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Scenario and Use Case Development

At 23:49:00 UTC, N427SB is at top-of-descent and slowing for a 2,000-foot per minute descent rate. This is much more aggressive than a transport category aircraft, but there is a gain in maneuverability and both fuel and time savings. Staying high longer and using a near idle descent save fuel and emissions.

At 00:15:00 UTC, N427SB is slowing to 250 knots and passing 10,000 feet. This restriction has been around for a long time, presumably introduced to reduce the damages from bird strikes and avoiding problems with "see and avoid" for general aviation aircraft. In a full TBO airspace the 250-knot restriction is a questionable legacy, but research is needed to determine if the benefits warrant eliminating the restriction.
The crew is expecting a GNSS RNP 0.1 approach to Runway 22L.

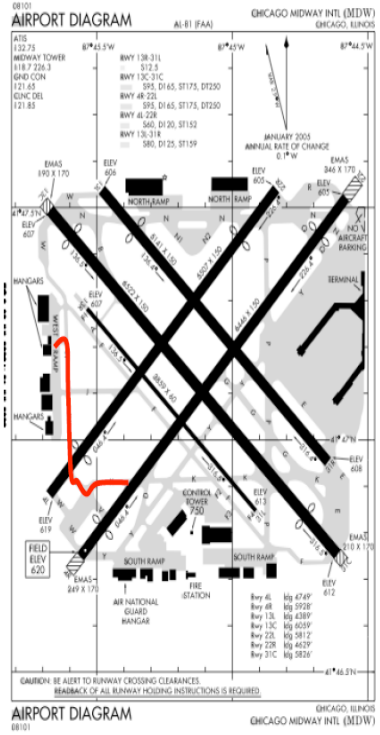

Figure 2.8. Airport Diagram for Midway

Scenario Narratives

Create Use Case

1. Translate scenarios into time sequenced action steps
2. ID "who" initiates action and "where"
3. Describe the action
4. ID "who" receives the results and "where"

Validate with Subject Matter Expert Walkthroughs

NextGen Enterprise in 2025

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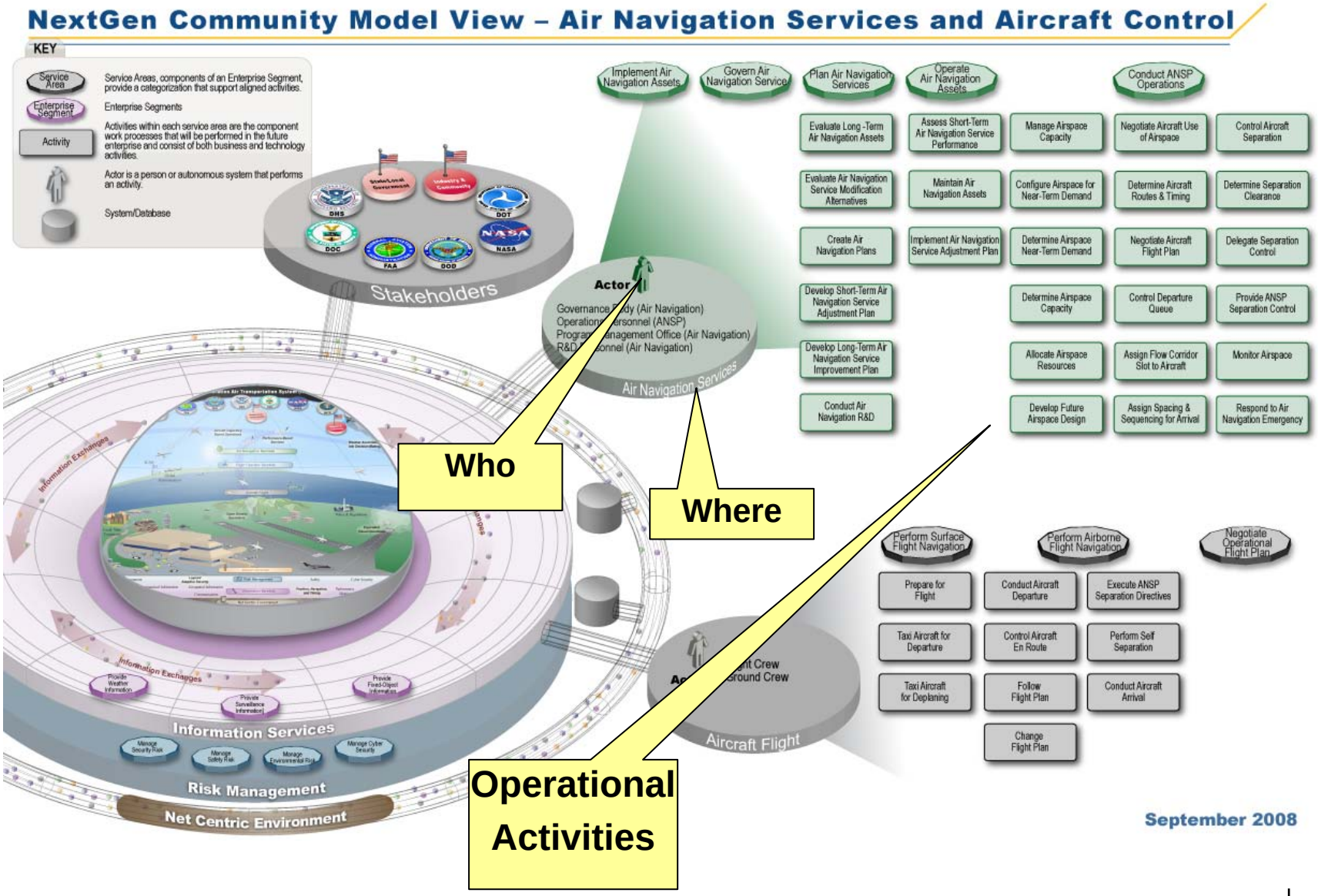

Assessing the capabilities

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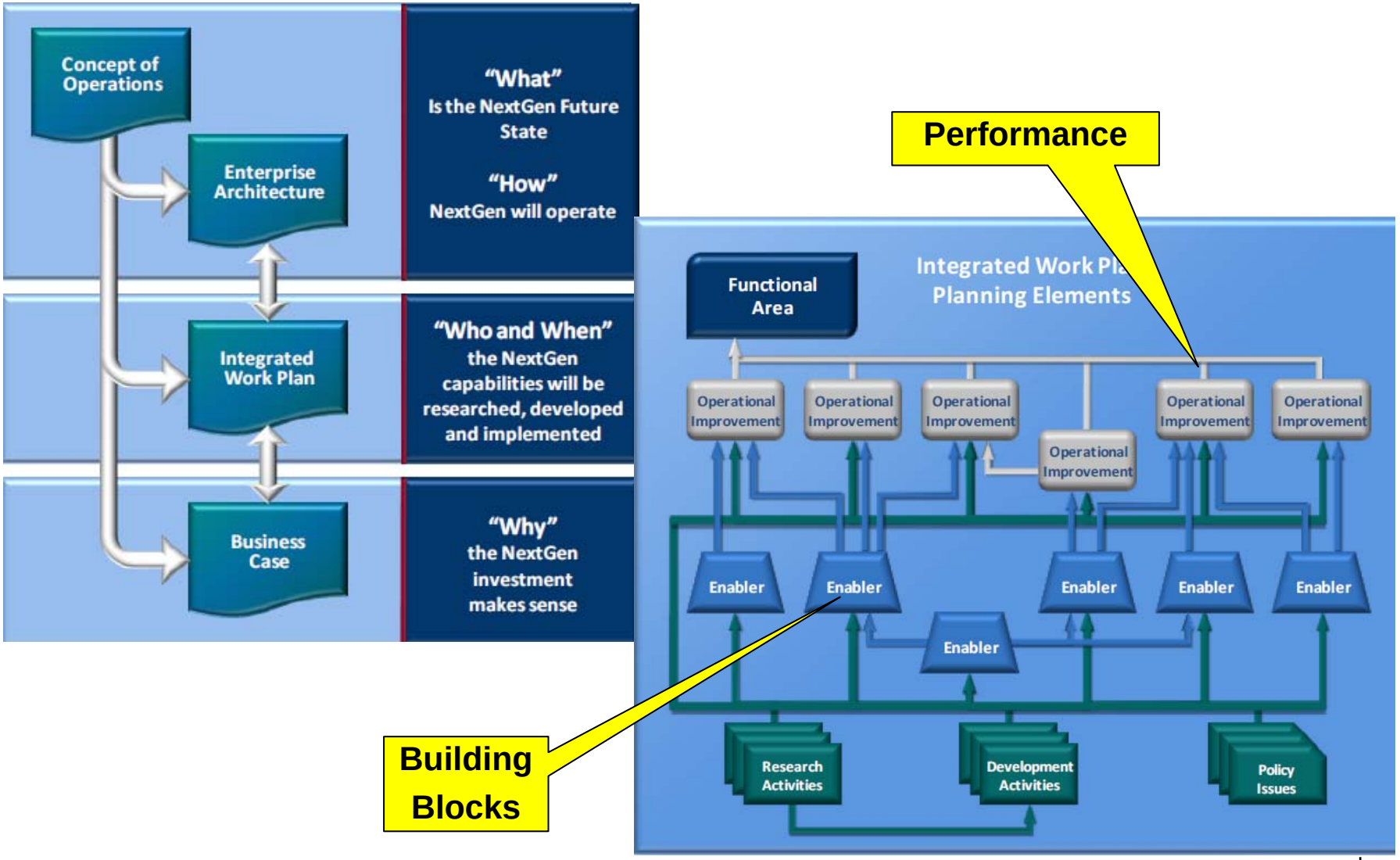
JPDO Integrated Work Plan



Key tool for the process - JPE

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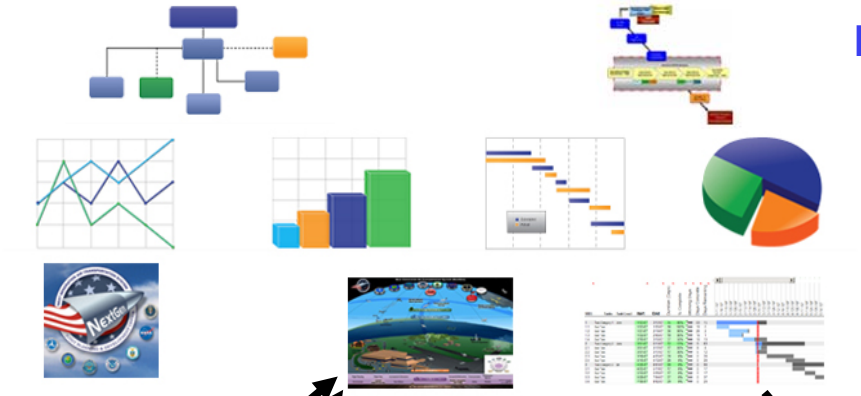
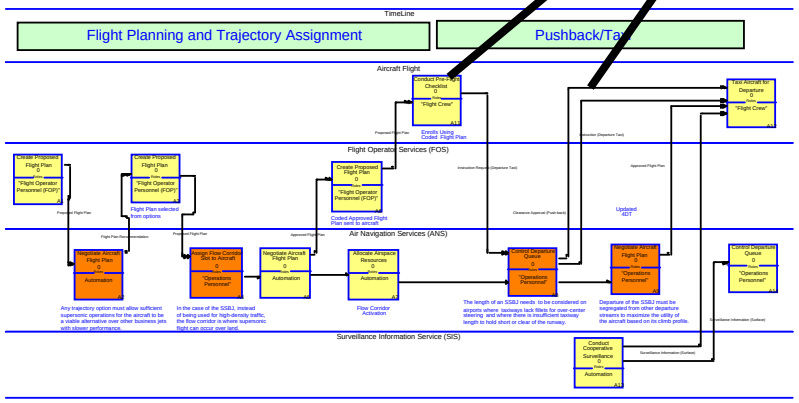


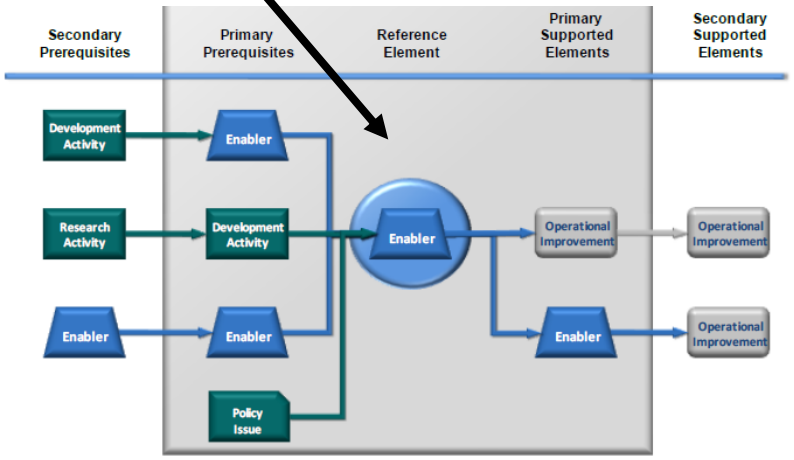
http://iie.jpdo.gov/ee/

Operational Activities

Info Flows

Enablers





Enabler Evaluation – a subset of 100's

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VLJ Enablers	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
(EN-0002) Network-Enabled Flight Object Information																		
(EN-0003) 4D Flight Plan Management Decision Support - Level 2																		
(EN-0004) 4D Flight Plan Automation - ANSP																		
(EN-0008) Trajectory Negotiation - Level 1 Controlled Time of Arrival (CTA)																		
(EN-0026) Surface Movement Decision Support - Level 2 Mid Term																		
(EN-0028) Avionics - Access to Airspace Boundary Information																		
(EN-0100) Surface Movement Decision Support - Level 1 Initial																		
(EN-0103) Avionics - Trajectory Management - Arrival/Departure																		
(EN-0109) Avionics - Surface Conflict Management																		
(EN-0110) Trajectory Negotiation - Level 2 En Route Time-Based Metering																		
(EN-0210) Flexible Routing Flight Plan Automation - Operator																		
(EN-0300) Networked Air Navigation Support Facilities																		
(EN-1006) Integrated Cooperative Surveillance Information - Level 1																		
(EN-1007) Avionics - Trajectory Management - Advanced Surface Operations																		
(EN-1023) Cooperative Surveillance - ADS-B Out Level 1																		
(EN-1025) Airport Surface Surveillance - Legacy ASDE-X																		
(EN-1039) GBNS - DME Legacy																		
(EN-1040) Space Based Navigation System - Galileo																		
(EN-0002) Network-Enabled Flight Object Information																		
(EN-0003) 4D Flight Plan Management Decision Support - Level 2																		
(EN-0006) 4D Flight Plan Management Decision Support - Level 1																		
(EN-0017) Trajectory Negotiation - Level 3 Automation-Assisted 4DTs																		
(EN-0018) Trajectory Negotiation - Level 4 Automated 4DTs																		
(EN-0019) Virtual Tower - Detail Operational Concept																		
(EN-0022) Automated Virtual Tower - Level 2 Multiple Runway Airport																		
(EN-0103) Avionics - Trajectory Management - Arrival/Departure																		
(EN-0005) 4D Flight Plan Automation - Operator																		
Electronic Flight Bag and Avionics Interface/Connection																		
Avionics Syncronization with Home Computer																		
Security Requirements to Start an Aircraft Engine																		
Real-time Access to Information for Flight Operations Center																		
Trajectory Management While En-Route-- Flight Operator																		
Automatic Exchange of New Controlled Time of Arrival to the Air Navigation Service Provider																		
Air-Ground Data Exchange with a Fixed-Base Operator for Provisioning																		

key:
- = enabler used as defined and as mapped
- = enabler is needed as defined but is not mapped to an Op Act that needs it
- = enabler used as mapped but not clear from definition if it's adequate
- = no enabler defined for this function

Process Flow

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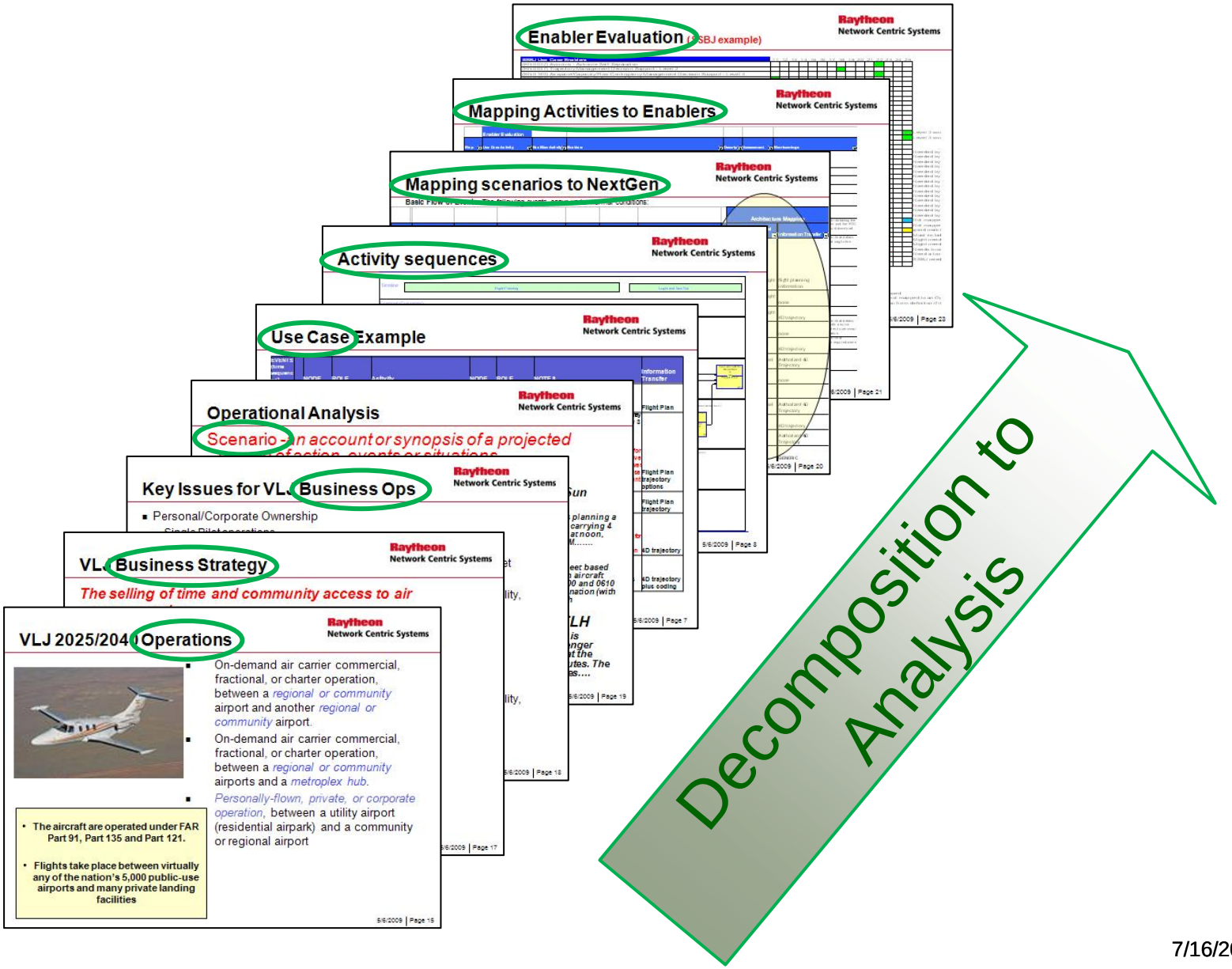

Integrated CNS Study

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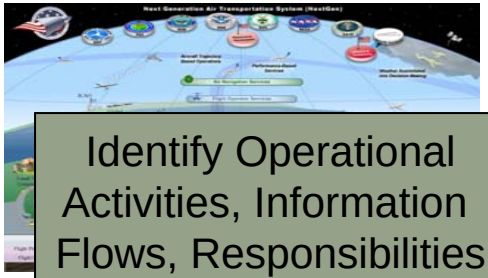


Identify Operational Activities, Information Flows, Responsibilities within the Scenario

Based on Enterprise Architecture FY11

Develop Time Sequence Diagram (OV-6c)

ID NextGen Enablers, Operational Improvements

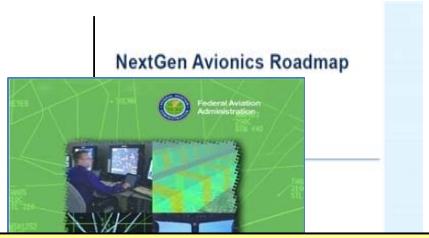
Based on IWG V1.0

Develop Critical Functional, Performance, and Interoperability Requirements for Enablers

Establish ICNS Design Space

Based on NextGen Implementation Plan

Develop alternative ICNS Architectures



Establish Nextgen Timeframe And Change Extent for ICNS OI's and Enablers

Based on AWG Roadmap and FAA Roadmap for Performance Based Navigation

Develop Analytical Approach To Evaluate Alternative ICNS Architectures

Scenario → Use Case → Functions

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EVENTS (time sequenced)	NODE	ROLE	Activity	NODE	ROLE	Functions
59	ANS	Automation	Identify aircraft for self-separation in the flow corridors.	ANS	Automation	ANS 4DT Management Tools - Self Separation Evaluation
60	ANS	Automation	Create new 4DTs and 4DC's.	ANS	Automation	ANS 4DT Management Tools - 4DT Management
61	ANS	Automation	Publish updated, alternative 4DTs.	Trajectory Management Service	Automation	Netcentric Infrastructure; ANS 4DT Management Tools - flight plan management; TMS Flight Plan Processing - access control; - flight plan access
62	Trajectory Management Service	Automation	Distribute updated 4DT to subscribers.	Aircraft Flight/FOS	Flight Crew/FOP	Netcentric Infrastructure; Critical datalink; TMS Flight Plan processing - publish/subscribe management; - flight plan management

Establishing the Requirements

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Functions defined to support Use Case Step

EVENTS (time sequenced)	NODE	ROLE	Activity	NODE	ROLE	NOTES	Functions
70	ANS	Automation	Delegates self-separation authority	Aircraft Flight	Flight Crew	ANS drops all conformance requirements to the 4D trajectory while the aircraft is in self-separation segment; data link (critical)	ANS Flight Tracking Services - Separation Control Aircraft Strategic Conflict Detection & Resolution (CD&R) System - conflict detection data link (critical)

Functional requirements developed to meet use case need

Function	Requirement
ANS Flight Tracking Services **- Separation Control** **Aircraft Strategic Conflict Detection & Resolution (CD&R) System** **- conflict detection** **data link (critical)**	**a/c position accuracy** **a/c intent** **Data link QoS**

Assessing OI Elements

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OI-0362 Self-Separation Airspace Operations

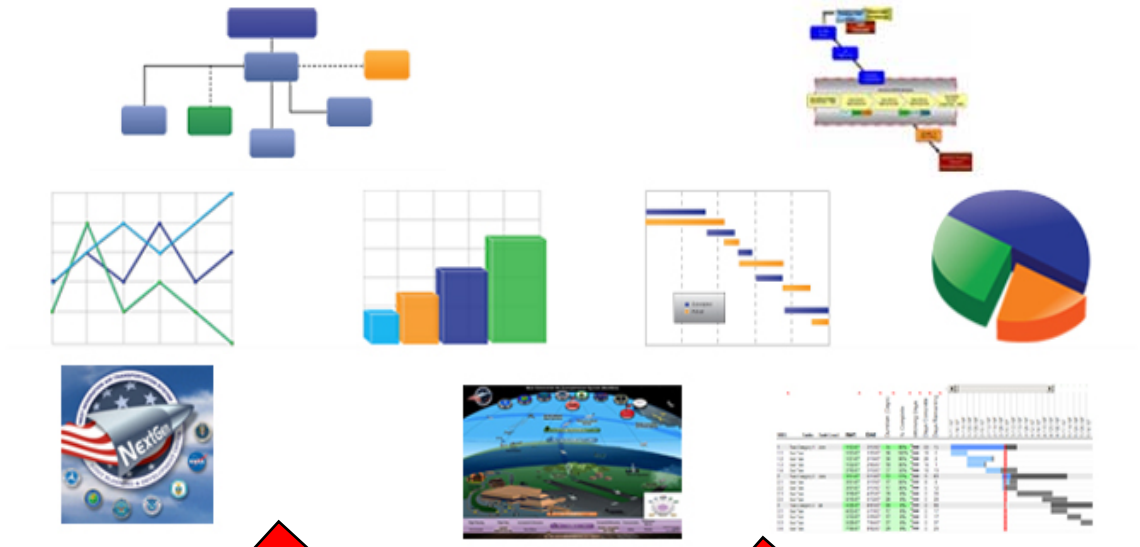
Enabler not adequate To provide ICNS Capability required

Use Case Steps	Functions	Requirements	EN-0016 Separation/Trajectory Management Detail Operational Concept	EN-0028 Avionics - Access to Airspace Boundary Information	EN-0031 Avionics - Airborne Merging and Spacing	EN-0032 Avionics - Airborne Self-Separation	EN-0036 Airspc/Capacity/Flow Cntngncy Mngmnt Decision Supp - Lvl 2 Ltd Dynamic	EN-0038 Separation Management Decision Support - Level 2	EN-0204 Avionics - Traffic Collision and Avoidance System - Level 2
86	Datalink (critical); ANS 4DT Management Tools - flight plan management; Aircraft FMS	**Communications:** RCP; ground to air 4DT/4DC updates					needs to address weather-related flow contingency management within a flow corridor and how to adjust flow corridor constraints		
87	Datalink (critical); ANS 4DT Management Tools - flight plan management; Aircraft FMS	**Communications:** RCP; ground to air instructions						specifically need support to help find slot in flow corridor	
88	Datalink (critical); ANS 4DT Management Tools - flight plan management; Aircraft FMS; Aircraft cockpit display	**Display:** 4DT/4DC **Communications:** air to ground acknowledgement							
89	Aircraft FMS	**Navigation:** RNP		flow corridor boundaries with weather constraints	merging and spacing in flow corridor				

Enabler adequate for ICNS needs

Enabler needs additional efforts to address ICNS requirements

Summary



Impact of Future Air Vehicles on NextGen

ICNS Functionality and Alternatives