

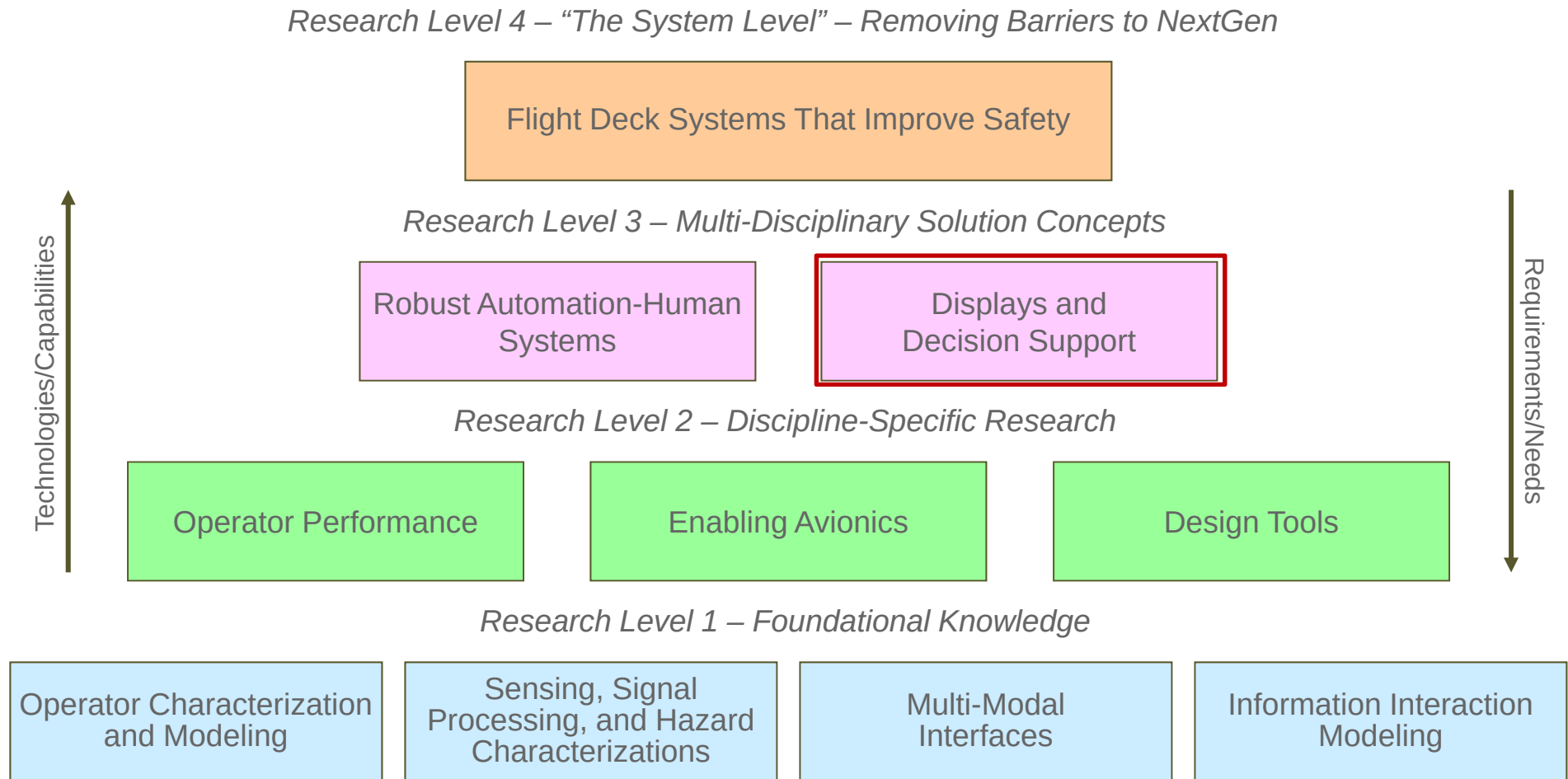
Concept of Operations – IIFD Displays and Decision Support

Randall E. Bailey

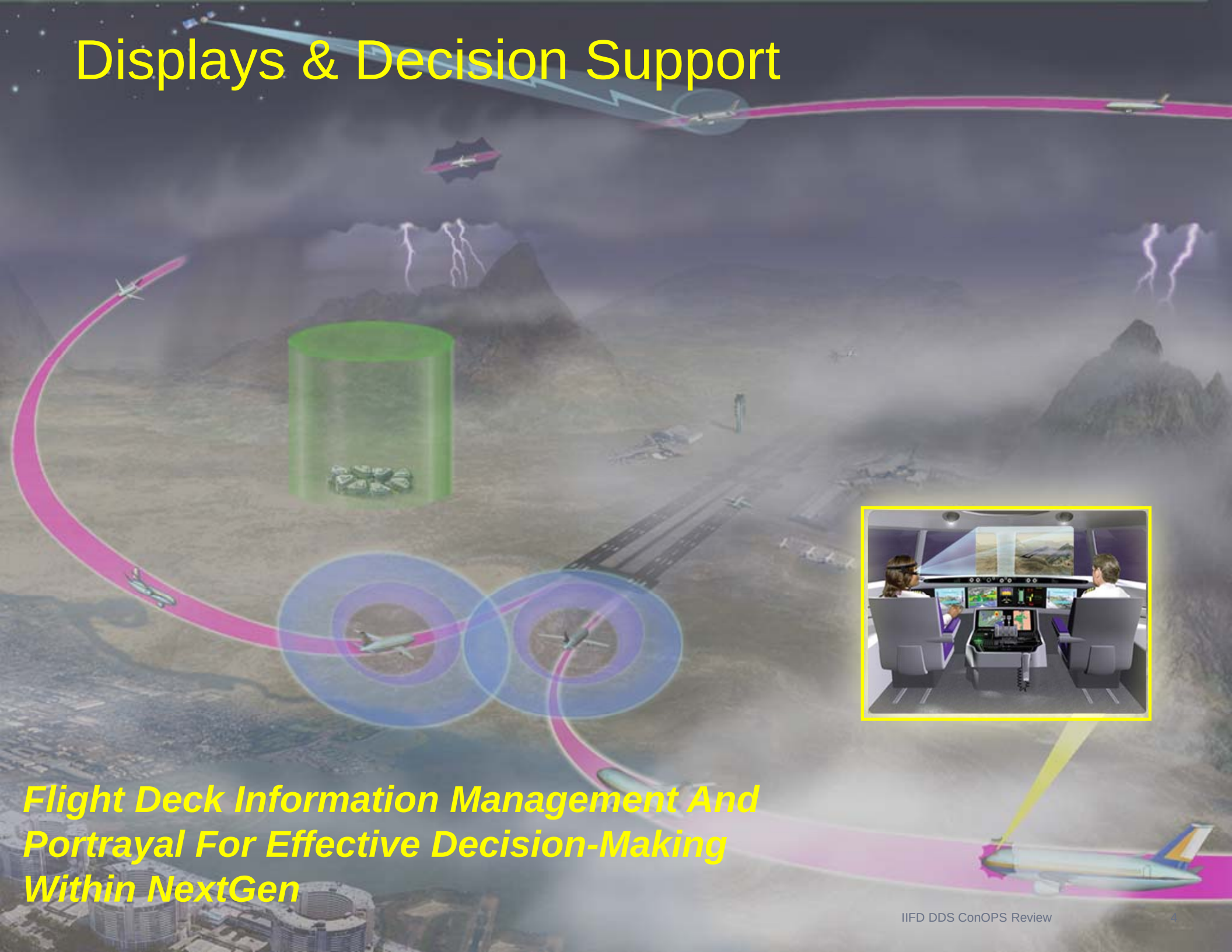
Outline

- Overview
- Concept of Operations (ConOPS) Assumptions
- “Better Than Visual” Concept
- Concept of Operation Highlights

Program Hierarchy

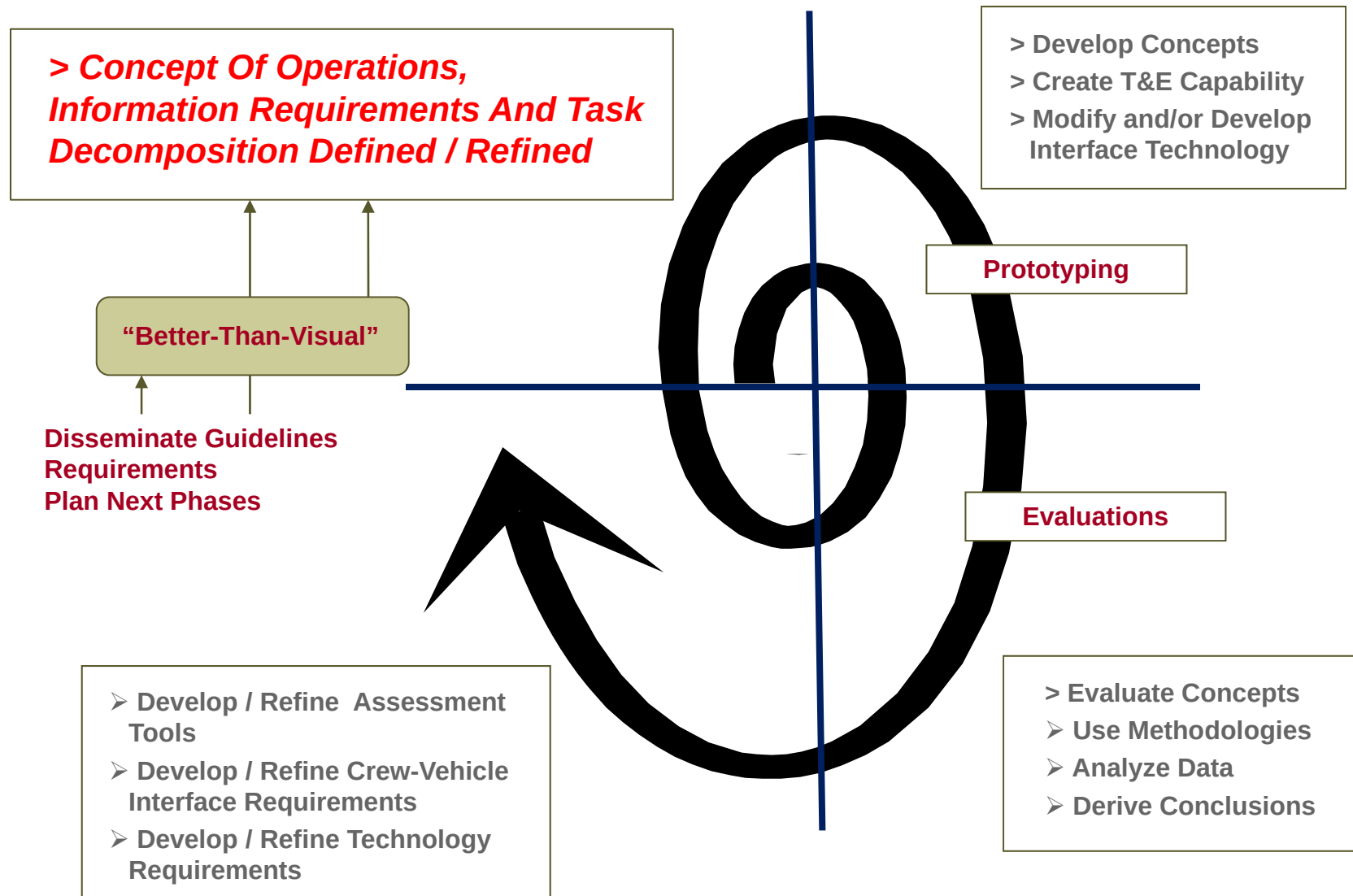


Displays & Decision Support



*Flight Deck Information Management And
Portrayal For Effective Decision-Making
Within NextGen*

Spiral Research & Development



ConOPS Assumptions

- Application Domain: Terminal Maneuvering Area But Concepts May Apply Across Flight
- Targeted Toward Technology/Concepts Which Can Achieve TRL of 7 By 2019
- Commercial And Business Aircraft Application
- Technology Insertion for NextGen
 - Majority of Aircraft Already Designed/ In-Service
 - Maximize Benefits for Equipage

Infrastructure Assumptions

Descent and Approach	
Key Ground Infrastructure	Avionics
• 4-Dimensional Weather Cube • ADS-B ground stations • ASDE-X • Common Automated Radar Terminal System/Standard Terminal Automation Replacement System enhancements • Data Communications • Enhanced/Integrated Traffic Management Advisor • Ground-Based Augmentation System • Terminal Flight Data Management System • Traffic Flow Management System	• ADS-B In and Out • Data Communications • FANS • Ground Based Augmentation System (GBAS) avionics • RNAV/RNP • VNAV

Push Back, Taxi, and Departure	
Key Ground Infrastructure	Avionics
• 4-Dimensional Weather Cube • ADS-B ground stations • Airport Surface Detection Equipment model X (ASDE-X) • Common Automated Radar Terminal System/Standard Terminal Automation Replacement System enhancements • Data Communications • Integrated Departure and Arrival Coordination System • Modernized Aeronautical Information Management System • Surface traffic management decision support tool • System-Wide Information Management (SWIM) • Terminal Flight Data Management System • Traffic Flow Management System	• ADS-B, TIS-B, FIS-B • Data Communications • RNAV/RNP

Landing, Taxi, Arrival	
Key Ground Infrastructure	Avionics
• 4-Dimensional Weather Cube • ADS-B ground stations • Airport Surface Detection Equipment model X (ASDE-X) • Common Automated Radar Terminal System/Standard Terminal Automation Replacement System enhancements • Data Communications • Enhanced/Integrated Traffic Management Advisor • Integrated Arrival and Departure Coordination Tool • Modernized Aeronautical Information Management System • Surface traffic management decision support tool • System-Wide Information Management (SWIM) • Terminal Flight Data Management System • Traffic Flow Management System	• ADS-B, TIS-B, FIS-B • Data Communications • RNAV/RNP

Comparative Analysis For IIFD DDS



***NextGen “Baseline”
Flight Deck***

Better Than Visual Operational Capability

Equivalent Visual Operations

- VFR-Like Operations:
 - 1) Self-Navigation
 - 2) See-to-Follow / See-and-Avoid
 - 3) Self-Separation
 - Obstacles
 - Traffic
 - Terrain
- *In All Weather and Visibility Conditions*

Constraints:

- No Addtn'l Airport Infrastructure
- Positive Cost/Benefit for Operator

Enhanced Visual Cap.

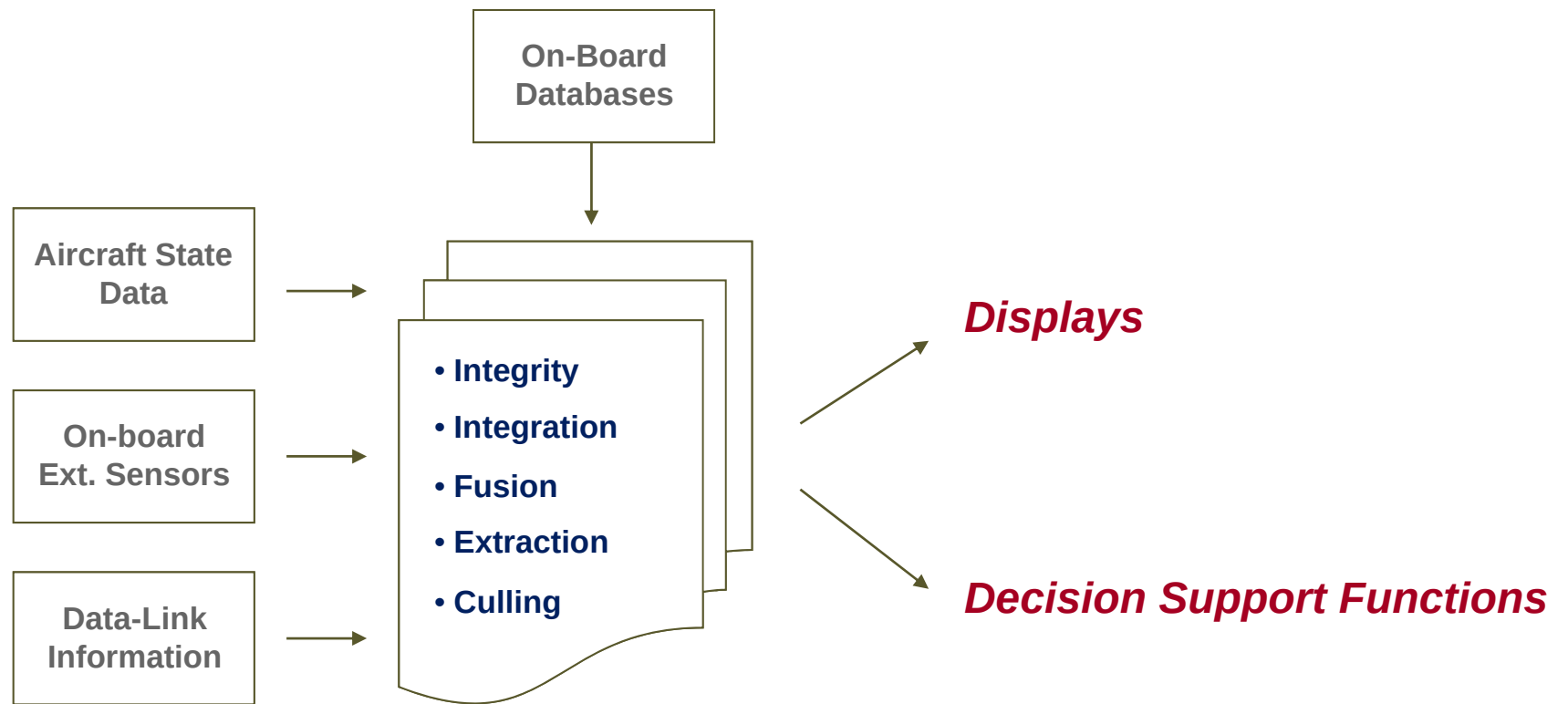
- Wake
- Other Wx Phenomenology
- Airspace, Notams, etc.
- CD&R in TMA, Including:
 - Blunder Detection

NextGen Environment

- Datalink Communications
- TBOs
 - RTAs
 - Sequenced and Spaced
 - 4D Surface Ops

"Better than Visual"

Enabling Technology - Comprehensive High Integrity Information Processing



Head-Worn Displays

Equivalent Visual Operations – An Electronic Means Provides “Equivalent” Visual References To That Of Natural Vision Independent Of The Actual Lighting And Atmospheric Conditions -

- The Safety And Capacity Of Visual Flight Rules (VFR) Operations Can Be Replicated and Improved Upon
- VFR Operational Procedures Can Be Utilized.

*Unlimited Field-of-
Regard
Information*



*Spatially-
Integrated
Information
Displays*

Minimal Clutter / No Display Minification

NextGen Environment

- Data-Link Communications:

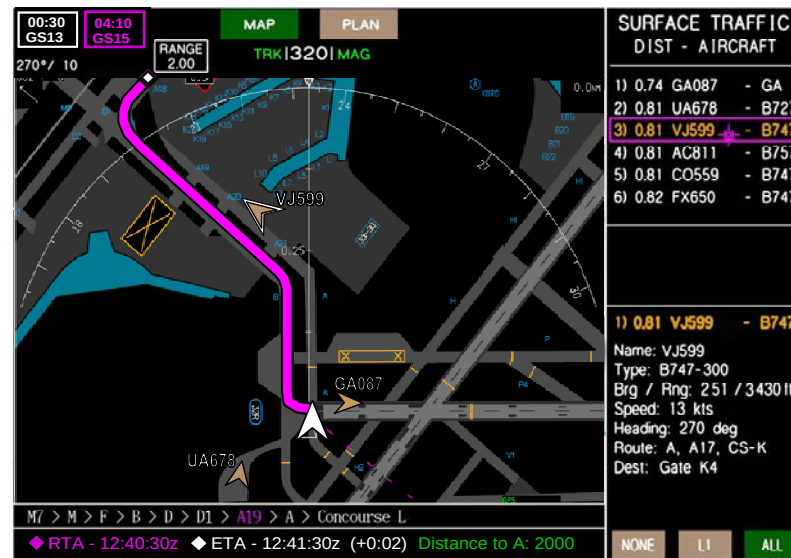
Capture the Good Features of Data-Comm

Retain / Replicate the Good Features of Radio-Comm

- Create A Party-Line Replica When Necessary / Desired



Surface Map With Alphanumeric Traffic Listing



Surface Map With Traffic and Ownship Intent

NextGen Environment (2)

- 4DT Procedures

Advanced Surface Display Concept

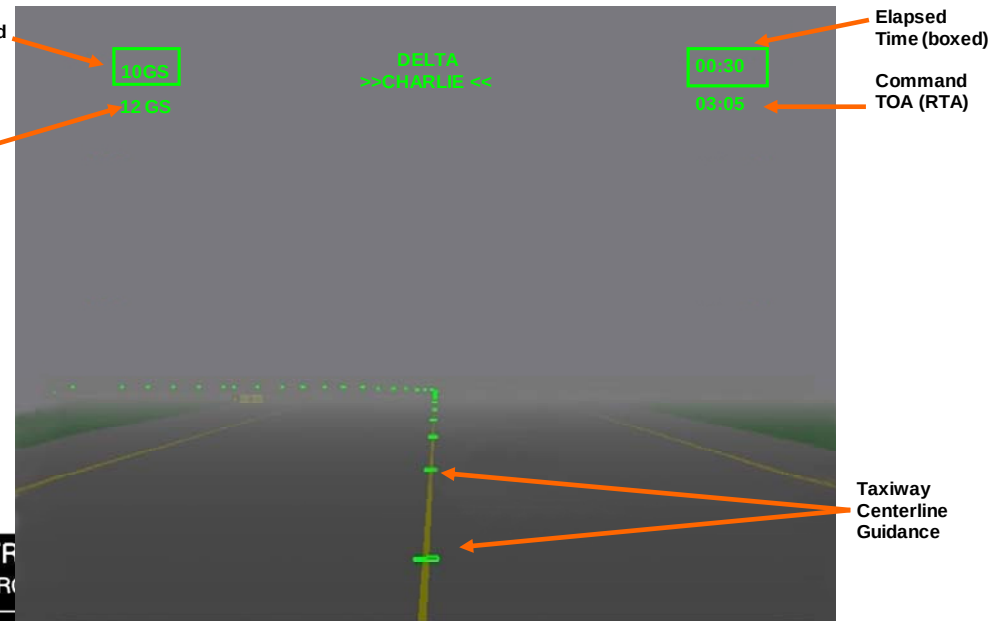


SURFACE TR	
DIST - AIR	
1) 0.74 GA087	- GA
2) 0.81 UA678	- B727
3) 0.81 VJ599	- B747
4) 0.81 AC811	- B757
5) 0.81 CO559	- B747
6) 0.82 FX650	- B747

1) 0.81 VJ599	- B747
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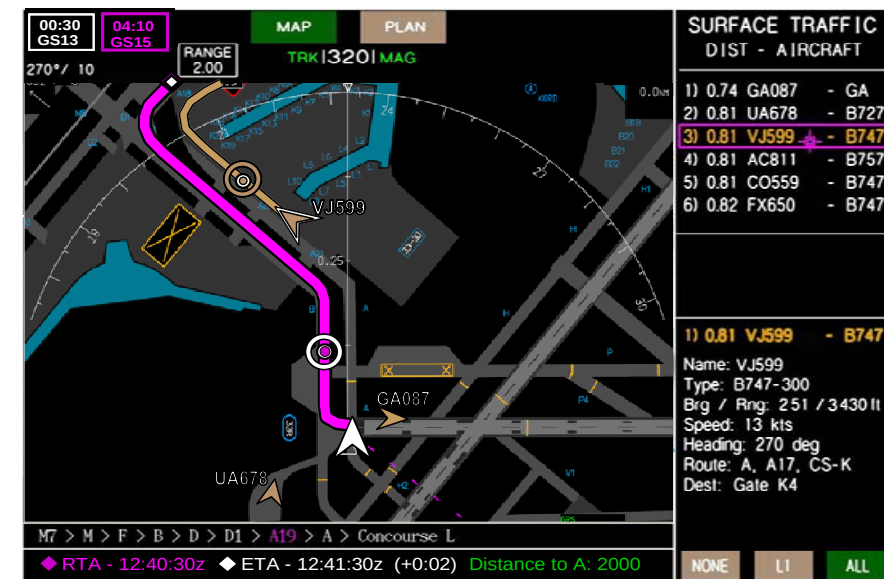
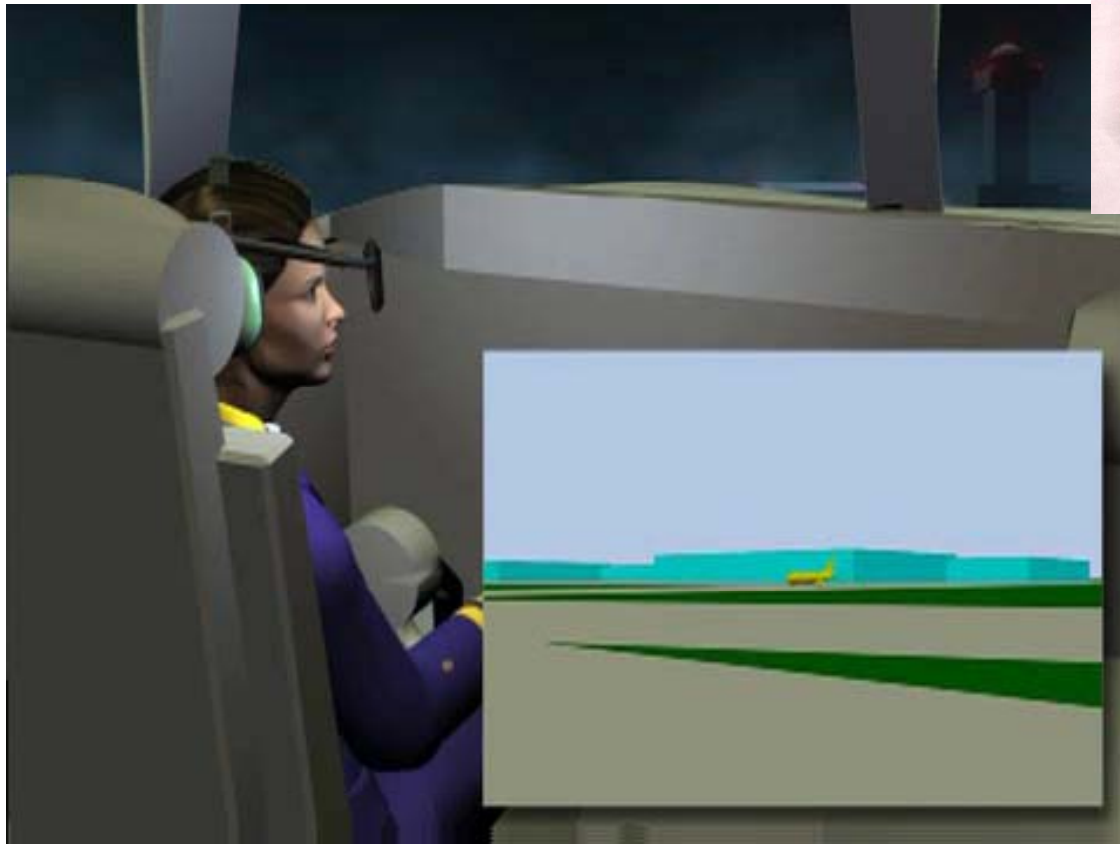
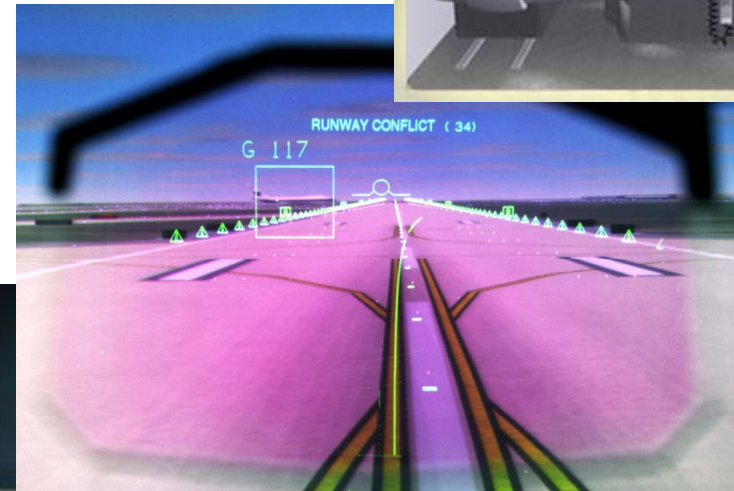
Name: VJ599
 Type: B747-300
 Brg / Rng: 251 / 3430 ft
 Speed: 13 kts
 Heading: 270 deg
 Route: A, A17, CS-K
 Dest: Gate K4

NONE LI ALL



NextGen Environment (3)

- Delegated Separation Procedures



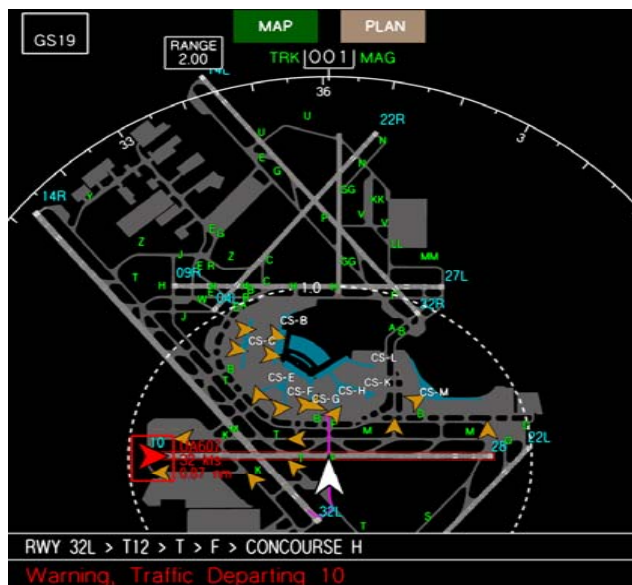
Enhanced Visual Capabilities

- Wake Visualization
- Other Weather Phenomena
- Airspace, NOTAMS, etc.
- Conflict Detection and Resolution

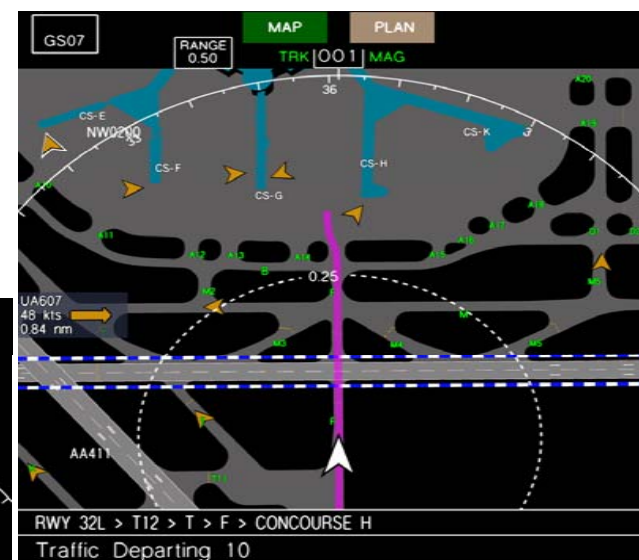
Airborne Conflict Warning



Taxiway Conflict Warning



Traffic Advisory



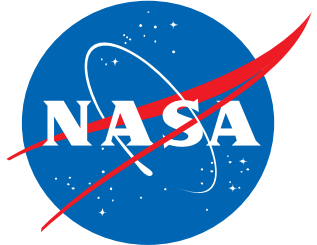
Summary

- ***RDT&E Laying Ground Work for “Better Than Visual” Operations***

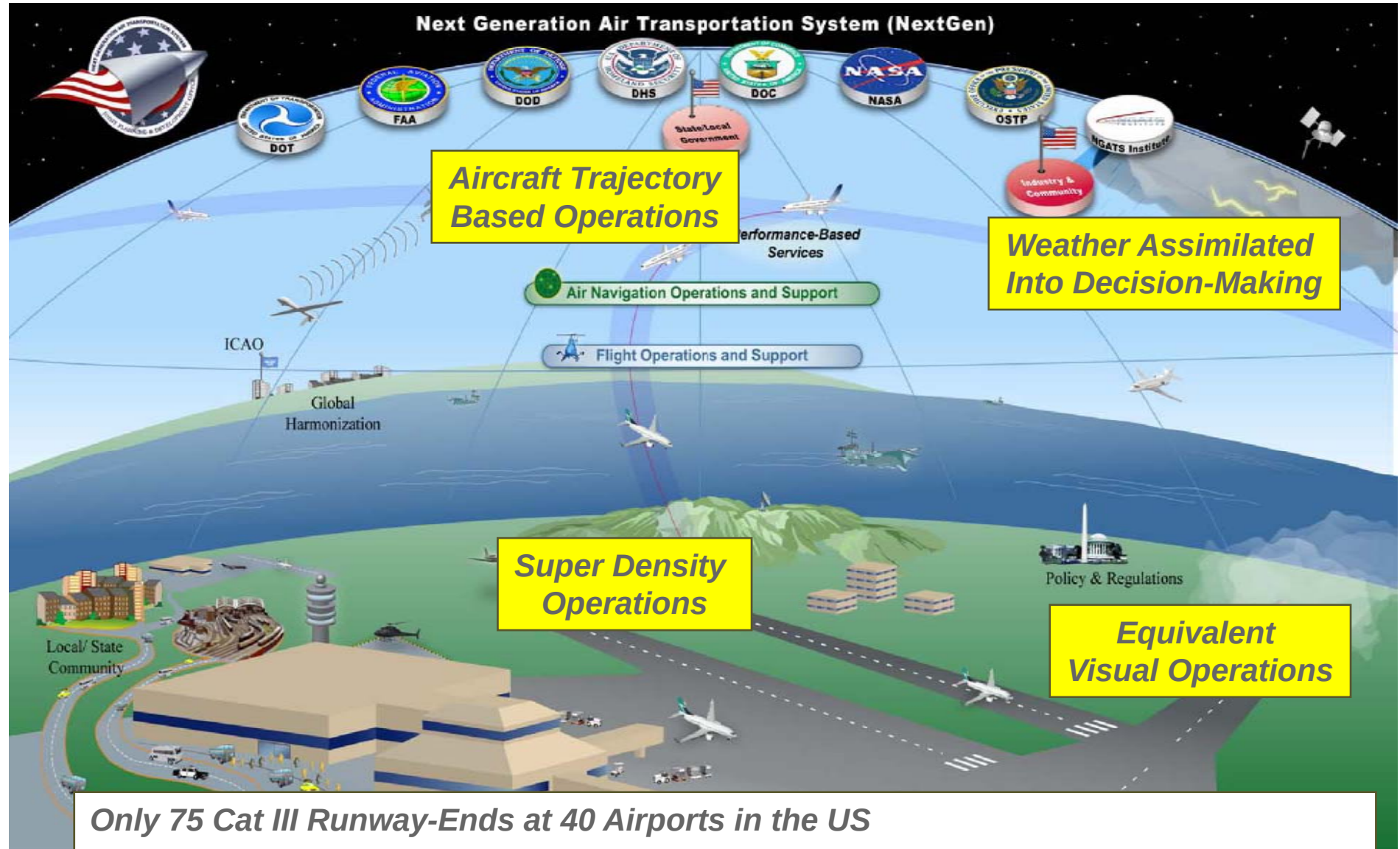
Equivalent Visual Operations

NextGen Communications And Operations

Enhanced Visual Capabilities



Tomorrow's Issues



Only 75 Cat III Runway-Ends at 40 Airports in the US

More Cat III Capability for NextGen?

> Facilities & Equipment Cost of \$4.2M for Lights, RVRs, ILS, and NavAids

75 Cat III Runway-Ends at 40 Airports in the US



JPDO Timeline

