Mixed Equipage

Transforming our thinking to embracing the dynamic environment and apply Mixed Performance Management Techniques

Ronald L. Stroup
Chief Systems Engineer for Air-Ground Integration
Federal Aviation Administration
NAS Implementation Harmonization Division, ANG-D3
Ronald.L.Stroup@faa.gov
202 267-1532

Agenda

- Scope of Air Ground Team (AGT)
- AGT Program Plan
- History (READC Brief 2009)
- AGT Activities
  - Mixed Performance Strategy
  - Stakeholder Operations
  - Domain Readiness
  - Aviamatics
  - Controller Aware
  - Trends
  - Enterprise Risks
- Risks/Key Challenges
- Accomplishments
- Funding Issues

Scope of Air-Ground Team

The aviation community has struggled with the terms “Mixed Equipage” and “Best Equipped-Best Served.”

- What does it mean and how will it be implemented? Many have focused on how to accommodate the airborne equipage aspects.
  - From an air traffic controller’s perspective, he or she sees many aircraft with different levels of performance that they have to accommodate and manage.
  - From a pilot’s perspective, he or she may see varying levels of performance across airspace and airports.
- Mixed performance management reflects policies, practices, and procedures by which the air transportation community navigates through the transition period from contemporary CNS to the prospective NextGen environment.

The Transition Strategy:
Leverage existing capabilities to support user-defined benefits-based NextGen operations to enable users to accrue benefits today, while providing a systemic pathway to transform the NAS and capture greater benefits

Air-Ground Integration Program

A-G Program Plan
FY2008 – 2010

- Integrated Framework
- Challenges
- Trends

- A-G NASEA Roadmap (Sept 2008)
- A-G Data Exchange Framework (Jan 2009)
- **REDAC NAS Sub-comm. Mtg. (2009)**
- Avionics Report (April 2010)
- **Mixed Performance Strategy (Sept 2010)**
- **Suite Spot (Oct 2010)**

A-G Program Plan
FY2011 – 2013

- Areas of Change
- Harmonization
- Mixed Performance

- NextGen Equipage Strategy (May 2011)
- **Integrated Framework (July 2011)**
- UAS Integration in the NAS (Mar 2012)
- A-G Data Exchange Philosophy (May 2012)
- **Trends Analysis (Ongoing)**
- **Stakeholder Operations Report (July 2012**
- **Domain Readiness (Sept 2012**)
- BEBS Workplan (Oct 2012)
- **Enterprise Risk/Opportunity (2013)**
- **Challenges to Operations (Aug 2013)**

A-G Program Plan
FY2014 – 2016

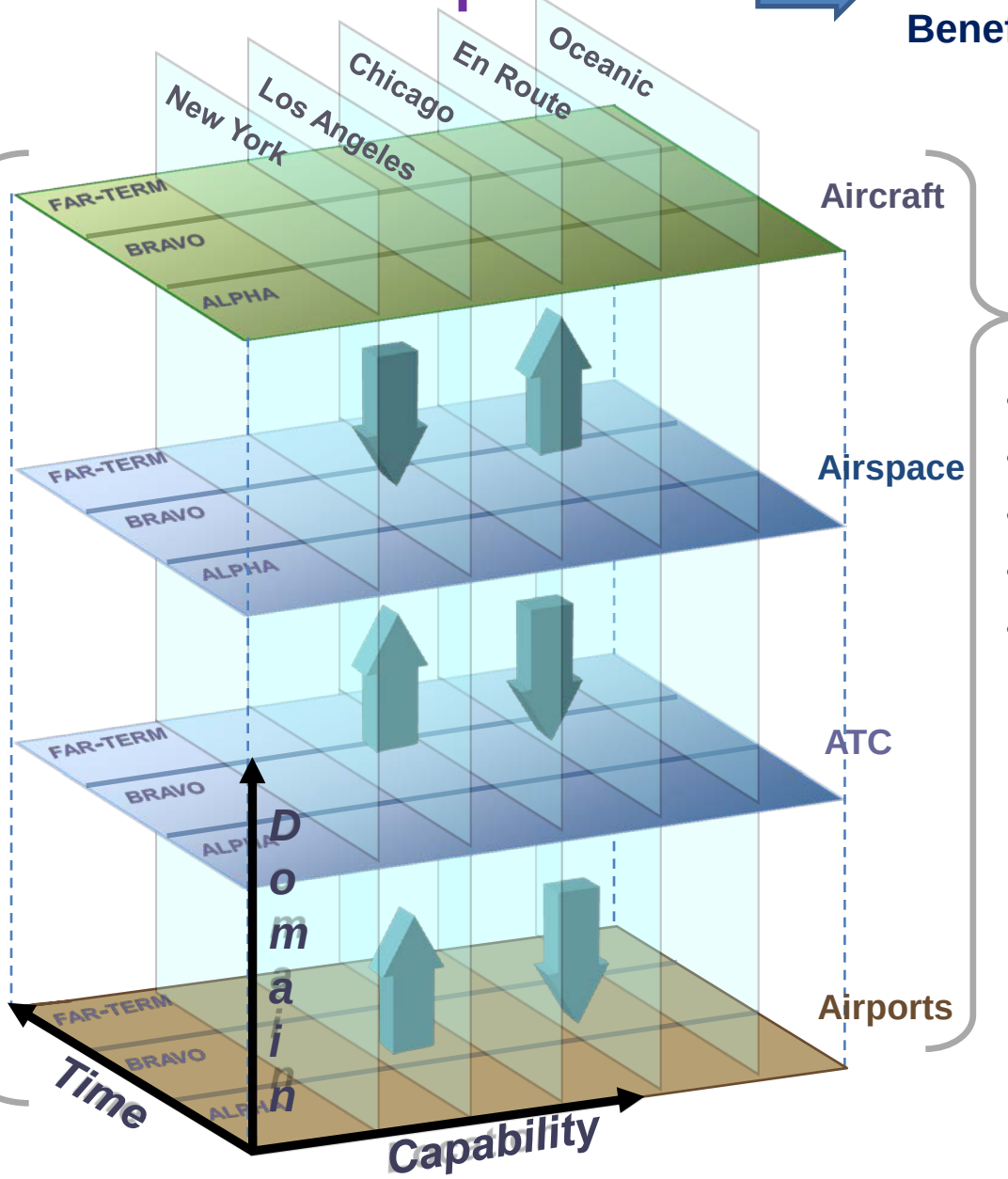
- Systems of Systems
- MBA Philosophy
- Aviamatics

- **Aviamatics Strategy (Jan 2014)**
- NextGen Transformation Project Plan
- PBN Strategy (May 2014)
- **Controller Aware Capability (June 2014)**
- Portfolio Assessments (TBD)
- Avionics Report (TBD)

Integrated Framework

NextGen Operations

Measurable Benefits



Cross-Cutting Factors

- Environmental
- Safety
- Information Security
- Economic
- International
- Regulation

Enablers

- People
- Procedures
- Technology
- Data/Information
- Policy

Legend:

- Private Sector
- FAA (USG)
- Local entities

History - REDAC Briefing 2009*

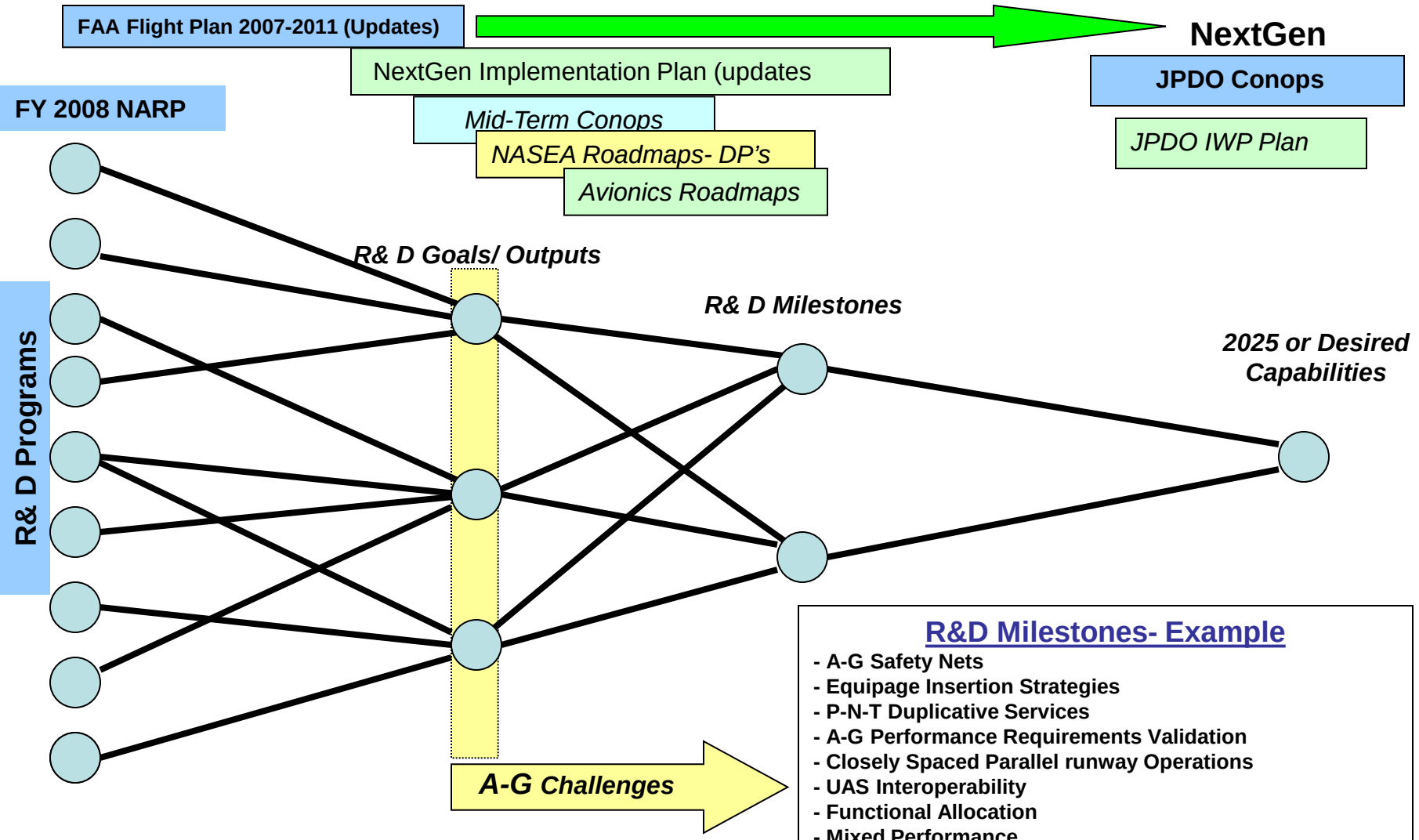
- Purpose
  - Provide Insight into the NextGen Air-Ground Program
  - Increase awareness of the scope of Air-Ground Activities
  - Seek your input to further improve Air-Ground Program

Agenda

- Relationship to NARP and REDAC Recommendations
- Enterprise Architecture
- Air-Ground program
- Sampling of Air-Ground Challenges
- Summary

* Briefed REDAC NAS Sub-committee, March 2009, NASA AMES

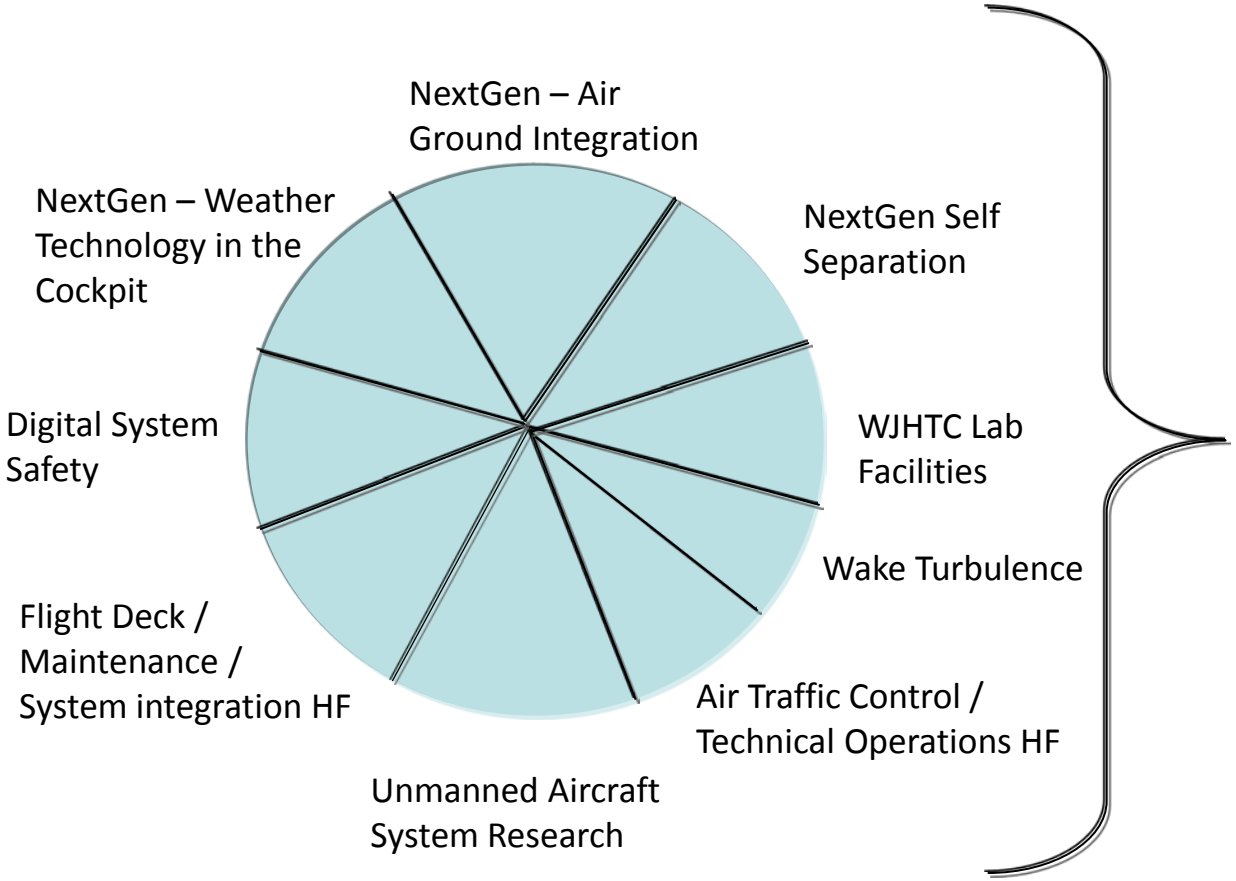
A-G Engineering & Analysis Plan: Alignment with NARP



R&D Milestones- Example

- A-G Safety Nets
- Equipage Insertion Strategies
- P-N-T Duplicative Services
- A-G Performance Requirements Validation
- Closely Spaced Parallel runway Operations
- UAS Interoperability
- Functional Allocation
- Mixed Performance

2009 NARP Budget Items Related to Air-Ground Integration



ADDITIONAL A-G TASKING

- Define interoperability of airborne and ground-based safety functions today and in NextGen.
- Develop NextGen Equipage Implementation Plan to support coordinated infrastructure investments
- Define an overall GPS backup strategy for navigation, surveillance, and timing aspects
- Define strategies to resolution UAS and ATC interoperability issues.
- Develop characteristics of dimensions to support allocation determination.
- Define criteria to assess non-deterministic systems.
- Mitigate airborne automation (Trajectory algorithms generation) disparity with ground automation (Trajectory algorithm generation) for effective and safe trajectory operations

Air/ Ground Program Development

Sources:

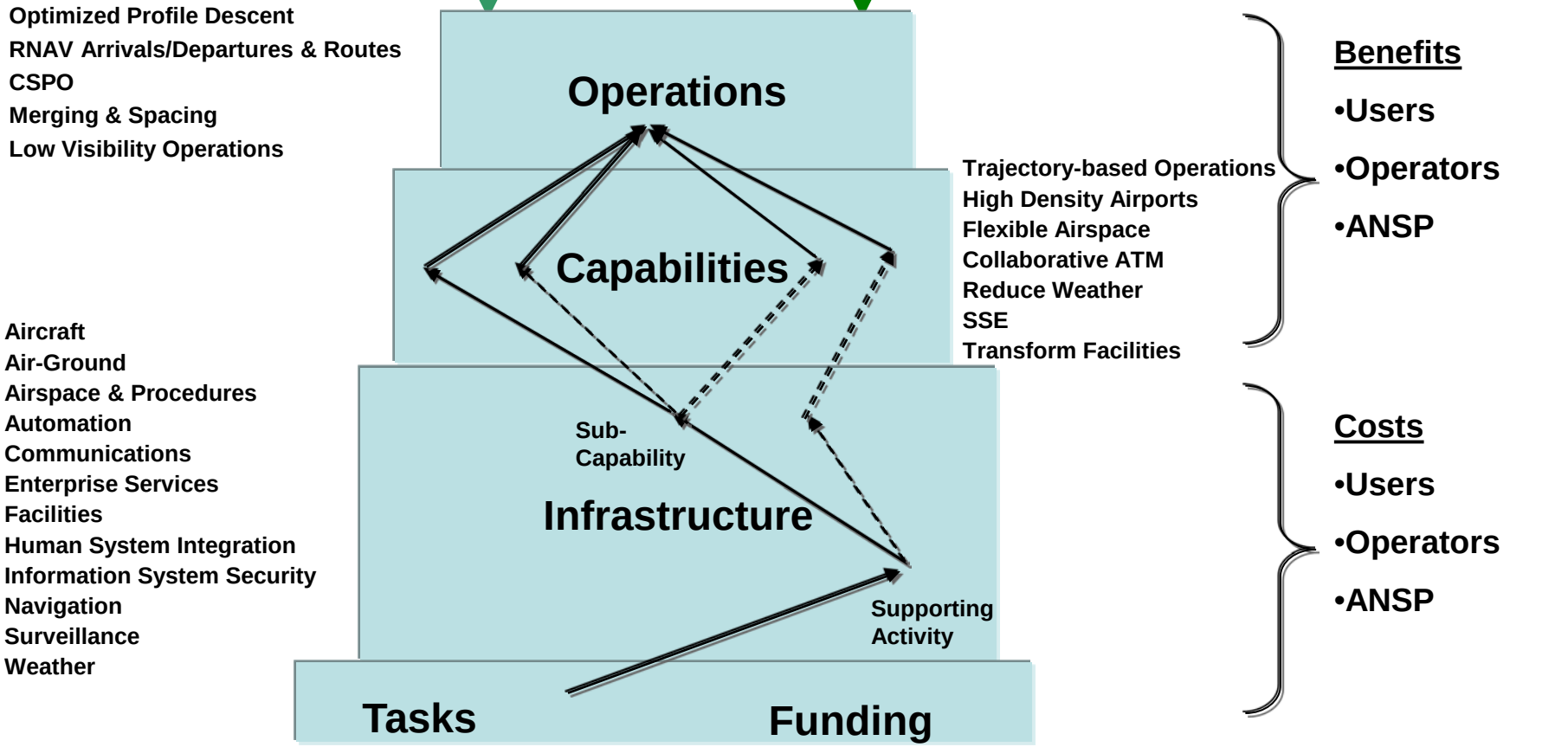
A-G Trends
Aviation Forecasts
Conferences
Industry Forums
International Groups

Industry Needs

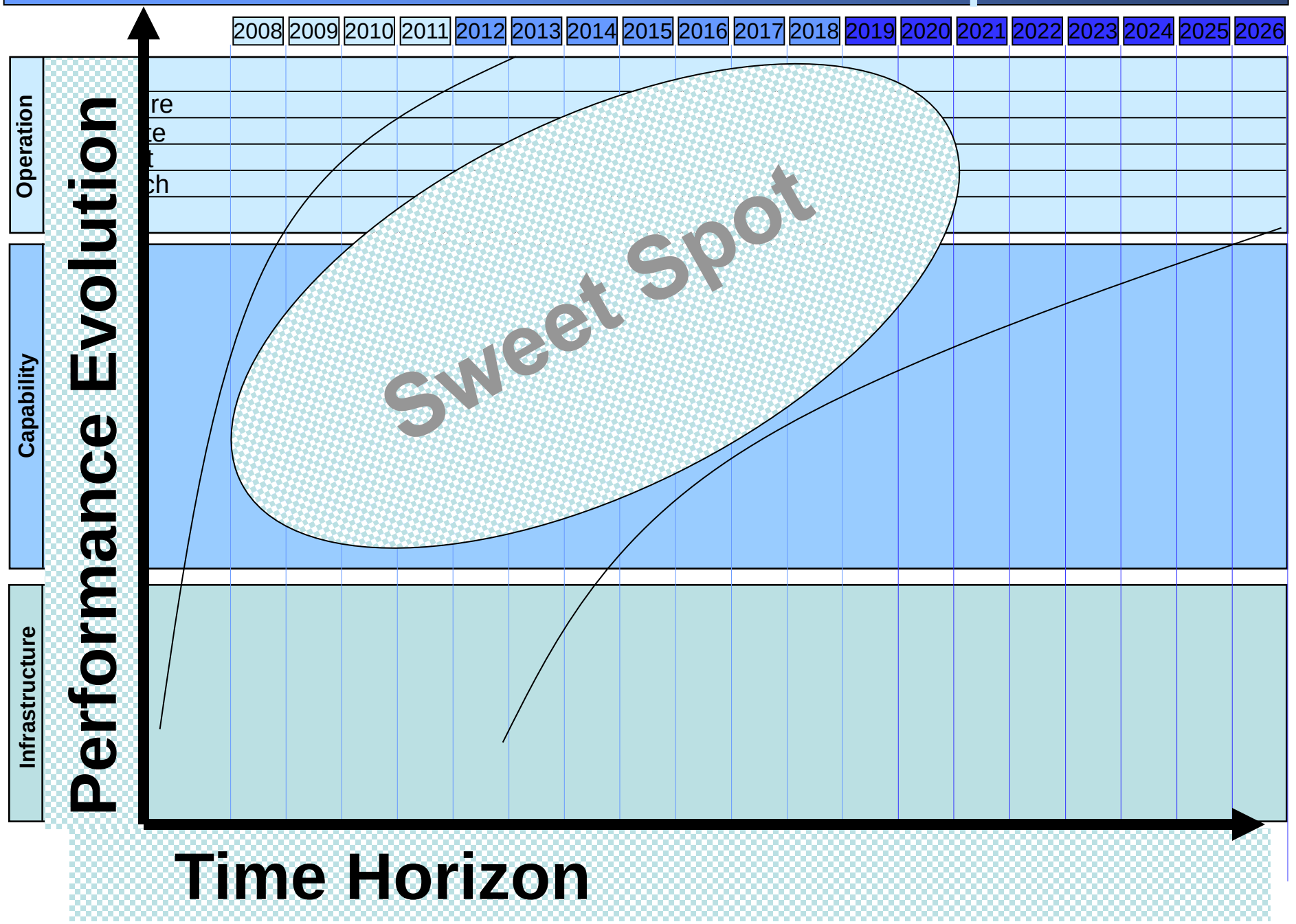
Agency Needs

Sources:

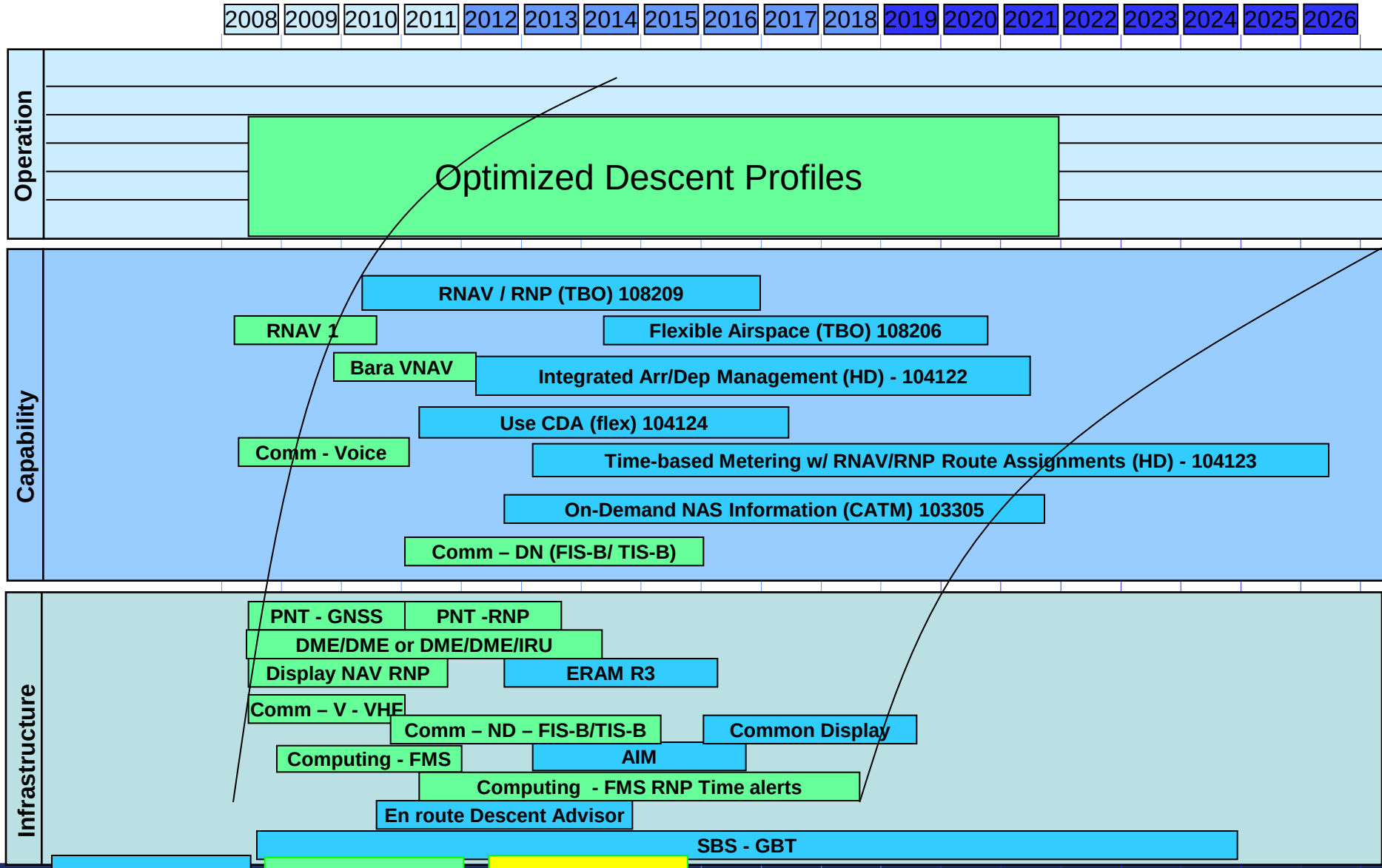
NextGen Implementation Plan-
JPDO Conops - NAS OI's -
NASEA – Service Roadmaps- .
FAA Budget- CIP-RPD's, etc



NextGen Performance Evolution Concept



Operational Thread



Mixed Performance Environment

NextGen will be implemented airport by airport, region by region, aircraft by aircraft, over a period of years. The FAA proposes moving from the concept of "first-come, first-served" to "best-equipped, best-served." While early adopters will reap the greatest benefits, lesser equipped aircraft must still be accommodated. However, interoperability across airborne platform domains, including platforms with mixed equipage will add to architectural complexity.

Key activities include:

- **Reduce airborne automation performance disparity to support precise trajectory paths**
- **Mitigate airborne automation (Trajectory algorithms generation) disparity with ground automation (Trajectory algorithm generation) for effective and safe trajectory operations**
- **Define Flight Trajectory conformance and alerting allocation.**
- **Develop recommendations to transition standards bodies from system-based perspective to performance-based perspective**

Equipage Insertion Strategies

This strategy allows for the necessary lead-time required to perform research, standards development, systems development, certification, and installation activities to support NextGen Air-Ground capabilities. Any ensuing equipage strategy must evaluate each functional initiative to determine where operational improvements, financial incentives or mandates are appropriate. The strategy must be capable of determining when operational incentives should be leveraged. The number of potential equipage mandates must be kept to a minimum.

The key activities are:

- ✓ **Define current and emerging avionics platform capabilities and the extendibility of those platforms to meet NextGen mid-term capabilities.**
- ✓ **Develop NextGen Equipage Implementation Plan with AVS to support coordinated infrastructure investments.**

Mixed Performance Strategy

Contract: SEATEC

POC: Tim Rider, Peter Morton, John Walker

POP: Jan 2010 – Sept 2010

Mixed Performance Strategy Looking Forward

- Why mixed performance management rather them mixed equipage – because the BE-BS operational paradigm is more then an airborne issue. The NAS is a widely distributed Systems-of-Systems (SoS) and NextGen is transforming current and emerging air transportation capabilities resulting in a dynamic and complex set of interactions involving equipment and procedures and their use by human operators.

- The question arises as to how you find the “sweet spot” among the complex participants in the NAS.
  - Those factors to be considered are aircraft technology evolution, airspace and flight procedures design, changing air traffic and airport infrastructure and procedures, and the training to support the transformational roles.

Summarizing Operational Principle Observations

Observation 1:

Some ANSPs support early equipage in ways that enhance operator economics, and respond to operator initiatives

Observation 2:

Best practice is a balance between "Build-It-And-They-Will-Come" & "Follow the Leader"

Observation 3:

Some nations and some US locations harvest "NowGen" best practices to adopt NextGen or existing technology opportunities

Observation 4:

Inhibitors to progress include
Obsolescent regulations,
"stovepiped" business case analyses,
airplane performance differences

Mini-Case Summary

Case Number	Case P = Past C = Current I W = In Work F = Future		Example E = Exclusionary B = BEBS	Status I = Implemented F = Future T = Transferrable*	Comment Already in US Airspace Ready for US application without NextGen Needs NextGen Technologies for US Application
A	RVSM	P	E	I	Need for airspace capacity, applicable to Q/T route implementation
B-1	Brisbane RNP	C	B	I, T1	Needs RNP, solves "trombone effect", *applicable to major hubs ATL, CLT, SEA*
B-2	Sydney RNP/GLS	C	B	I, T2	Requires RNP & GLS, *transferrable to key US location EWR/JFK/LGA*
C	WestJet	C	B	I, T1	Requires extensive RNP implementation, *applicable to US airlines SW & AS system wide*
D	LAX STAR/FMS	C	B	I,T1	Proven, requires new procedures, airspace re-design, *applicable to most metroplex areas*
E	Hudson Bay ADS-B	I W	E	I, F,T3	Needs aircraft equipage, *eventually applicable to Caribbean and other transoceanic gateways*
F	AS SeaTac RNP	I W	B	F,T1	Requires change to TERPS design & EIS rules *Applicable to any airports where airlines want to operate "IFR flight paths over VMC published procedures"*
G	SW RNP	I W	B	F,T1	Ready to go, requires new RNP procedures *SW waiting for FAA or contractor procedures*
H	Q & T Routes	F	E	F	Will start BEBS and migrate to Exclusionary, new procedures & airspace redesign
I	GA Mountain	F	B	F,T2	Requires equipage and ADS-B installations, *applicable to Adirondacks, Rockies, Cascades, Olympics, Sierra mountainous areas*
J	GA VFR/IFR	F	B	F,T3	Requires equipage and ADS-B installations, *applicable to thousands of non towered GA airports across the nation*
K	Panama RNP/CSPR** PTY	I W & F	B	F,T3	Innovative CSPR implementation, *applicable to major airports with CSPR e.g. SFO, SEA*
L	Cat II/III Landing Capability	P	B	I	Provided BEBS advantage to equipped aircraft
M	Turbo Jet ⇨ Turbo Fan	P	E	I	Implemented by rule changes to serve community and fuel burn interests
N	Virtual & Remote Tower Airport	F	B	F,T3	Experimental, requires extensive development , *applicable to many GA airports*
O-1, O-2	Airplane Performance & Differences	IW & F	B	I, F,T1	Requires guidance material development, *Focus KATL, include GA, applicable to many airports*

* "T1" immediately applicable opportunity high priority, "T2" second priority, "T3" third priority

**Closely Spaced Parallel Runways

Strategy & Policy Recommendations (I)

- Recommendation 1: “Embrace Early Adopters;” listen to operator leaders for fertile opportunities to create value from existing and NextGen technologies; accelerate NextGen adoption through use of operator initiated Early Implementation Projects with targeted BEBS objectives
- Recommendation 2: Provide a management structure that simplifies access to multiple FAA organizations for operators seeking BEBS projects and penetrates the bureaucracy as needed to make things happen; ideally a “one-stop-shop”
- Recommendation 3: Identify NextGen technologies for which there is little adoption enthusiasm; determine how to enhance the business case or the synergy with other technologies that have adoption momentum
- Recommendation 4: Convene experts in aircraft performance, business case analysis, procedure & practices, air traffic operations and human factor considerations in workshop/task force/symposium settings to address where past practice inhibits progress. Examine airspace modeling practices to assure all constituent airspace participants are considered appropriately for Mixed Performance/BEBS coverage
- Recommendation 5: Identify areas in the NAS to “import” successful BEBS cases applied internationally as a catalyst to move forward within the FAA. Classify opportunities to demonstrate/validate mixed performance BEBS practices and policies in the U.S. that have the highest near term impact and lowest cost; engage the FAA to move ahead with several such projects in cooperation with stakeholder operators

Insights leading to a solution

- Focus on Operational Clusters at a location – Drives a suite of capabilities across domains
  - Aligned with SESAR
  - Aligned with ICAO System block Upgrade
- Customize RNAV/RNP procedures (New York Tracon)
- RNAV SIDS or STARs not both to maintain flexibility
- Establish minimum approach and departure performance levels
  - RNAV 1 – En Route
  - RNP 0.3 – Approach and Departure
- Leverage Fleet and Infrastructure readiness

Suggested Next Steps

By way of Recommendation #4: Convene Operational and Technical experts

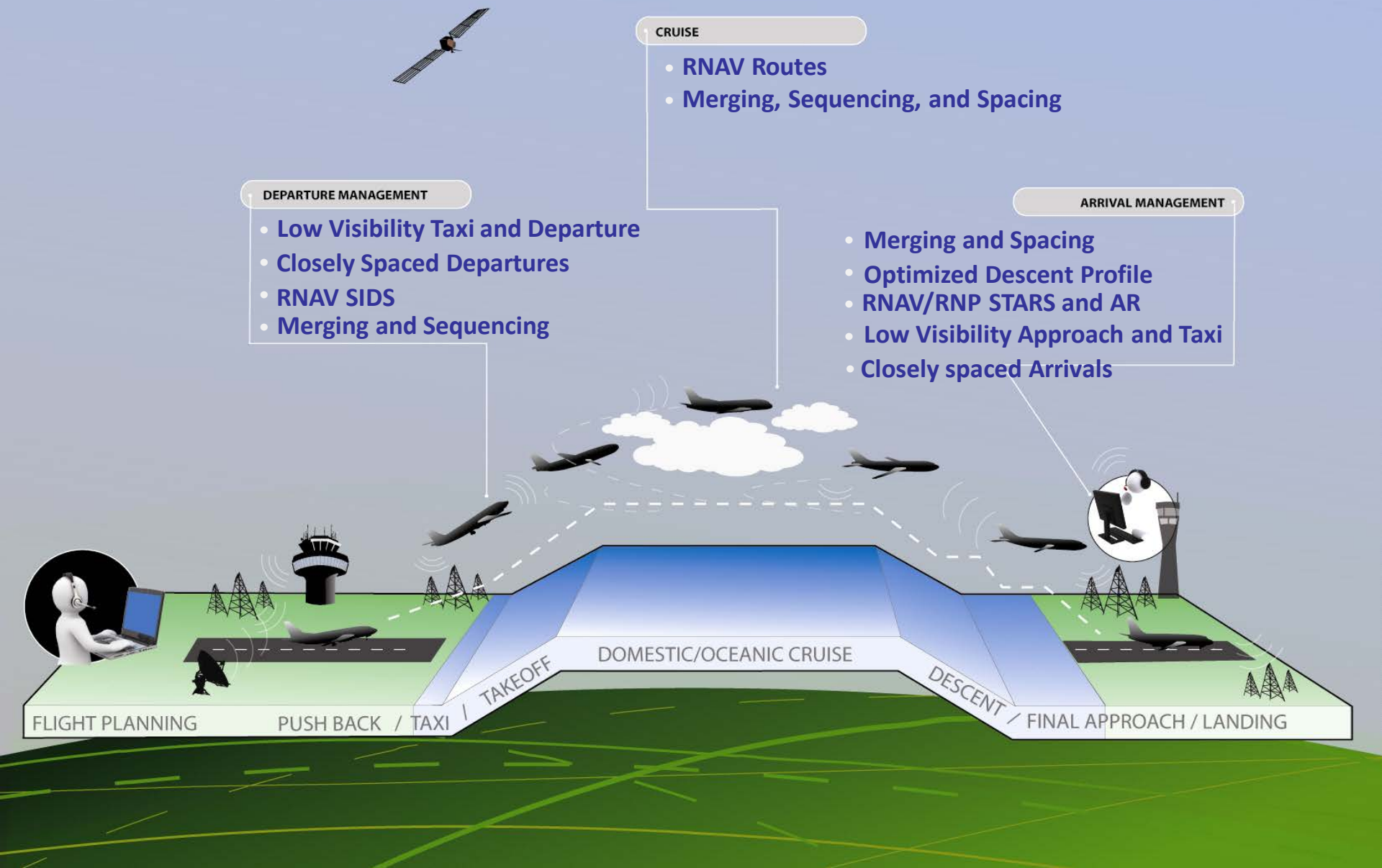
- Gain a better understanding mixed operations across the domains
- Define procedures and practices based on NextGen capabilities
- Review allocation of system benefits to ensure future investments
- Clarify the Human Factor roadmap from current to future operations

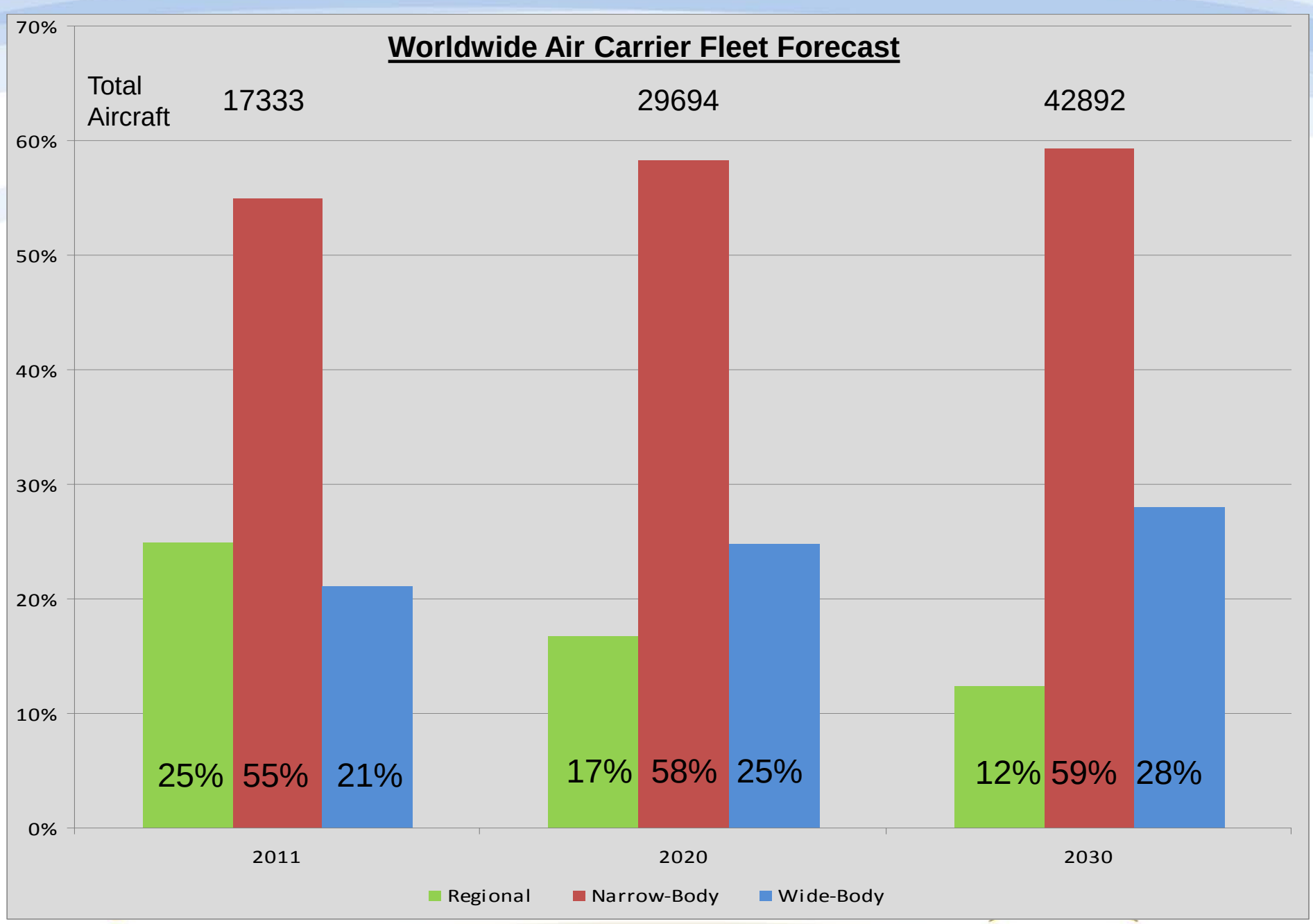
Stakeholder Operations

OTA: Boeing

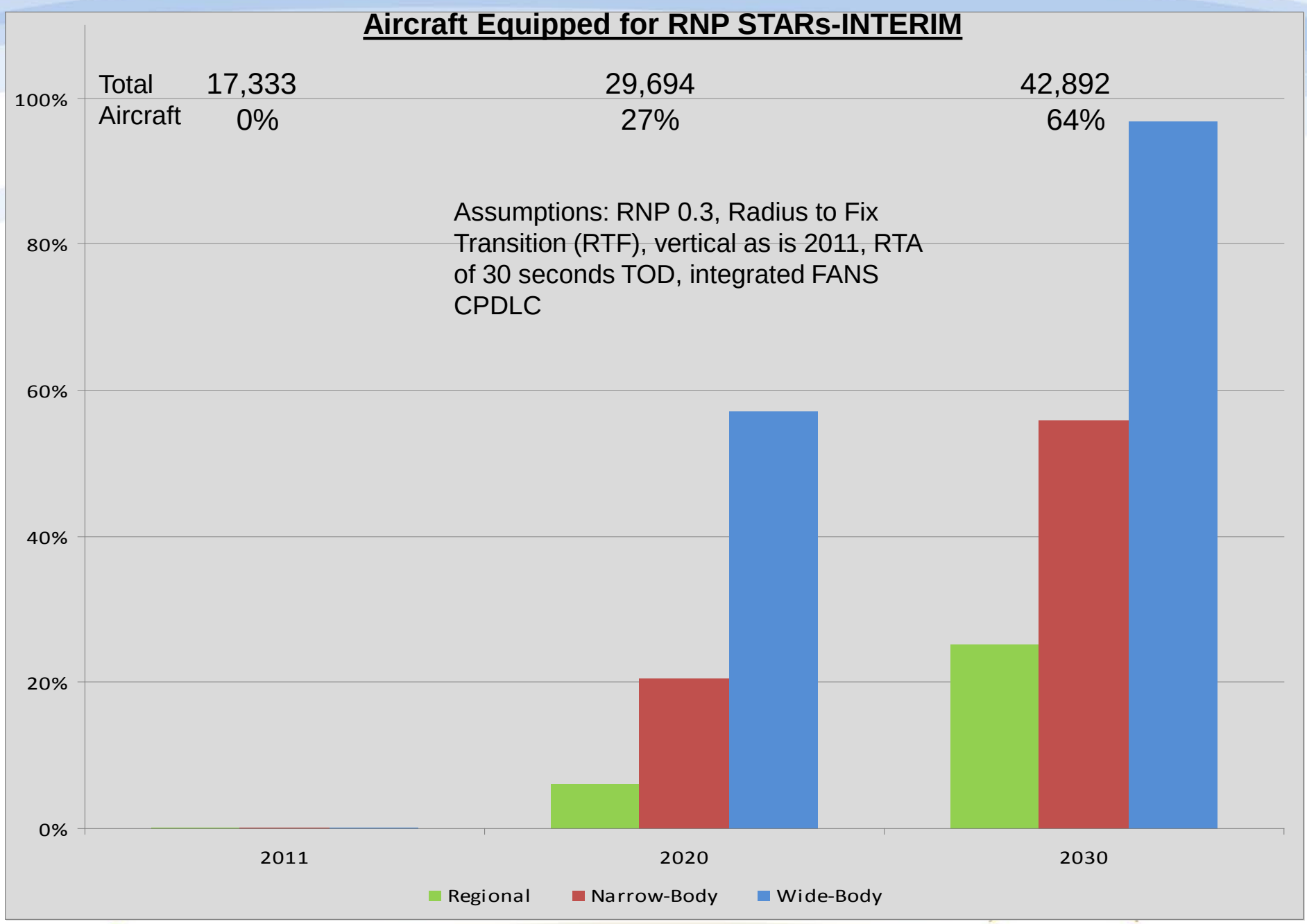
- POC: Boeing, Airbus, Embraer, Bombardier
- POP: Apr 2010 – Aug 2012

1) Where does Aviation Community Want to Go?

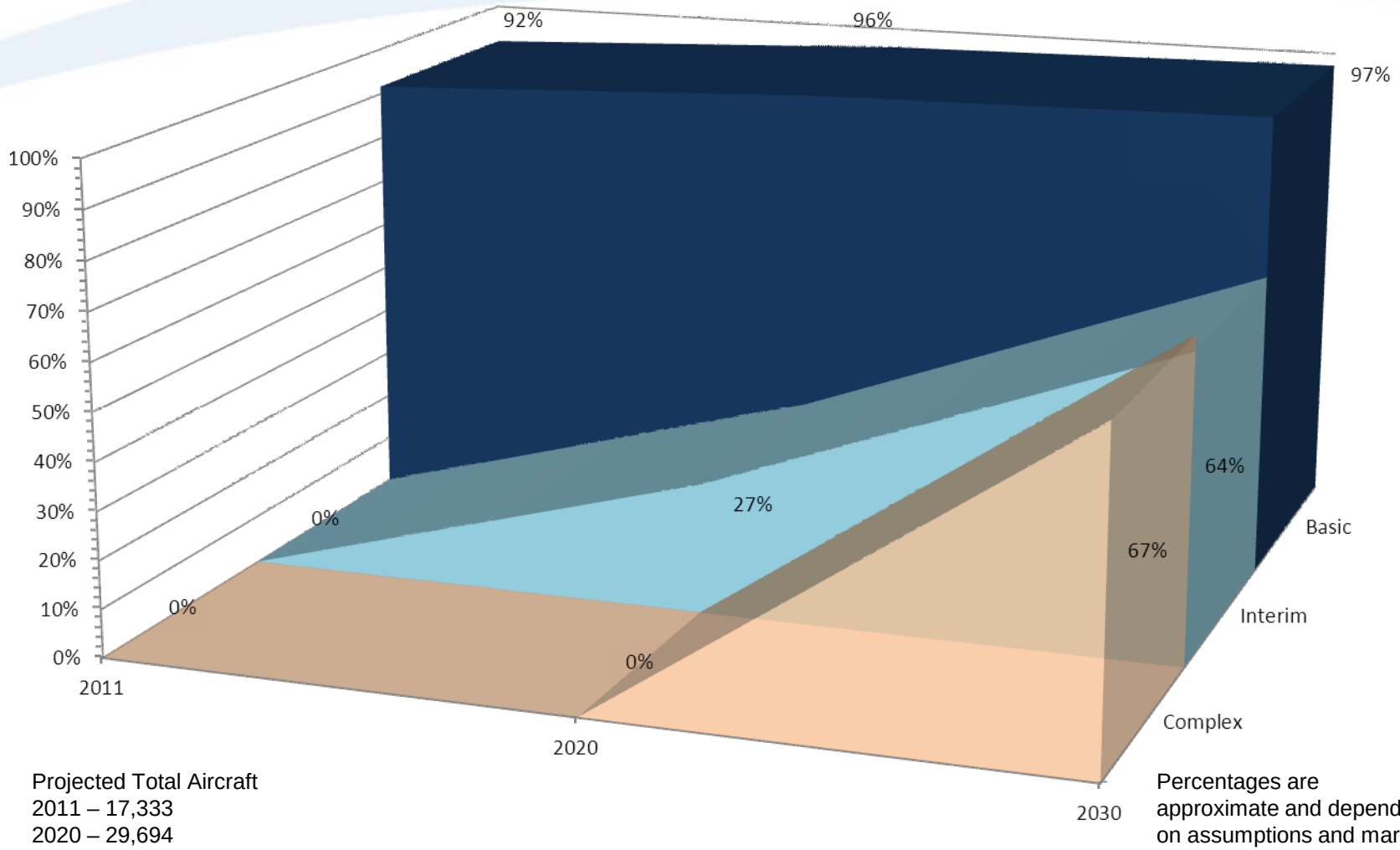



Worldwide Air Carrier Fleet Forecast
Total Aircraft
17333
29694
42892
70%
60%
50%
40%
30%
20%
10%
0%
25%
55%
21%
17%
58%
25%
12%
59%
28%
2011
2020
2030
Regional
Narrow-Body
Wide-Body

Aircraft Equipped for RNP STARs-INTERIM



Aircraft Equipped for RNAV/RNP STAR



Projected Total Aircraft
2011 – 17,333
2020 – 29,694
2030 – 42,892

Percentages are approximate and dependent on assumptions and market forces

FAA

NextGEN

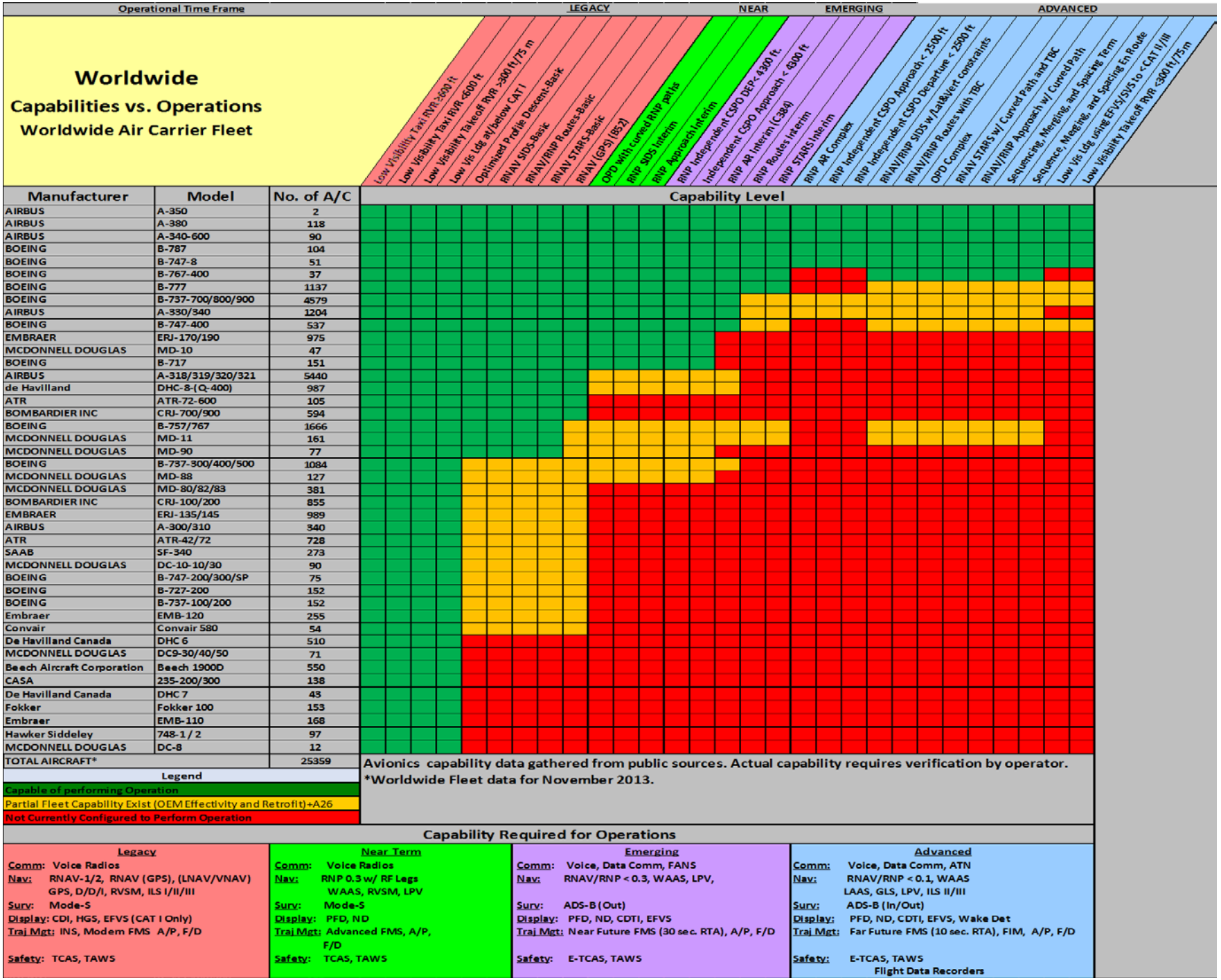
Domain Readiness

Contract: CSSI

- POC: Gary Schaffer, Jerry Whittaker (AvVets LLC)
- POP: Oct 2010 – Sept 2015

Fleet Capability Readiness

Worldwide
Capabilities vs. Operations
Worldwide Air Carrier Fleet



Manufacturer	Model	No. of A/C
AIRBUS	A-350	2
AIRBUS	A-380	118
AIRBUS	A-340-600	90
BOEING	B-787	104
BOEING	B-747-8	51
BOEING	B-767-400	37
BOEING	B-777	1137
BOEING	B-737-700/800/900	4579
AIRBUS	A-330/340	1204
BOEING	B-747-400	537
EMBRAER	ERJ-170/190	975
MCDONNELL DOUGLAS	MD-10	47
BOEING	B-717	151
AIRBUS	A-318/319/320/321	5440
de Havilland	DHC-8-(Q-400)	987
ATR	ATR-72-600	105
BOMBARDIER INC	CRJ-700/900	594
BOEING	B-757/767	1666
MCDONNELL DOUGLAS	MD-11	161
MCDONNELL DOUGLAS	MD-90	77
BOEING	B-737-300/400/500	1084
MCDONNELL DOUGLAS	MD-88	127
MCDONNELL DOUGLAS	MD-80/82/83	381
BOMBARDIER INC	CRJ-100/200	855
EMBRAER	ERJ-135/145	989
AIRBUS	A-300/310	340
ATR	ATR-42/72	728
SAAB	SF-340	273
MCDONNELL DOUGLAS	DC-10-10/30	90
BOEING	B-747-200/300/SP	75
BOEING	B-727-200	152
BOEING	B-737-100/200	152
Embraer	EMB-120	255
Convair	Convair 580	54
De Havilland Canada	DHC 6	510
MCDONNELL DOUGLAS	DC9-30/40/50	71
Beech Aircraft Corporation	Beech 1900D	550
CASA	235-200/300	138
De Havilland Canada	DHC 7	43
Fokker	Fokker 100	153
Embraer	EMB-110	168
Hawker Siddeley	748-1 / 2	97
MCDONNELL DOUGLAS	DC-8	12
TOTAL AIRCRAFT*		25359

Capability Level

Legend

- Capable of performing Operation
- Partial Fleet Capability Exist (OEM Effectivity and Retrofit)+A26
- Not Currently Configured to Perform Operation

Avionics capability data gathered from public sources. Actual capability requires verification by operator.
*Worldwide Fleet data for November 2013.

Capability Required for Operations

Legacy

Comm: Voice Radios
Nav: RNAV-1/2, RNAV (GPS), (LNAV/VNAV) GPS, D/D/I, RVSM, ILS I/II/III
Surv: Mode-S
Display: CDI, HGS, EFVS (CAT I Only)
Traj Mgt: INS, Modem FMS A/P, F/D
Safety: TCAS, TAWS

Near Term

Comm: Voice Radios
Nav: RNP 0.3 w/ RF Legs WAAS, RVSM, LPV
Surv: Mode-S
Display: PFD, ND
Traj Mgt: Advanced FMS, A/P, F/D
Safety: TCAS, TAWS

Emerging

Comm: Voice, Data Comm, FANS
Nav: RNAV/RNP < 0.3, WAAS, LPV,
Surv: ADS-B (Out)
Display: PFD, ND, CDTI, EFVS
Traj Mgt: Near Future FMS (30 sec. RTA), A/P, F/D
Safety: E-TCAS, TAWS

Advanced

Comm: Voice, Data Comm, ATN
Nav: RNAV/RNP < 0.1, WAAS LAAS, GLS, LPV, ILS II/III
Surv: ADS-B (In/Out)
Display: PFD, ND, CDTI, EFVS, Wake Det
Traj Mgt: Far Future FMS (10 sec. RTA), FIM, A/P, F/D
Safety: E-TCAS, TAWS Flight Data Recorders

Fleet Capability Readiness

United States

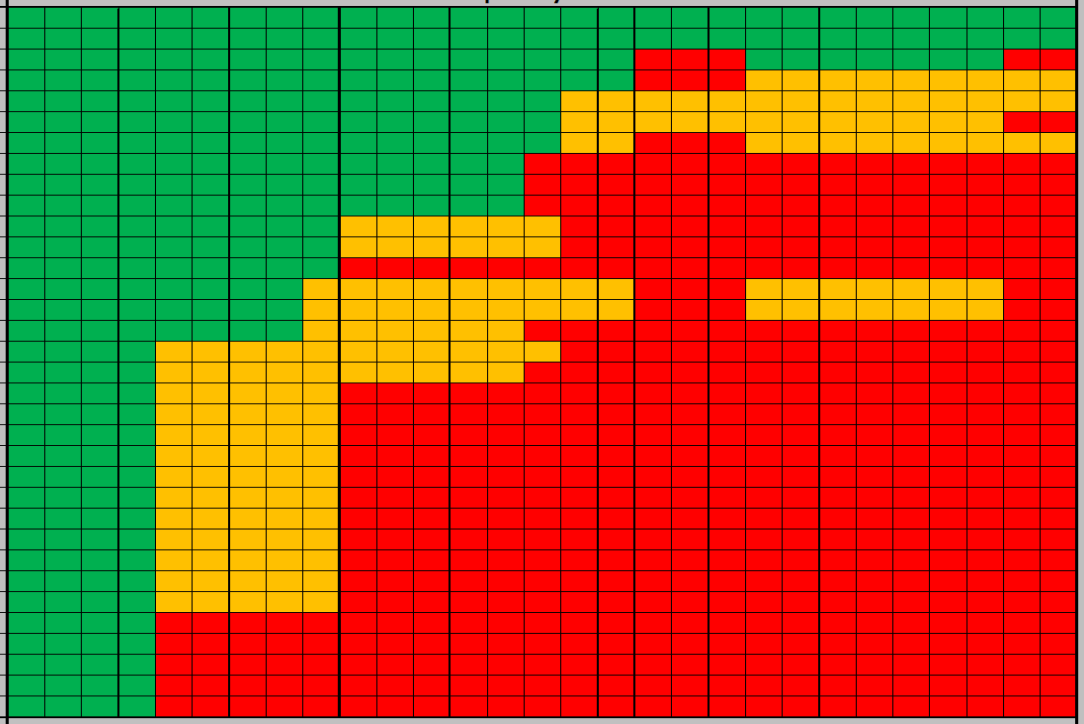
Capabilities vs. Operations

Master List

Operational Time Frame	LEGACY								NEAR			EMERGING						ADVANCED					
	Low Visibility Taxi RVR ≥600 ft	Low Visibility Taxi RVR <600 ft	Low Visibility Takeoff RVR>300 ft/75 m	Low Vis Ldg at/below CAT I	Optimized Profile Descent-Basic	RNAV SIDS-Basic	RNAV/RNP Routes-Basic	RNAV STARS-Basic	RNAV (GPS) (B52)	OPD with curved RNP paths	RNP SIDS Interim	RNP Approach Interim	RNP Independent CSPO DEP< 4300 ft.	Independent CSPO Approach < 4300 ft	RNP AR Interim (C384)	RNP Routes Interim	RNP STARS Interim	RNP AR Complex	RNP Independent CSPO Approach < 2500 ft	RNP Independent CSPO Departure < 2500 ft	RNAV/RNP SIDS w/LatⅆVert constraints	RNAV/RNP Routes with TBC	OPD Complex	RNAV STARS w/ Curved Path and TBC	RNAV/RNP Approach w/ Curved Path	Sequencing, Merging, and Spacing Term	Sequence, Merging, and Spacing En Route	Low Vis Ldg using EFVS/SVS to < CAT II/III	Low Visibility Takeoff RVR <300 ft/75m

Manufacturer	Model	No. of A/C
BOEING	B-787	8
BOEING	B-747-8	6
BOEING	B-767-400	37
BOEING	B-777	179
BOEING	B-737-700/800/900	1162
AIRBUS	A-330/340	66
BOEING	B-747-400	101
EMBRAER	ERJ-170/190	270
MCDONNELL DOUGLAS	MD-10	47
BOEING	B-717	106
AIRBUS	A-318/319/320/321	838
de Havilland	DHC-8-(Q-400)	80
BOMBARDIER INC	CRJ-700/900	423
BOEING	B-757/767	898
MCDONNELL DOUGLAS	MD-11	116
MCDONNELL DOUGLAS	MD-90	65
BOEING	B-737-300/400/500	186
MCDONNELL DOUGLAS	MD-88	225
MCDONNELL DOUGLAS	MD-80/82/83	123
BOMBARDIER INC	CRJ-100/200	502
EMBRAER	ERJ-135/145	529
AIRBUS	A-300/310	153
ATR	ATR-42/72	21
SAAB	SF-340	60
BOEING	B-747-200/300	9
BOEING	B-727-200	19
BOEING	B-737-100/200	5
Embraer	EMB-120RT	51
Convair	Convair 580	9
De Havilland Canada	DHC8-300	55
MCDONNELL DOUGLAS	DC9-30/40/50	29
Beech Aircraft Corporation	Beech 1900D	30
CASA	235-200/300	2
MCDONNELL DOUGLAS	DC-8	2
TOTAL AIRCRAFT*		6412

Capability Level



Avionics capability data gathered from public sources. Actual capability requires verification by operator.

*United States Fleet data for November 2013.

Legend

- Capable of performing Operation
- Partial Fleet Capability Exist (OEM Effectivity and Retrofit)
- Not Currently Configured to Perform Operation

Capability Required for Operations

Legacy

- Comm: Voice Radios
- Nav: RNAV-1/2, RNAV (GPS), (LNAV/VNAV) GPS, D/D/I, RVSM, ILS I/II/III
- Surv: Mode-S
- Display: CDI, HGS, EFVS (CAT I Only)
- Trai Mgt: INS, Modern FMS A/P, F/D
- Safety: TCAS, TAWS

Near Term

- Comm: Voice Radios
- Nav: RNP 0.3 w/ RF Legs WAAS, RVSM, LPV
- Surv: Mode-S
- Display: PFD, ND
- Trai Mgt: Advanced FMS, A/P, F/D
- Safety: TCAS, TAWS

Emerging

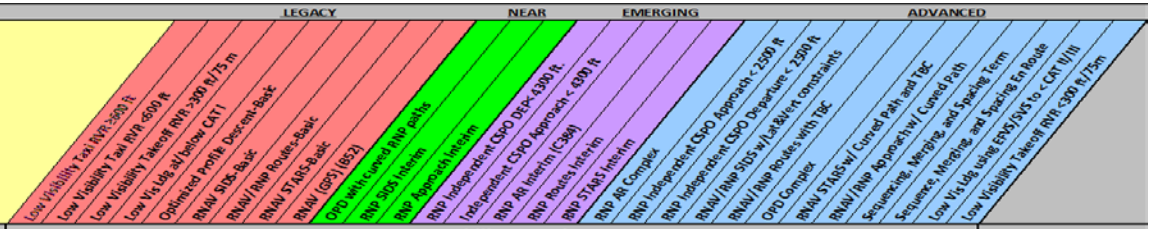
- Comm: Voice, Data Comm, FANS
- Nav: RNAV/RNP < 0.3, WAAS, LPV,
- Surv: ADS-B (Out)
- Display: PFD, ND, CDTI, EFVS
- Trai Mgt: Near Future FMS (30 sec. RTA), A/P, F/D
- Safety: E-TCAS, TAWS

Advanced

- Comm: Voice, Data Comm, ATN
- Nav: RNAV/RNP < 0.1, WAAS LAAS, GLS, LPV, ILS II/III
- Surv: ADS-B (In/Out)
- Display: PFD, ND, CDTI, EFVS, Wake Det
- Trai Mgt: Far Future FMS (10 sec. RTA), FIM, A/P, F/D
- Safety: E-TCAS, TAWS Flight Data Recorders

High-End Business Jet Readiness

United States Business Jet Fleet Capabilities vs. Operations Master List



Manufacturer	Model	No. of A/C
Dassault Aviation	Falcon 7X	47
Gulfstream Aerospace	G500/550	201
Gulfstream Aerospace	G650	25
Learjet	Learjet 70/75	3
Bombardier	BD-700	195
Cessna	Cessna 680 Citation Sovereign	212
Cessna	Cessna 750 Citation 10	249
Hawker Beechcraft	Hawker 4000	34
Eclipse	Eclipse 500	209
Eclipse	Eclipse 550	1
Bombardier	BD-100	273
Embraer	Phenom 100/300	224
Raytheon Aircraft	Premier	175
Gulfstream Aerospace	Gulfstream V/C-37A	140
Gulfstream Aerospace	G150	66
Israel Aircraft Industries	G280	15
Dassault Aviation	Falcon 2000	278
Dassault Aviation	Falcon 50	248
Cessna	Cessna 510 Citation Mustang	240
Raytheon Hawker	Hawker 1000 (PW305Turbofan)	34
Gulfstream Aerospace	G300/350/400 GLF 4	195
Dassault Aviation	Falcon 900	260
Cessna	Cessna 525/A/B/C CitationJet	990
Honda	HondaJet	5
Israel Aircraft Industries	IAI1123/1124	175
Rockwell	Jet Commander	5
Rockwell	Jet Commander B	2
Lockheed	Jetstar	11
Learjet	Learjet 20/30 series	695
Learjet	Learjet 40	79
Learjet	Learjet 45	277
Learjet	Learjet 55	100
Learjet	Learjet 60	251
Grumman	Gulfstream II/B/SP/TT/III/C-20/SP	248
Gulfstream Aerospace	Gulfstream IV/C-20/IVSP	381
Israel Aircraft Industries	G100/200	173
Dassault Aviation	Falcon 10/20/100/200	268
Canadair	CL 600 / 601	224
Bombardier	CL604	180
Bombardier	CL605	74
Mitsubishi Heavy Industries	Diamond 300-1A	46
Cessna	Cessna 560 Citation Ultra	1093
Cessna	Cessna 650 Citation 3/6/7	231
Cessna	Cessna 500/501 Citation	341
Israel Aircraft Industries	Astra	25
Israel Aircraft Industries	Astra SP / SPX	94
Hawker Beechcraft	Beechjet 400 / 400XPR	625
Hawker Beechcraft/Raytheon/Bae	125-800 (TFE-731)	462
Hawker Beechcraft	Hawker 750 / 850XP 900XP	154
North American Aviation Inc	Sabre 40/60/65/75A/80A	113
Morane-Saulnier	MS760-IR	15
Cessna	Cessna 550/S550/551 Citation Bravo	679
Hawker Siddeley	125-1 / -600 (Viper)	30
BAe	125-F600 / 700 (TFE-731)	106
TOTAL AIRCRAFT*		11476

Capability Level

Legend

Capable of performing Operation

Partial Fleet Capability Exist (OEM Effectivity and Retrofit)+A26

Not Currently Configured to Perform Operation

Avionics capability data gathered from public sources. Actual capability requires verification by operator.

*United States Business Jet Fleet data for November 2013.

Capability Required for Operations

Legacy

Comm: Voice Radios

Nav: RNAV-1/2, RNAV (GPS), (LNAV/VNAV) GPS, D/D/I, RVSM, ILS I/II/III

Surv: Mode-S

Display: CDI, HGS, EFVS (CAT I Only)

Traj Mgt: INS, Modern FMS, A/P, F/D

Safety: TCAS, TAWS

Near Term

Comm: Voice Radios

Nav: RNP 0.3 w/ RF Legs WAAS, RVSM, LPV

Surv: Mode-S

Display: PFD, ND

Traj Mgt: Advanced FMS, A/P, F/D

Safety: TCAS, TAWS

Emerging

Comm: Voice, Data Comm, FANS

Nav: RNAV/RNP < 0.3, WAAS, LPV,

Surv: ADS-B (Out)

Display: PFD, ND, CDTI, EFVS

Traj Mgt: Near Future FMS (30 sec. RTA), A/P, F/D

Safety: E-TCAS, TAWS

Advanced

Comm: Voice, Data Comm, ATN

Nav: RNAV/RNP < 0.1, WAAS LAAS, GLS, LPV, ILS II/III

Surv: ADS-B (In/Out)

Display: PFD, ND, CDTI, EFVS, Wake Det

Traj Mgt: Far Future FMS (10 sec. RTA), FIM, A/P, F/D

Safety: E-TCAS, TAWS Flight Data Recorders

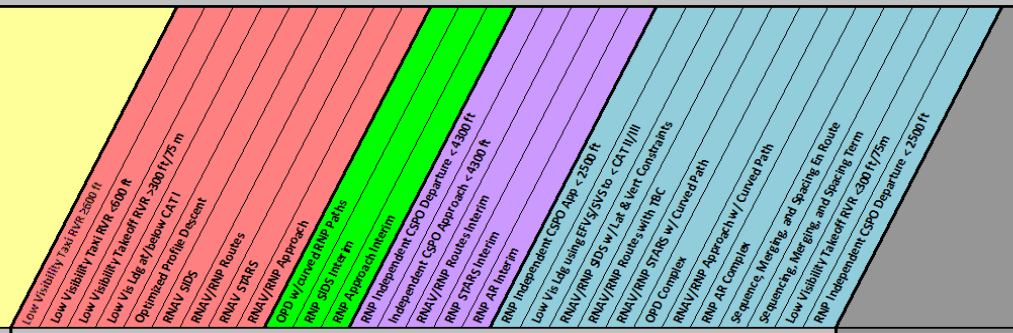
Developed by FAA Air-Ground Team , ANG-D3, Ronald.L.Stroup@faa.gov

NextGen Capabiltiy Delivery

OPERATIONAL TIMEFRAMES	LEGACY	NEAR	MERGING	ADVANCED

NSIP Readiness vs. NextGen Operations
Master DRAFT Ver 1.1

Updated: 11/2/2012
Alignment with the Boeing Equipage OTA Phase III Final Report



Operational Improvements (OI's)	Capability Level
CATM - 105208 - TMI with flight specific trajectories	
CATM - 105302 - Continuous Flight Day Evaluaton	
CATM - 101102 - Full Flight Plan Constraint Evaluation with Feedback	
CATM - 108212 - Management of Special Activity Airspace	
CATM - 103305 - On-Demand NAS Information	
CATM - 105207 - Full Collaborative Decision Making	
CATM - 104208 - Enhanced Departure Flow Operations	
FLEX - 102406 - Full Surface Situation Information	
FLEX - 103207 - Runway Safety Situational Awareness for Controllers	
FLEX - 103208 - Runway Safety Situational Awareness for Pilots	
FLEX - 104207 - Enhanced Surface Traffic Operations	
FLEX - 102140 - Wake Turbulence for Departures	
FLEX - 104124 - Optimized Profile Descent	
FLEX - 107107 - Ground-Based Augmentation System Precision Approaches	
FLEX - 107117 - Low Visibility/Ceiling Approach Operations	
FLEX - 107118 - Low Visibility/Ceiling Landing Operations	
FLEX - 107119 - Expanded Low Vis using Lower RVR Minima	
FLEX - 102154 - Wake Re-categorization	
FLEX - 107202 - Low Visibility Surface Operations	
FLEX - 102144 - Wake Turbulence Mitigation for Arrivals CSPR's	
FLEX - 107115 - Low Visibility/Ceiling Takeoff Operations	
HD - 104209 - Initial Surface Traffic Management	
HD - 104123 - Time Based Metering using RNAV/RNP Route Assignments	
HD - 104117 - Management of Arrival/Surface/Departure Flow Operations	
HD - 102141 - Parallel Runway Operations	
HD - 104122 - Integrated Arrival/Departure Airspace Management	
HD - 104128 - Time-Based Metering in Terminal Environment	
HD - 104208 - Enhanced Departure Flow Operations	
TBO - 104120 - Point in Space Metering	
TBO - 108209 - Increase Capacity/Efficiency using RNAV/RNP	
TBO - 102137 - Automation Support for Separation Management	
TBO - 102108 - Oceanic In-Trail Climb and Descent	
TBO - 104102 - Flexible Entry Time for Oceanic Tracks	
TBO - 102114 - Initial Conflict Resolution Advisory	
TBO - 102118 - Delegated Responsibility for In-Trail Separation	
TBO - 108206 - Flexible Airspace Management	
WX - 103119 - Integration of WX into Automation and Decision-Making	
WX - 103116 - Improved WX Information from non-ground based sensors	
SSE - 109302 - Operational Security Capability	
FAC - 109402 - Remotely Staffed Tower Services	
FAC - 109405 - Business Continuity Services	
104115 - Tactical Management of Flow in the Enroute Arrival/Departures	
107103 - RNAV SIDs/STARs and Approaches	

Acquisition Bandwidth perspective

Legend

- Capability Planned for Alpha
- Capability Planned for Bravo
- Capability Planned for Charlie and Beyond

Notes: The NSIP Alpha, Bravo, and Charlie OI increments were mapped to NextGen Operations based on Required Functions to support the Operations. The OI increments were then assessed to determine if the planned capability is an Enhanced Functions vs. Required Functions for the NextGen Operations. Highlighted Boxes indicate the timeframe for delivery of a NextGen Capability linked to the NextGen Operations.

Capability Required for Operations

Comm: Voice Radios, Automation: HOST, ERAM (Optional), STARS, Nav: GNSS,WAAS, DME, ILS Surv: ASDE-X (Optional), ASR 4/8/9/11, PRM Safety: MSAW, Conflict Alert	Comm; Voice Radios, Automation: HOST/ERAM (Optional), TMA, STARS, ARTS II/IIE, MICROEARTS Nav: GNSS, WAAS, DME, ILS Surv: ASR 4/8/9/11, PRM, ASDE-X TIS-B (Optional) Safety: MSAW, Conflict Alert	Comm: Voice, DC Seg 1 (FANS) Automation: ERAM P3, TAMR CATM WP 3/4,TFDM TBFM WP3 Nav: GNSS, WAAS, LAAS, DME, ILS Surv: ASR 4/8/9/11, PRM-A(MLAT) ASDE-X, TIS-B Safety: MSAW, Enhanced Safety Systems	Comm: Voice, DC Seg 1-2 (ATN) Automation: ENROUTE/TERM AUTOMATION CATM WP 3/4, NG FAR TERM WP Nav: GNSS, WAAS, LAAS, ILS Surv: ASR 4/8/9/11, PRM-A(MLAT) ASDE-X, TIS-B Safety: Integrated Safety Systems

Developed by FAA Air-Ground Team , ANG-D3, Ronald.L.Stroup@faa.gov

Core Airport Capability Readiness

Airports Domain vs. Operations Readiness
Master Ver 1.0
Update: 4.8.2014

Airport	Low Visibility Taxi RVR 1200 ft	Low Visibility Taxi RVR <600 ft	Low Visibility Takeoff RVR >300 ft/75 m	Low Vis Ldg at/below CAT I	Optimized Profile Descent-Basic	RNAV SIDS-Basic	RNAV/RNP Routes-Basic	RNAV STARS-Basic	RNAV/RNP Approach	OPD w/curved RNP Paths	RNP SIDS Interim	RNP Approach Interim	RNP Independent CSPO Departure <4300 ft	Independent CSPO Approach <4300 ft	RNP Routes Interim	RNP STARS Interim	RNP AR Interim	RNP Independent CSPO Departure <2500 ft	Low Vis Ldg using EFVS/SVS to <CAT II/III	RNAV/RNP SIDS w/Lat&Vert constraints	RNAV/RNP Routes with TBC	RNAV STARS w/ Curved Path and TBC	OPD Complex	RNAV/RNP Approach w/ Curved Path	RNP AR Complex	Sequence, Merging, and Spacing En Route	Sequencing, Merging, and Spacing Term	Low Visibility Takeoff RVR <300 ft/75m	RNP Independent CSPO Approach <2500 ft
	LEGACY									NEAR								EMERGING						ADVANCED				
Hartsfield-Jackson Atlanta International (ATL)																												
General Edward Lawrence Logan International (BOS)																												
Baltimore/Washington International Thurgood Marshall (BWI)													N/A	N/A			N/A											N/A
Charlotte/Douglas International (CLT)																												
Washington National (DCA)													N/A	N/A			N/A											N/A
Denver International (DEN)																												
Dallas/Fort Worth International (DFW)													N/A	N/A			N/A											N/A
Detroit Metropolitan Wayne County (DTW)																												
EWR - Newark Liberty International (EWR)													N/A	N/A			N/A											N/A
Fort Lauderdale-Hollywood International (FLL)																												
Honolulu International (HNL)	N/A	N/A	N/A										N/A	N/A			N/A											N/A
Washington Dulles International (IAD)													N/A	N/A			N/A											N/A
George Bush Intercontinental (IAH)																												
John F. Kennedy International (JFK)																												
Las Vegas-McCarran International (LAS)	N/A	N/A	N/A																									
Los Angeles International (LAX)													N/A	N/A			N/A											N/A
LaGuardia (LGA)													N/A	N/A			N/A											N/A
Orlando International (MCO)																												
Midway International (MDW)													N/A	N/A			N/A											N/A
Memphis International (MEM)																												
Miami International (MIA)																												
Minneapolis-St. Paul International (MSP)																												
O'Hare International (ORD)													N/A	N/A			N/A											N/A
Philadelphia International (PHL)																												
Phoenix Sky Harbor International (PHX)	N/A	N/A	N/A																									
San Diego International (SAN)																												
Seattle-Tacoma International (SEA)																												
San Francisco International (SFO)																												
Salt Lake City International (SLC)																												
Tampa International (TPA)																												

Legend

Infrastructure sufficient for NextGen operations

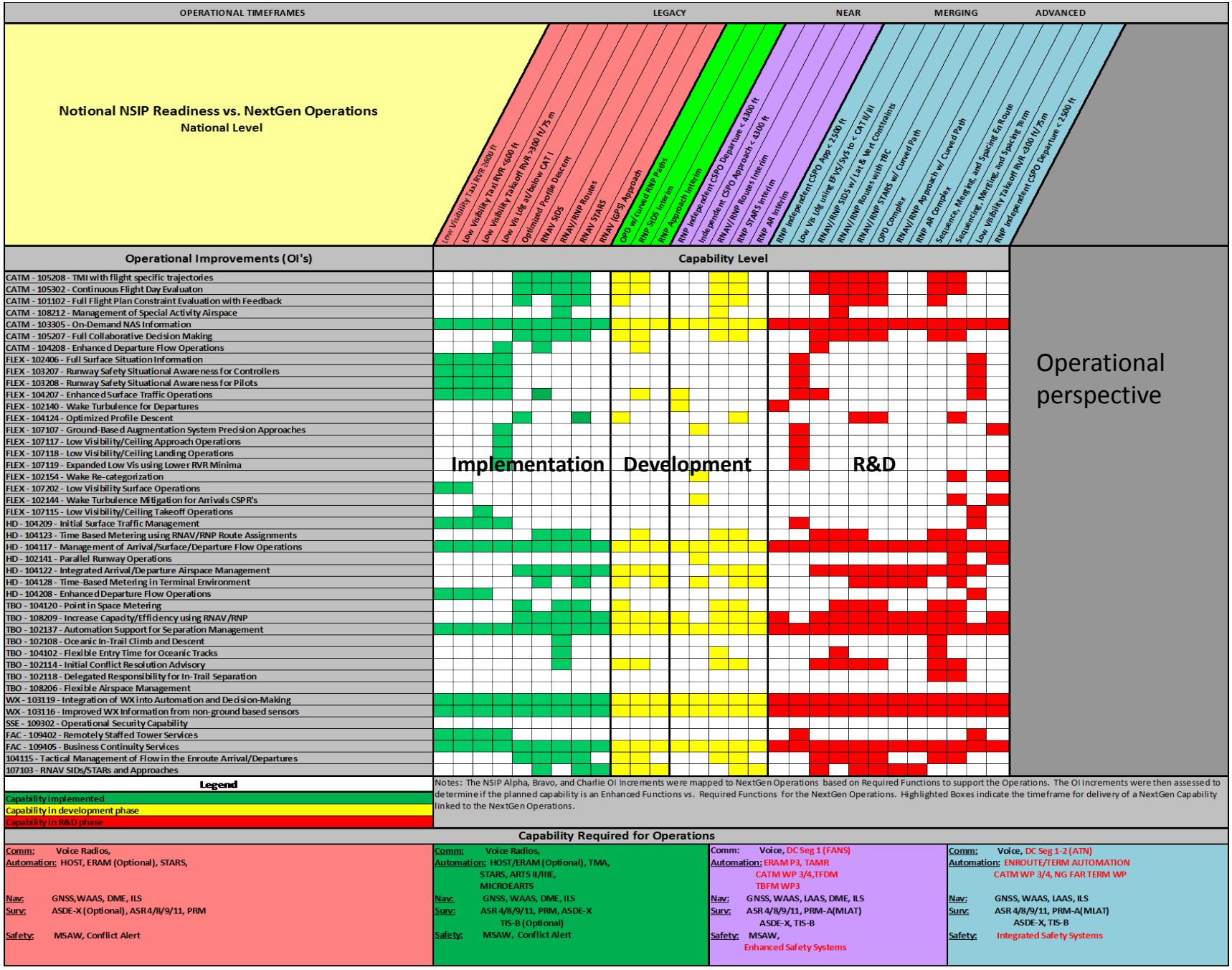
Infrastructure not in place to support operation

NA = CSPO not planned due to current airport configuration

Capability Required for Operations

Legacy	Near Term	Emerging	Advanced
Airport Facilities: SMGCS Plan, RVR, RWY/TWY MARKING Airport Light Systems, RWSL (Optional)	Airport Facilities: A-SMGCS LVL 1, RVR TWY LGT/MARKING, RWSL (Optional) Airport Light Systems	Airport Facilities: A-SMGCS LVL 2, RVR, TWY LGT/MARKING Airport Light Systems, RWSL	Airport Facilities: A-SMGCS LVL3/4, DEVS, RVR TWY LGT/MARKING, RWSL Airport Light Systems

Notional NAS Capability – National Level



Developed by FAA Air-Ground Team , ANG-D3, Ronald.L.Stroup@faa.gov

Aviamatics

Contract: SEATEC

POC: Tim Rider, Peter Morton, John Walker, Gelen Muse, Dr. Katrina Hur

POP: Jan 2010 – July 2010

Early Work –

- SWIM Air

Contract: CSSI

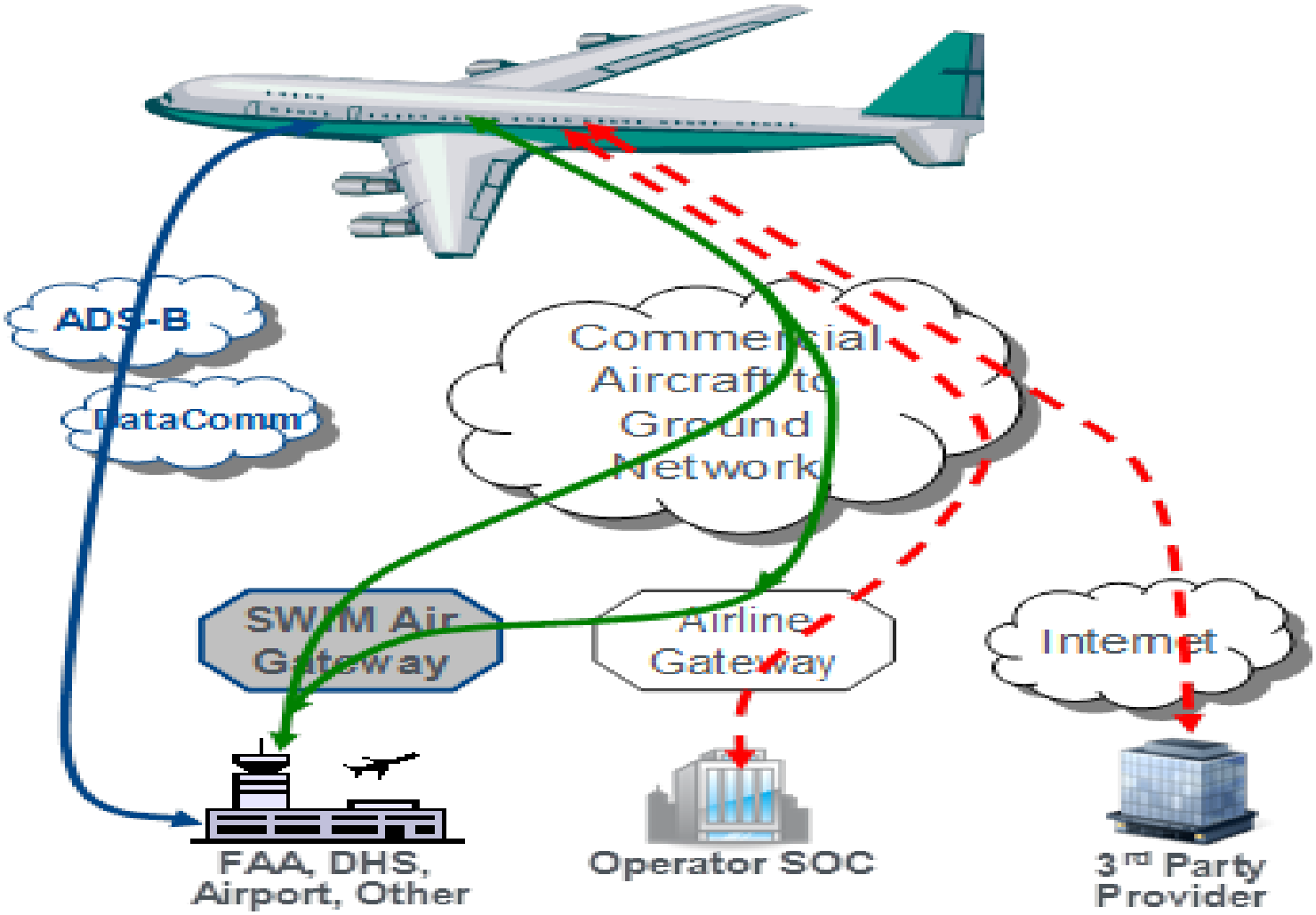
POC: Gary Schaffer, Jerry Whittaker (AvVets LLC)

POP: Oct 2010 – Sept 2015

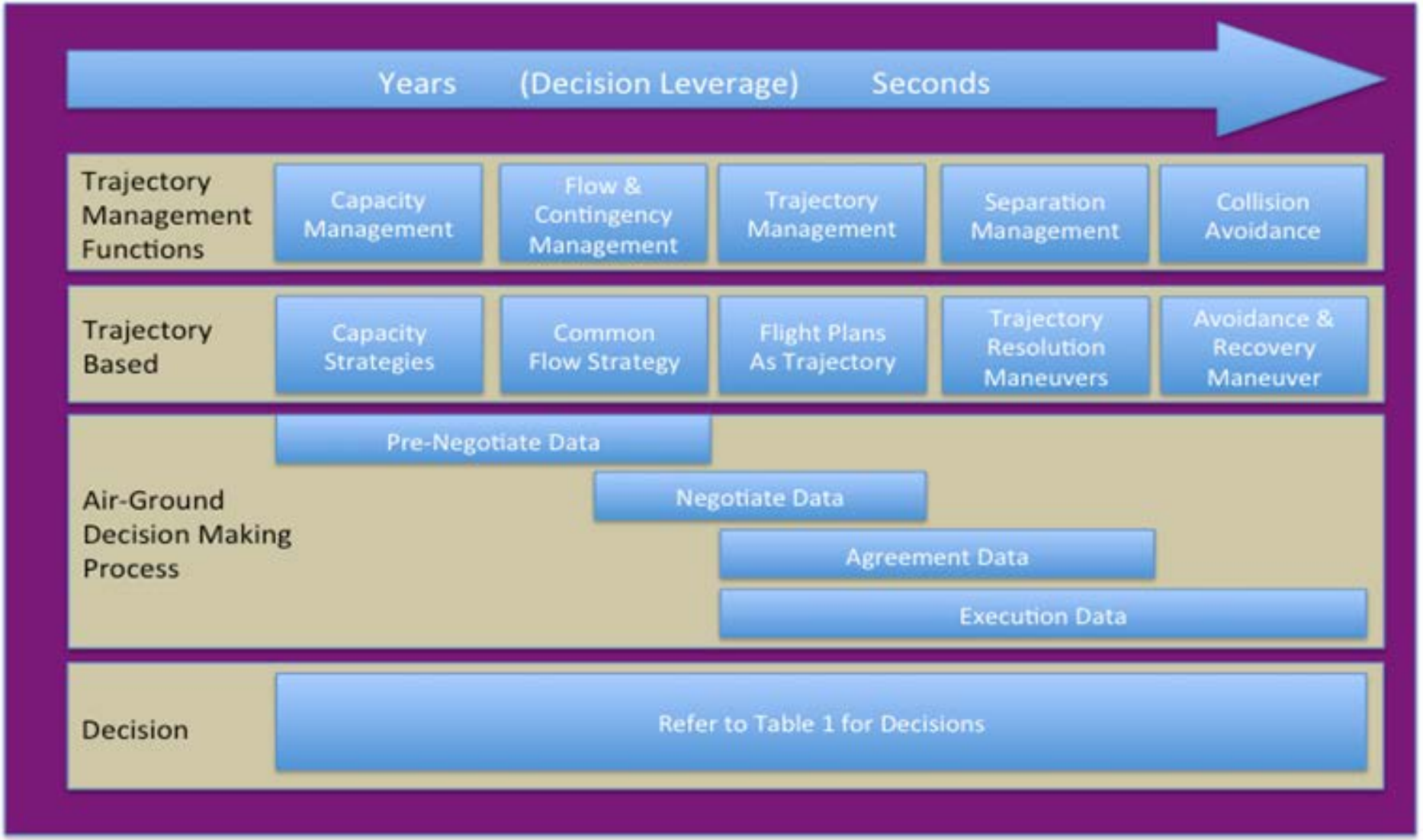
Early Work –

- Link analysis
- Air-Ground Data Exchange Framework

SWIM AIR Scope

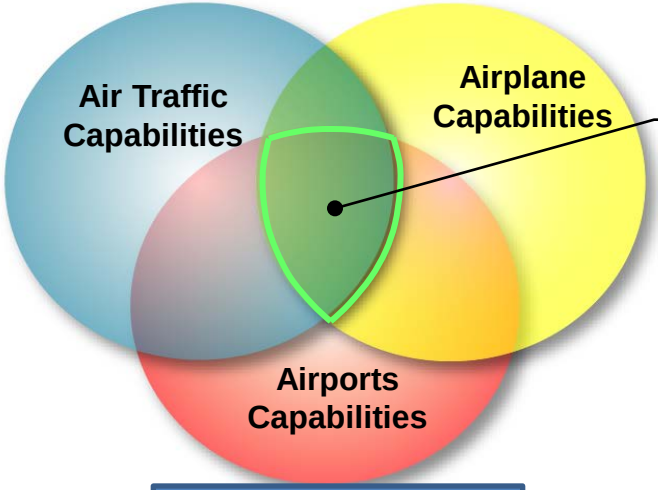


A-G Data Exchange Framework



ATM Functions	Decisions	Required Data Elements
1. Capacity Management	***ANSP****:* 1.) To determine available resources and allocation to meet anticipated demand (i.e. Airspace, Airport, Sector Capacity, Workload, etc.) 2.) To implement Capacity Management initiatives and enhancements to maximize capacity and maintain throughput. ***A/C Operators***: To schedule operations based on operator objectives and available NAS resources and capacity.	• NAS Resources (Airspace, Facilities, Airports, Personnel, etc.) • NAS Capacity & Performance Objectives • Schedules with route information • Constraints (Terrain, Restricted Airspace or SUA's, etc.)
2. Flow & Complexity Management	***ANSP:*** 1.) To develop, implement, and execute Traffic Management Initiatives to maintain throughput. 2.) To determine when to terminate Traffic Management initiatives. ***A/C Operators***: 1.) To request optimal routing for operator goals. 2.) To participate in determining Traffic Management Initiatives and Flow Complexity Management initiatives.	• NAS Capacity (i.e. Airport, Airspace, Runways, etc). • Aircraft flows (i.e. all A/C flight plans, route & intent Information). • Constraints (WX, Terrain, Traffic Congestion Surface & Airborne, Restricted Airspace or SUA's, etc.)
3. Trajectory Execution	***ANSP:*** 1.) To approve or amend the aircrafts requested or intended trajectory based on known constraints or traffic. 2.) To process and forward flight plans. ***A/C Operators:*** 1.) To file or amend a trajectory-based flight plan with ANSP. 2.) To accept ANSP approved flight plans.	• A/C Identification • A/C Performance • Route & intent Information • Constraints (WX, Terrain, Traffic Congestion - Surface & Airborne, restricted Airspace or SUA's, etc.)
4. Separation Management	***ANSP:*** 1.) Is separation maintained in accordance with FAA Order 7110.65 Separation Standards? 2.) Issue / amend Clearances (short-range, long-range) and ensure accuracy. 3.) Issue instructions, traffic alerts, taxi routes, surface advisories, determine sequence (arrival/ departure) 4.) Approve delegated Separation operations. ***A/C Operators***: 1.) Request, accept, or refuse Clearances from ANSP. 2.) Request to amend trajectories from ANSP. 3.) Request and accept delegated separation.	• A/C Identification • Surveillance Data- Surface & Airborne • 7110.65 Separation Standards • All a/c route & intent information • Aircraft performance • Terrain & Airspace Constraints
5. Collision Avoidance Management	***ANSP*** determines a response to an aircraft executing a TCAS RA or TAWS warning. ***A/C Operators:*** The pilot executes TCAS RA or TAWS Instruction and notifies ANSP	• A/C Identification with Intent • Terrain Information • Traffic Information - Surface & Airborne • Surface Obstacles • TCAS RA or TAWS Alert

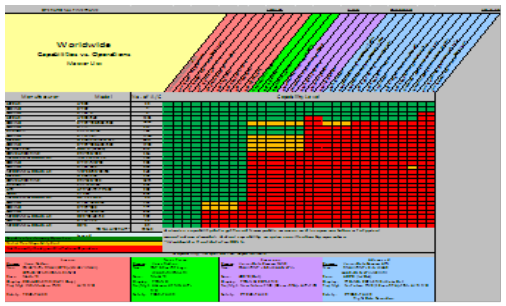
Enterprise Network Enabled Operations



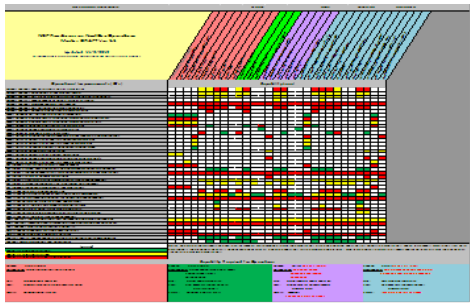
Success *only* occurs here.

Data integration
Big Data
Cloud Computing
Service Oriented Architecture

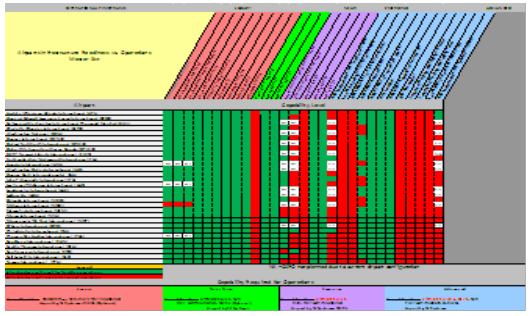
Airline Operations Center | FAA Command Center | Airport Operations Center



Fleet Readiness



NSIP Schedule



Airport Readiness

Aviamatics Final Thoughts

Identify what we (air transportation community) wants to accomplish and what data is needed to support that vision.

Identify current domain capabilities and applicable operational information.

Develop a concept to understand and define how information can be and will be used by the stakeholders.

Recognized the key deficiencies in achieving the goal.

Develop a Roadmap based on proper system-of-system management that leverages SOA and cloud computing and Big Data capabilities.

Controller Aware Capability

Contract: CSSI

POC: Gary Schaffer, Jerry Whittaker (AvVets LLC)

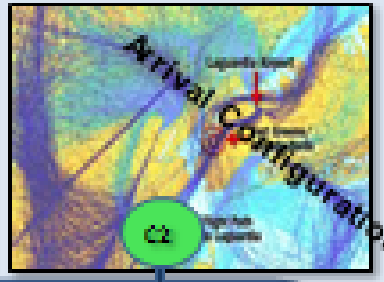
POP: Oct 2010 – Sept 2015

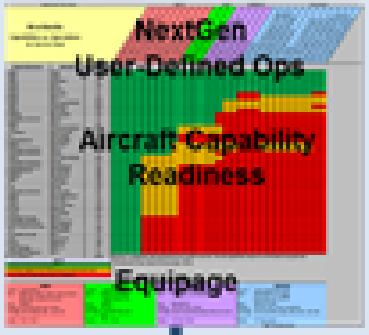
Operational Analysis & Investment Path

	Legacy Operations	Near-term Operations	Emerging Operations	Advanced Operations
Capability	**C-1**	**C-2**	**C3**	**C-4**
Operations	• Low Vis Taxi RVR > 600 ft. • Low Vis Taxi RVR < 600 ft. • Low Vis Takeoff RVR > 300 ft. • Low Vis Landing below Cat I • OPD - Basic • RNAV SIDS - Basic • RNAV STARS - Basic • RNAV(GPS) - Basic • RNAV Routes – Basic	• OPD with curved path • RNAV SID –Interim • RNP Approach-Interim	• RNP Independent CSPO Departure < 4300 ft. • Independent CSPO Approach < 4300 ft. • RNP AR - Interim • RNAV Routes – Interim • RNP STARS - Interim	• RNP AR – Complex • RNP Independent CSPO Approach < 2500 ft. • RNP Independent CSPO Departure < 2500 ft. • RNAV/RNP SIDs w/Lat&Vert constraints • RNAV/RNP Routes with TBC • OPD-Complex • RNAV STARS w/curved path & TBC • RNAV/RNP Approach w/curved path • Term: Merging, Seq. & Spacing • Enroute: Merging, Seq. & Spacing • Low Vis Landing using EFVS < Cat II/III • Low Vis Takeoff RVR < 300 ft.
Airborne Equipage	**Comm**: Voice **Nav**.: RNAV 1 / 2, RNAV(GPS) LNAV/VNAV, GPS, D/D/I, RVSM, ILS I/II/III **Surv**: Mode-S **Display**: CDI, HGS, EFVS (Cat I only) **Traj mgt**.: INS, Modern FMS, A/P, F/D **Safety**: TCAS, TAWS	**Comm**: Voice **Nav**: RNAV/RNP 0.3 w/RF Leg, WAAS,RVSM, LPV, ILS I/II/III **Surv**: Mode-S **Display**: PFD, ND **Traj mgt**.: Advanced FMS, A/P, F/D **Safety**: TCAS, TAWS	**Comm**: Voice, Data Comm/FANS, Date Recorder **Nav**: RNAV/RNP <0.3, WAAS, LPV, ILS I/II/III **Surv**: ADS-B (out) **Display**: PFD, ND, CDTI, EFVS **Traj mgt**.: Near Future FMS (30 sec RTA), A/P, F/D **Safety**: E-TCAS, TAWS	**Comm**: Voice, Data Comm/ATN, Data Recorder **Nav:** RNAV/RNP < 0.1, WAAS, LAAS, GLS, LPV, ILS II/III **Surv**: ADS-B (in/out) **Display**: PFD, ND, CDTI, EFVS, Wake Det. **Traj mgt**.: Far Future FMS (10 sec RTA), FIM, A/P, F/D **Safety**: E-TCAS, TAWS

CAPABILITY- BASED ATM OPERATIONS

Definition:
An aircraft's capability level supports the delivery of ATM services for NextGen user-defined operations which optimizes overall NAS performance.





CAPABILITY LEVELS

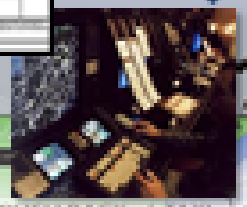
C1 C2 C3 C4

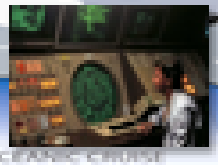
Air Traffic Management Services

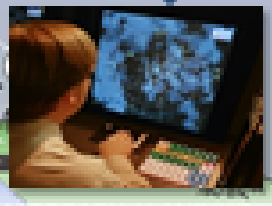
TRAFFIC FLOW MANAGEMENT
AUTOMATION/DECISION SUPPORT TOOLS

TFDM, CATM, ATOP,
ERAM, STARS, ARTS, TAMR

CDM Messaging



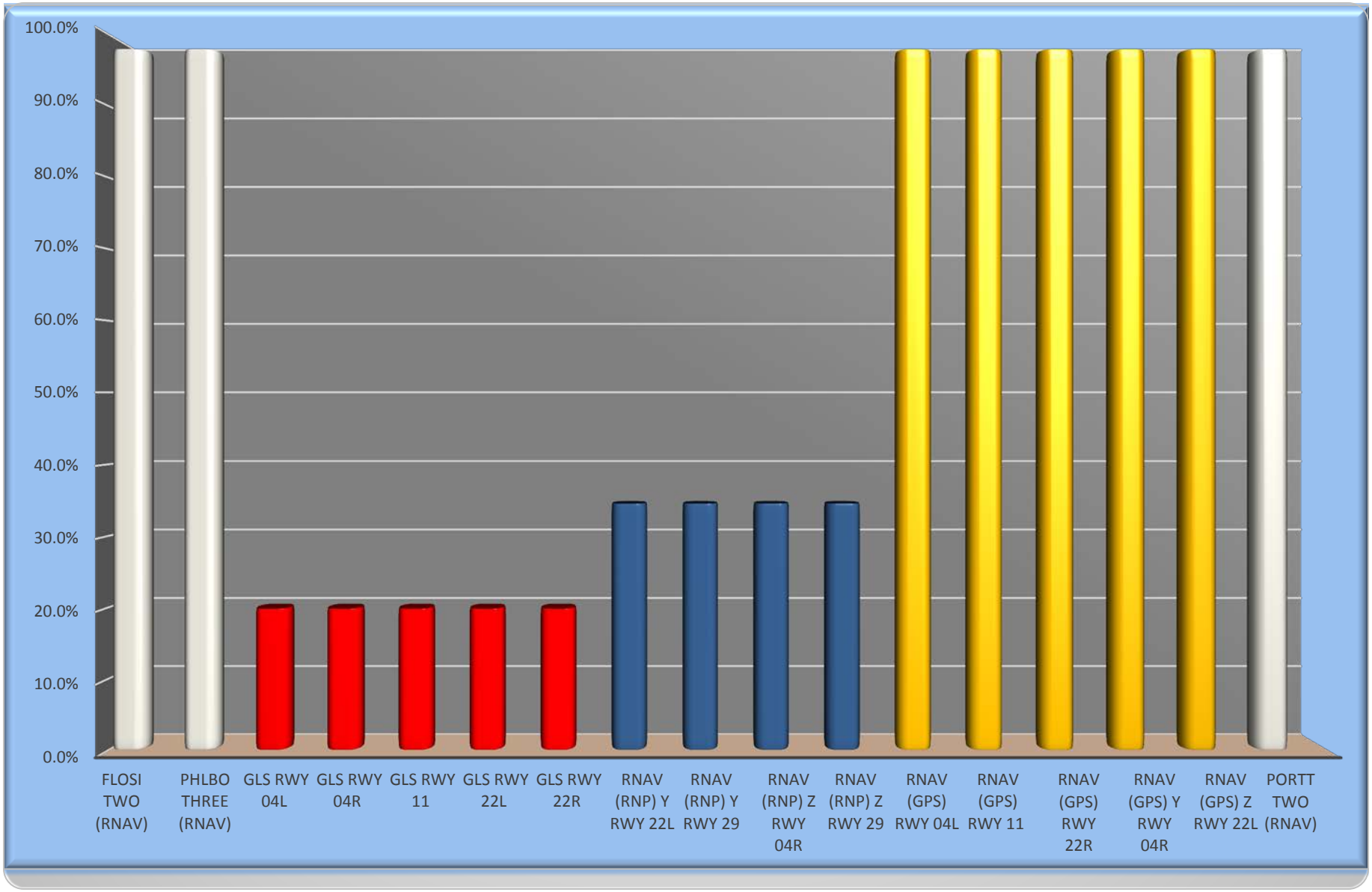


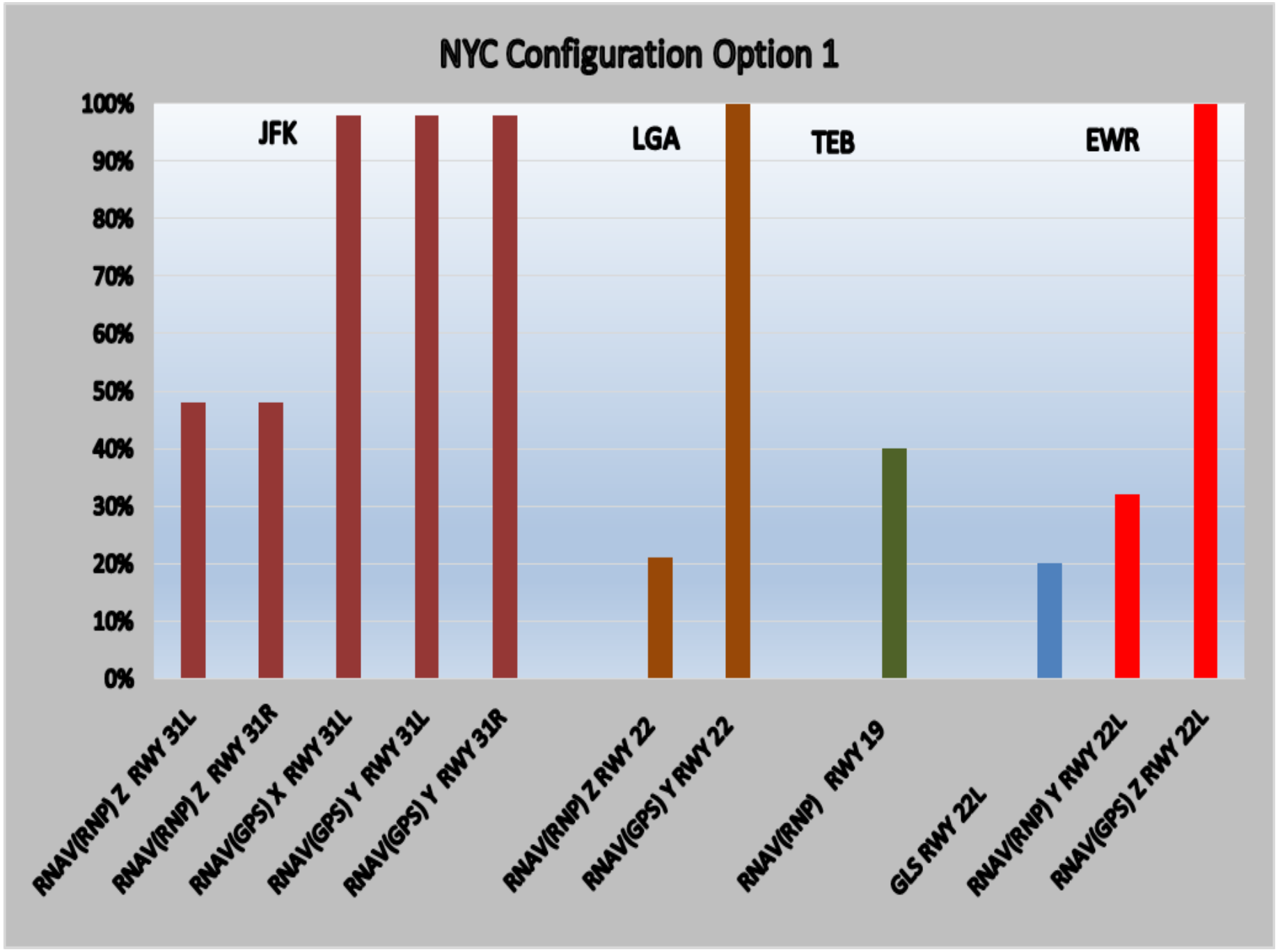


C2 C2 C2

FLIGHT PLANNING PUSH BACK / TAXI DOMESTIC/OCEANIC CRUISE DESCENT FINAL APPROACH / LANDING

EWR


100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
FLOSI TWO (RNAV)
PHLBO THREE (RNAV)
GLS RWY 04L
GLS RWY 04R
GLS RWY 11
GLS RWY 22L
GLS RWY 22R
RNAV (RNP) Y RWY 22L
RNAV (RNP) Y RWY 29
RNAV (RNP) Z RWY 04R
RNAV (RNP) Z RWY 29
RNAV (GPS) RWY 04L
RNAV (GPS) RWY 11
RNAV (GPS) RWY 22R
RNAV (GPS) Y RWY 04R
RNAV (GPS) Z RWY 22L
PORTT TWO (RNAV)


NYC Configuration Option 1
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
JFK
LGA
TEB
EWR
RNAV(RNP) Z RWY 31L
RNAV(RNP) Z RWY 31R
RNAV(GPS) X RWY 31L
RNAV(GPS) Y RWY 31L
RNAV(GPS) Y RWY 31R
RNAV(RNP) Z RWY 22
RNAV(GPS) Y RWY 22
RNAV(RNP) RWY 19
GLS RWY 22L
RNAV(RNP) Y RWY 22L
RNAV(GPS) Z RWY 22L

Trends

Contract: CSSI

- POC: Gary Schaffer, Jerry Whittaker (AvVets LLC)
- POP: Oct 2010 – Sept 2015

NextGen Stakeholder Trends

- Airlines have moved from an increasing market-share to a **maximizing profit** strategy and remain focused on **reducing operating costs**.

- **Stakeholder reluctance to invest – uncertainty** - due to rising fuel prices, emissions regulations, availability of mature technology. Industry is **targeting investments with minimal dependency** on other stakeholders efforts:
  - OEM's designing and building aircraft with composites that are more fuel efficient, environmentally friendly and move D-checks from every 6 yrs. to 10/12 yrs.
  - Terminal upgrades, introduction of passenger entertainment (wi-fi), upgrading of overhead bins to improve customers flying experience (CY12 - $870M)
  - Incorporation of blended-wing and wing-lets designs to improve fuel efficiency by 20%.
  - Rulemaking for runway safety zones and ICAO Emissions Framework will likely drive investments prioritization.

- Airport privatization appears to be evolving. The trend the past couple of decades has been taking on more service contracts, management contracts, and "finance-build-operate-transfer". This will put even more pressure successfully executing a collaborative approach to NextGen as the **airport business case will move away state and local set of criteria to pure privatization criteria**.

- Airlines will find satellite-based in-flight entertainment appealing because they are increasingly **seeking other revenue sources** that will require more broadband bandwidth, including streaming videos, online shopping, booking hotels and local destination coupons. This is a potential opportunity to develop an overall NextGen information exchange concept to share much needed data/information to support emerging and advanced NextGen capabilities.

- SESAR Master Plan which was supposed to be up a running in 2020, **now has a revised date of 2030**. Consolidation of Functional Airspace Blocks has not been completed. The EU has announce a revised plan dubbed SESII+. **Technology is devolving from the center to the edge**, **services are being re-validated and allocated** between central and regional control as Europe recognizes technology as an enabler of **capabilities to support user services and needs**.

- Environmental Market-Based Measures (MBM) will become the driver for aircraft and airline investments. **ICAO will establish MBM limits by 2016 and go into effect in 2020**. Operators will seek to **reduce environmental footprint** (noise, emissions, and fuel burn) below the limits to secure credits. Some **credits will be banked** to offset older fleet operations until newer replacements and some **credits will be sold** to add a new revenue source.

Enterprise Risks

Contract: Volpe – PDA Associates

POC: Paul Abramson

POP: 2010 – 2011

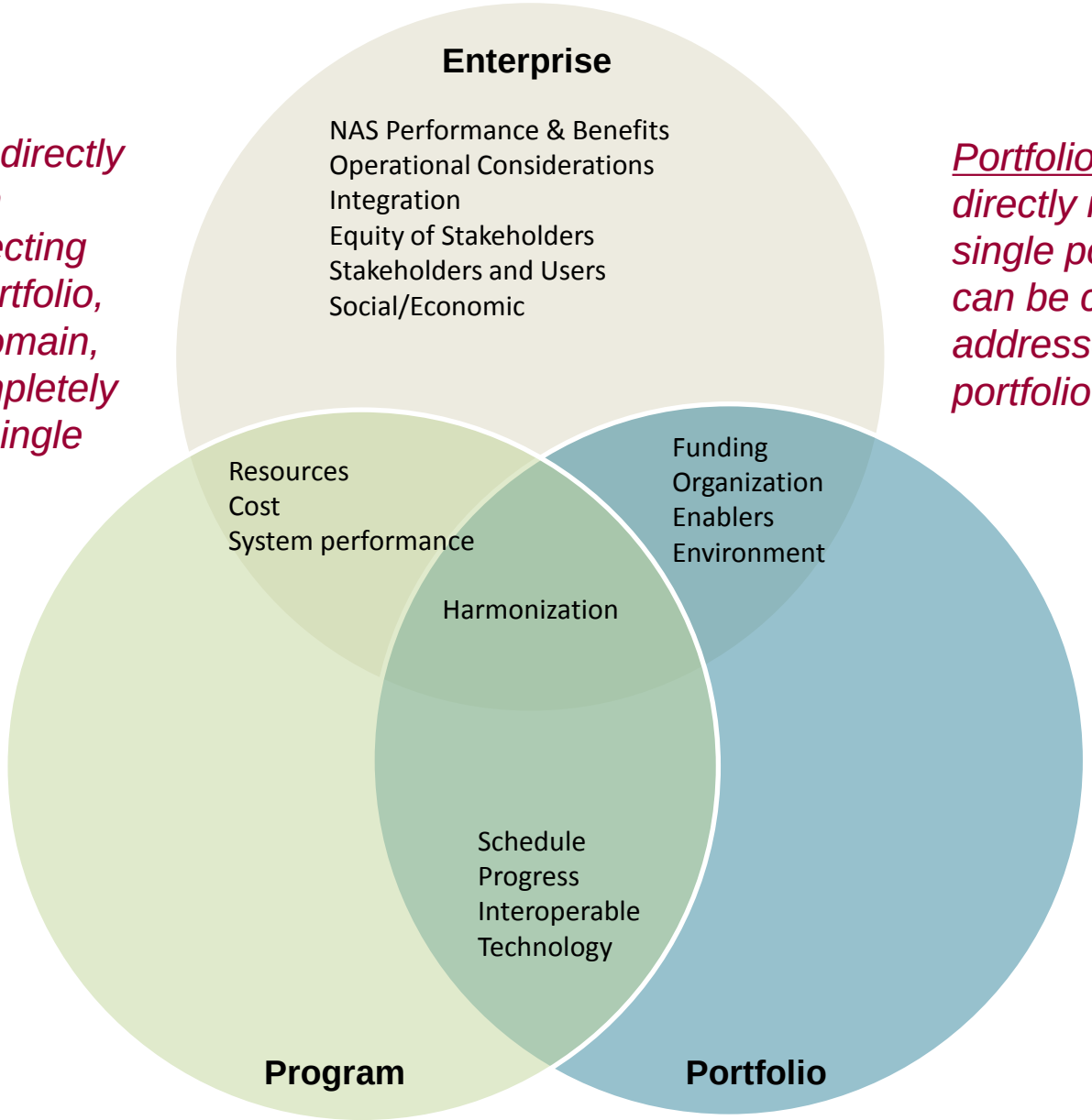
Contract: BAH

POC: Jay Pollack

POP: 2012 - 2013

Risk Category Alignment

<u>Summary Risks</u> -directly impacts NextGen objectives by affecting more that one portfolio, or program, or domain, or cannot be completely addressed by a single organization.



<u>Portfolio Risks</u> - directly impacts a single portfolio and can be completely addressed by one portfolio team.

Key Challenges- Mitigation 1

Challenge	Mitigation
ERAM - (NextGen, Safety) - This is critical to get in place with the right functionality and performance level for current operations, NextGen and Safety. ERAM needs to provide the baseline capability currently in "HOST" and mitigate "HOST" deficiencies before we can look at adding new capability for NextGen. However, it is important to understand the needed NextGen capabilities so Automation can evolve in a cost effective manner.	• Develop a get-healthy plan to provide the core functionality to maintain current operational performance. • Identify core emerging and advanced functionality needed to meet NextGen performance targets and allocation across the air transportation domains (Aircraft, Airspace, Air Traffic, and Airports). • Develop and execute the automation modernization plan to align with operational stakeholders needs
Standards - (NextGen, Safety) - To date standards have been federated among systems and domains. Development of cross domain standards (air and ground systems) would ensure complementary capabilities are aligned across the domains.	• Work with Govt-Industry standards bodies to close the gap and define capability requirements • Update NextGen standards gap analysis (Navigation, Communications, Surveillance, Automation, and Safety) to meet NextGen capability performance targets. • Allocate capability requirements across the domains.

Key Challenges- Mitigation 2

Challenge	Mitigation
Enterprise Integration -(NextGen, Safety) - In development of the NextGen strategy, focus was placed on technology (equipage based) driving future capabilities of the NAS. In retrospect, a more functional/operations based approach could align cross organizational readiness for NextGen capabilities. This will provide a pathway to transform the NAS and takes into account the entire air transportation communities perspective. It also allows for natural market forces to drive equipage rather than new rules.	• Conduct trade-space to identify supporting capabilities and enabling technology candidates • Apply comprehensive and balanced programmatic, financial, and systems engineering best practices to NextGen implementation. • Work with Govt-Industry to update and validate Operational Capabilities analysis that aligns NextGen operational improvements along the operational stakeholders needs as opposed to acquisition bandwidth. • Update and validate operational implementation plans for metroplex and individual facilities
Organizational Optimization - (NextGen, Safety) - Define clear and concise set of roles and responsibilities across the FAA to support the planning, development, operations, and sustainment of services to our operational stakeholders. We have become focused on each organizational elements becoming self-sufficient leading to duplication of efforts. In the current environment we are spending too much effort responding to the IG and GAO as opposed to defining our work to meet the needs of operational stakeholders.	• Develop a services implementation roadmap defining the inputs, processes, and outputs for each organizational element. This will provide roles and responsibilities, scope, interdependencies of each of the organizational team members to delivering services to our air transportation operational stakeholders. • Define the knowledge, skills and experience (KSE's) needed to support each of the organizational elements and identify the knowledge, skills and experience of FAA personnel to align personnel and organizational KSE's

Key Challenges- Mitigation 3

Challenge	Mitigation
APNT - NextGen's capabilities and GPS vulnerabilities remain a critical risk. There is no clear data to determine if the current FAA alternatives meet the minimum level of functionality and performance needed to minimize the operational impact of a GPS outage that would affect data communications, ADS-B, and PBN enabling technologies. There appears to be a disconnect between what our international partners and other government agencies are either doing or considering.	• The legislation passed by the House authorizes DHS to partner with public or private entities to build a system that would not only backup GPS, but also work indoors, underground and underwater — all characteristics of long-wave Loran technology. • The FAA needs to determine what PNT performance level can be achieved by the current alternatives under consideration and if the impact is sufficient to maintain air transportation operations
PBN Baseline - Currently there is a gap between operational stakeholder needs and NextGen efforts resulting in limited to no value to the air transportation community. This gap results from OI Increments having no common context to drive complementary capability functions and performance levels across the domains.	• Recommends the establishment of a baseline PBN performance level for each phase of flight: Oceanic RNP Routes – RNP 4.0; Arrivals RNAV STAR – RNAV 1.0; Approach RNAV (GPS) – RNP 1.0 / RNP 0.3; Departures RNAV SID – RNAV 1.0; En route RNAV Routes – RNAV 2.0 • PBN procedures being implemented at an airport or metroplex location should focus on procedures aligned with the predominate airport runway operating configuration; the performance level required by the procedure should align with the locations fleet performance level; the procedures if not being implemented as part of a complete airspace re-design effort should complement local operating rules, constraints and LOA's; the procedures should have minimums equal to or better than existing procedures.

Key Challenges- Mitigation 4

Challenge	Mitigation
Environmental Footprint - ICAO is working on Market-based Measures (MBM) due to be published in 2016 and go into effect in 2020. NextGen will continue to compete for operational stakeholder investment funding. NextGen and its enabling technologies have been associated with capacity and efficiency benefits. Many of the NextGen enabling technologies are optional equipment as opposed to baseline equipment (ADS-B In – Interval management, visual separation, surface, ITP) to support current and near-future operations and their benefits. Airlines with a footprint below ICAO's standard could see this as a potential revenue stream and supporting a strong business case.	• Identify NextGen operations and associated domain enabling factors that would provide a reduction in the environmental (noise, emissions, fuel burn) footprint for aviation. • The ANSP's can enable environmentally friendly operational capabilities (continuous climb from destination, issuing flight trajectories before pushback, transiting military training areas, block flight levels, direct routing to destination, and continuous descent to destination). These types of ANSP capabilities correspond to Q and T routes, 30-30 Oceanic operations, and RNAV STAR (OPDs). • See the Air-Ground Teams Quick Look Report on Leveraging NextGen to enable a reduction in the Environmental Footprint of Aviation.

Accomplishments

2010

- SWIM Program is targeting SWIM Air Conops for segment 3.
- ICAO/IATA interested in combining forces to share data that links operations to equipage to support data-driven decision-making.

2011

- ICAO Global CNS Block Upgrade proposes a suite of technologies to support user needs that leverages latent capabilities while providing a transition plan to introduce new capabilities

2012

- Provided NY and Grand Metroplex analysis to airports to support NY capacity study
- NextGen incorporating Airports planning into NSIP
- SESAR ATM Master Plan breaks down by aircraft/ANSP/airports

2013

- Equipage-aware TFM Conops has incorporated our capability-based operations and scenarios into the latest draft Conops to support CATM WP2 and WP3
- FAA looking at NextGen rulemaking a suite of technologies aligned with OEM timelines
- BEBS Workplan on JFK and MDW
- APO Strategic Policy issues were derived from the A-G roadmap

2014

- IATA looking at regional fleet capability and have asked for our data. Sent them world-wide, domestic and Atlanta fleet readiness sheets
- DOT Transportation Research Board asking for more information on domain readiness to align R&D with needs.
- NASEA looking to incorporate other domain dependencies into EA.

Funding Issues

- Operations-based Team (CSSI)
  - SME's
    - Controller (tracon, tower)
    - Pilot/Engineer (Commercial, Business, GA)
    - Airport planner (Federal Employee)
- Funding depletion: Approximately Sept 2014
- Outreach Support – Conferences and meetings

Acronyms

- ADS-B – Automatic Dependent Surveillance Broadcast
- AGT – Air Grount Team
- ATC– Air Traffic Control
- EUROCAE – European body to develop aviation technical standards
- GA – General Aviation
- ICAO – International Civil Aviation Organization
- MOC – Metroplex Operational Capability
- NAC – NextGen Advisory Committee
- NAS – National Airspace System
- NextGen – Next Generation Air Transportation System
- NOC – National Operational Capability
- OI – Operational Improvement
- OPD – Optimized Profile Descent
- R&D – Research and Development
- RNAV/RNP – Area Navigation/Required Navigation Performance
- SESAR – Single European Sky Air Traffic Management Research
- USG – United States Government