



Boeing Airspace Operational Design Update

China – U.S. Aviation New Technology Workshop

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Topics

- Airspace Operational Design (AOD) Description
- Near-Term: Technology and Operations Trends
- Mid-Term: Technology and Operations Trends
- AOD: Examples of Applying Technology to Improve Operations

Airspace Operational Design (AOD) Description

What the AOD is: Timeline

Boeing Commercial Airplanes (BCA) developed the AOD as a blueprint for making airplane upgrades and improving airspace and airport operations

2008 – 2012
Near-Term



AOD V1.5

2013 – 2018
Mid-Term



AOD V2.1



Why the AOD was Created

- Support Boeing's efforts to accelerate the modernization of air traffic management operations
- Improve airspace capacity, safety, and efficiency, and reduce environmental impact for air traffic operations



How the AOD will be Implemented

Boeing will implement a single-focused plan by working with key industry stakeholders

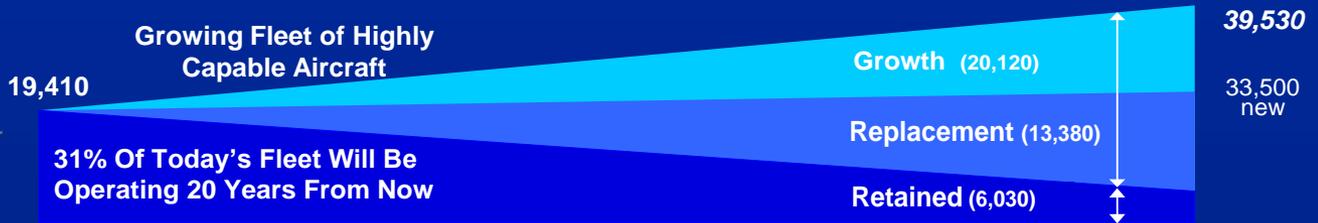




Air Transportation System Roadmap

2010 2015 2020 2025 2030

Airplane Population

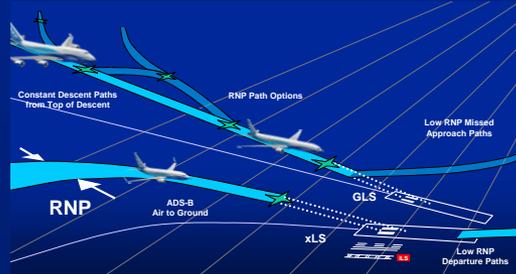


Airspace Operations

Manual ATC Intervention, Control by Radar & Navaid



Pre-Defined Performance Based Airspace



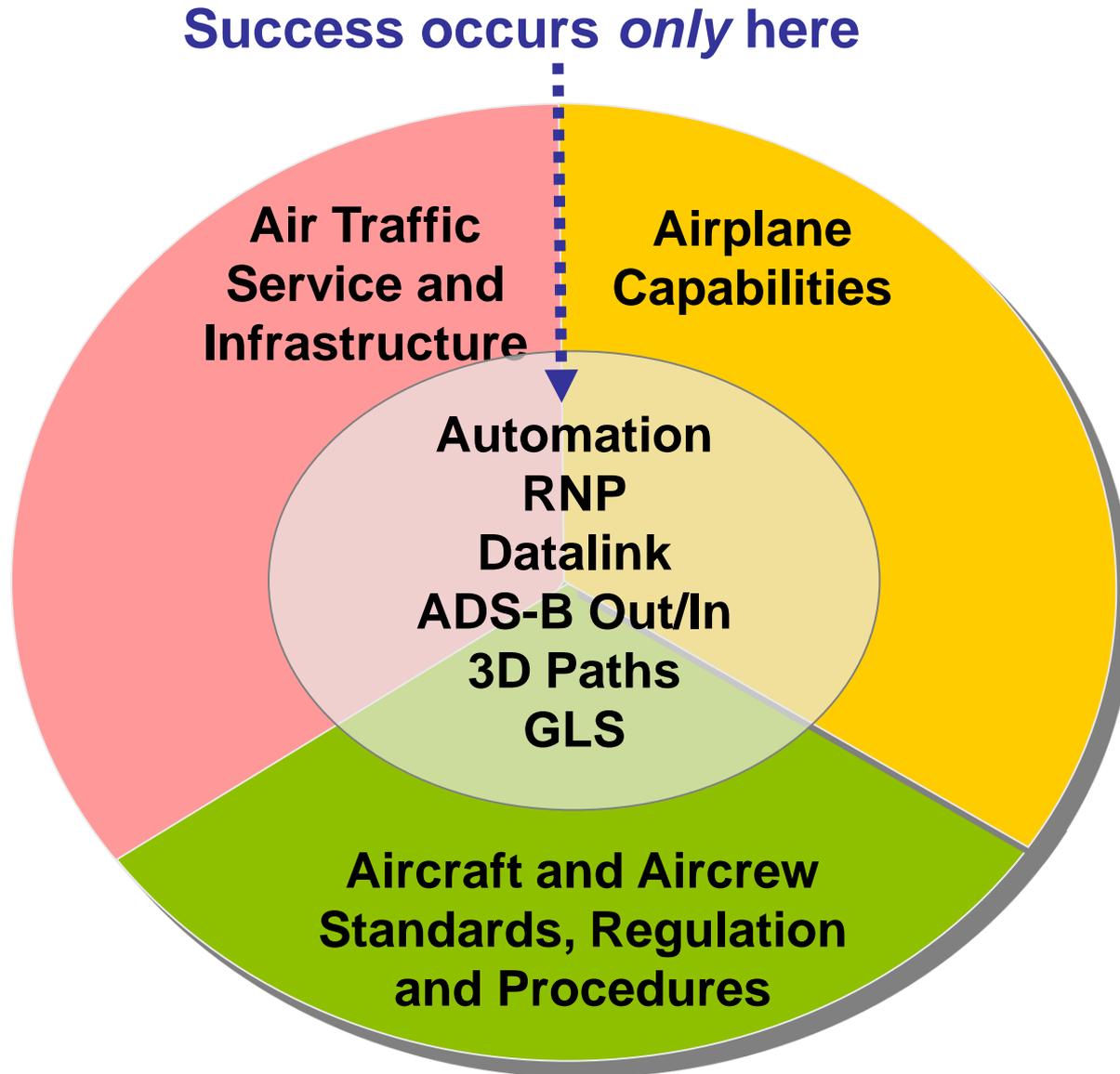
Dynamic Performance Based Airspace



Key Capabilities

ATM Automation	Time-Based Arrivals	TRACON RPI	Extended TBFM				
	Conflict Detection	Arr/Dep/Surf Data Integration	Time-based RNP/RNAV Arrivals	Surface Tool	Departure Tool	4D Trajectory Negotiation Tool	
Communication		Link 2000+		TRACON TBFM			
Analog Voice	FANS-1	FANS-2		FANS-3			
ACARS	ATN	Oceanic RCP		Continental RCP			
		Polar SATCOM	Broadband IP	Digital Voice	Future Subnetworks		
Navigation		GLS Cat I	GLS Cat III	Multi Freq / Constellation GNSS		Global Cat I from Space	
	RNP	RNP AR		Expanded Windfield	Advanced RTA		
Full Profile RTA	AMM	ORE Indication	EVS/SVS	Graphical WX	Graphical Taxi	GNSS Backup System	
Surveillance	Extended Squitter	ADS-B In/CDTI	Spacing	ACAS/ADS-B Integration			Self Separation
	ADS-C	ACAS 7.1		SURF IA	Adv ADS-C		
Prim / Sec Radar		ADS-B Out DO260B		Delegated Separation			
System Wide Information Management			Adv Inter-Facility Coord		Shared Trajectory & Surveillance Info		
OLDI	ETMS	AIDC	RADNET	Aero/Met Info			

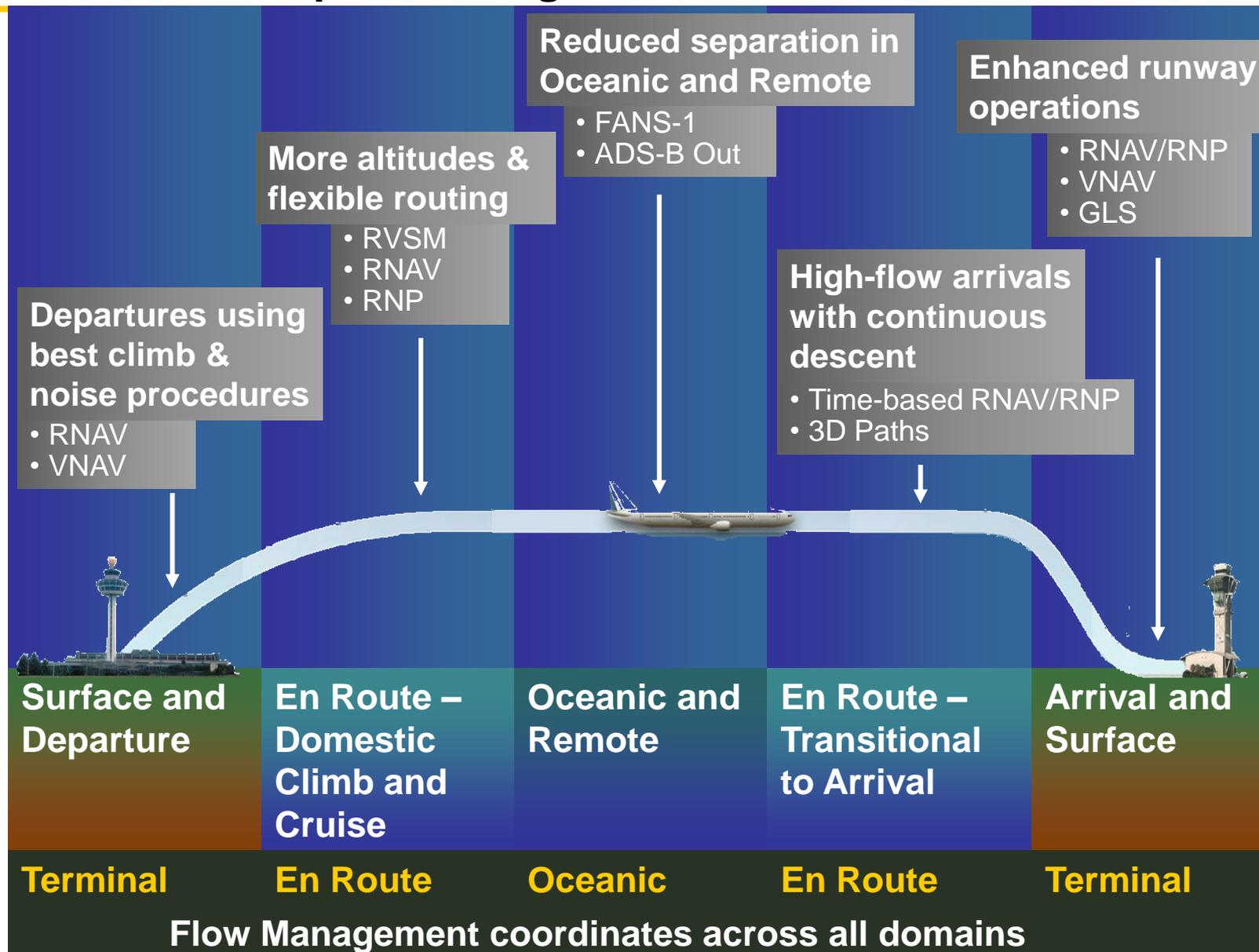
What Success Looks Like



Near Term

Technology and
Operations Trends

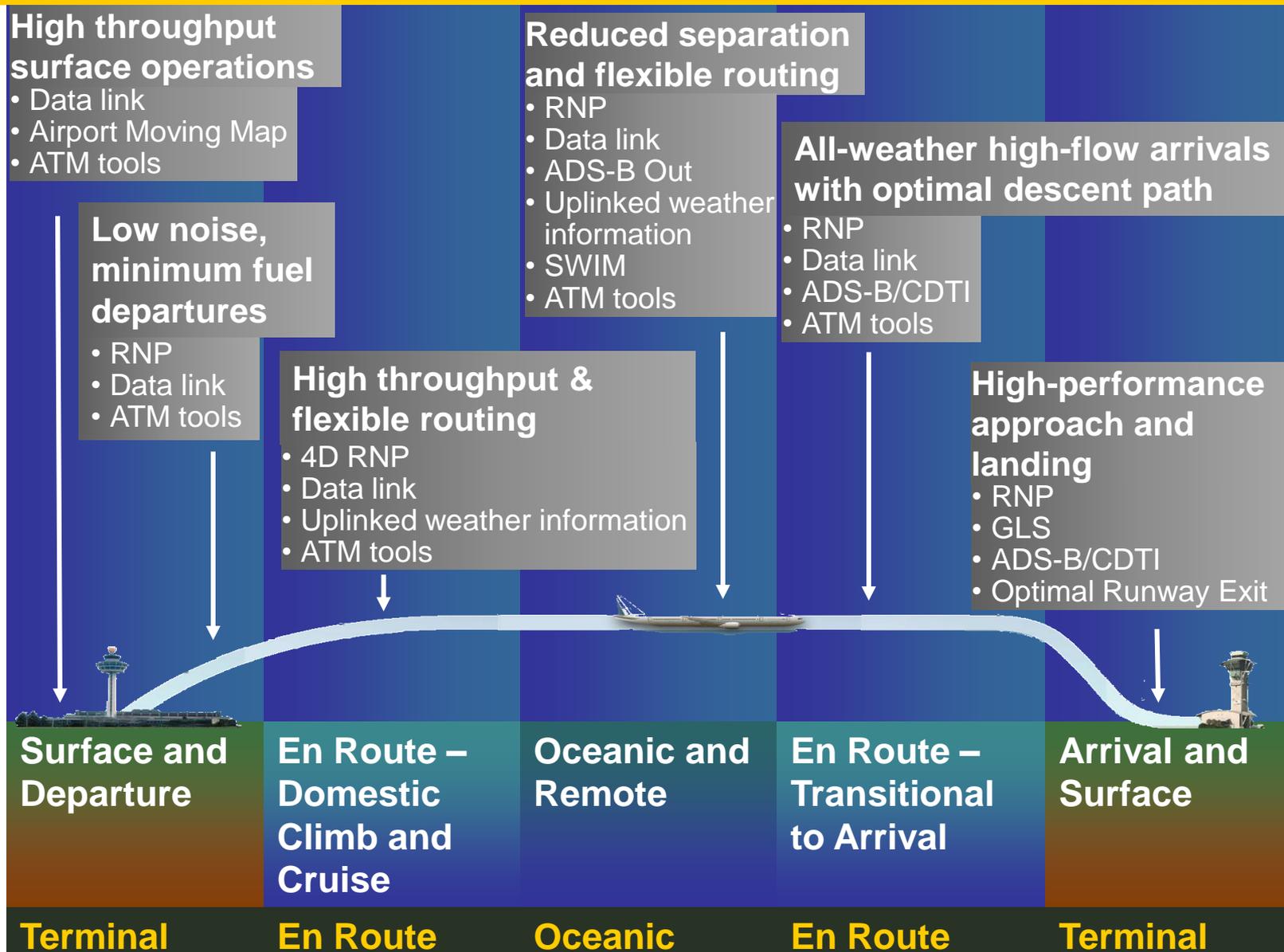
Near-term trends for each phase of flight



Mid-Term

Technology and Operations Trends

Mid-term trends for each phase of flight



AOD

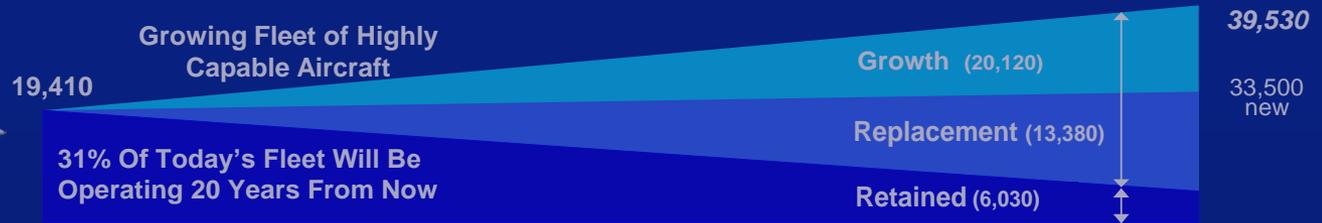
Examples of Applying Technology to Improve Operations



Air Transportation System Roadmap

2010 2015 2020 2025 2030

Airplane Population



Growing Fleet of Highly Capable Aircraft

19,410

31% Of Today's Fleet Will Be Operating 20 Years From Now

Growth (20,120)

Replacement (13,380)

Retained (6,030)

39,530

33,500 new

Airspace Operations

Manual ATC Intervention, Control by Radar & Navaid

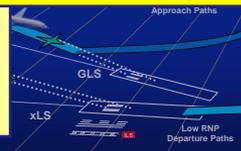


Pre-Defined Performance Based Airspace



5nm Spacing With ADS-B Out (Non-Radar Airspace)

3nm Spacing With ADS-B Out (Radar Airspace)



Dynamic Performance Based Airspace



Key Capabilities

ATM Automation

Time-Based TRACON RPI

Extended TBFM

Surveillance Data Processing & Display of Radar & ADS-B

Time-based RNP/RNAV Arrivals

Surface Tool

Departure Tool

4D Trajectory Negotiation Tool

Conf

Integration Conflict Resolution

4D Conflict Resolution

Communication

Analog Voice

FANS-1

Link 2000+

FANS-2

FANS-3

ACARS

ATN

Oceanic RCP

Polar SATCOM

Broadband IP

Digital Voice

Future Subnetworks

Navigation

RNP

GLS Cat I

GLS Cat III

Multi Freq / Constellation GNSS

Global Cat I from Space

Full Profile RTA

AMM

RNP AR

Expanded Windfield

Advanced RTA

Prim / Sec Radar

ADS-C

ACAS 7.1

ADS-B Out DO260B

ORE Indication

EVS/SVS

ORE Active

GNSS Backup System

Surveillance

Extended Squitter

ADS-B In/CDTI

Spacing

ACAS/ADS-B Integration

Self Separation

System Wide Information Management

OLDI

ETMS

AIDC

RADNET

Adv Inter-Facility Coord

Aero/Met Info

Shared Trajectory & Surveillance Info

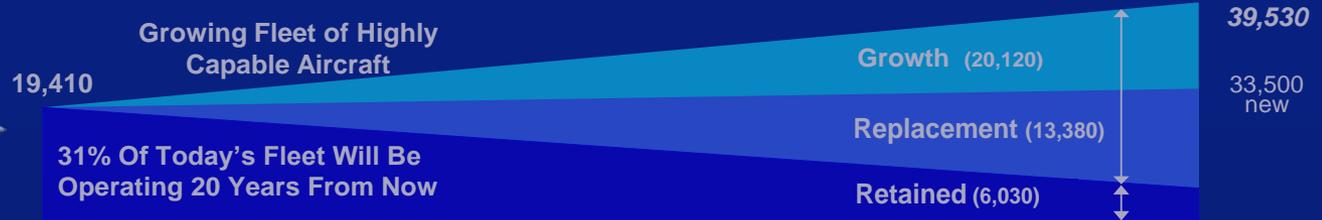
R9.1



Air Transportation System Roadmap

2010 2015 2020 2025 2030

Airplane Population



Airspace Operations

Manual ATC Intervention, Control by Radar & Navaid



Pre-Defined Performance Based Airspace



High-flow arrivals with continuous descent

Dynamic Performance Based Airspace

Complex high-flow arrivals with continuous descent



Key Capabilities

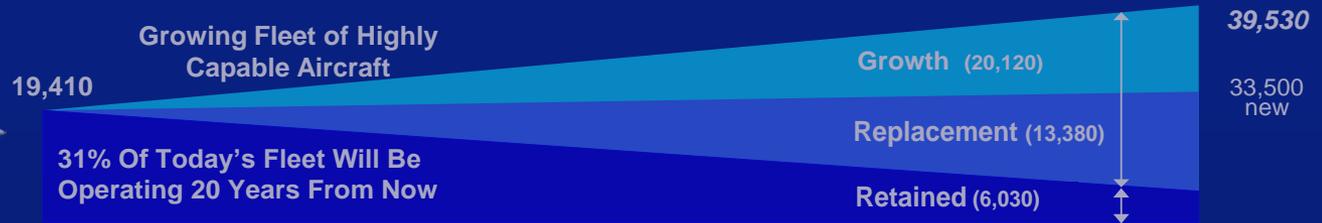
ATM Automation	Time-Based Arrivals	TRACON TBM	Extended TBFM	Surface Tool	Departure Tool	4D Trajectory Negotiation Tool	
	Conflict Detection	Time-based RNP/RNAV Arrivals	TRACON TBFM	Arr/Dep/Sum Data Integration	Conflict Resolution	4D Conflict Resolution	
Communication	Analog Voice	FANS-1	Link 2000+	FANS-2	FANS-3	Continental RCP	
	ACARS	ATN	Polar SATCOM	Oceanic RCP	Broadband IP	Digital Voice	Future Subnetworks
Navigation	RNAV	RNP	GLS Cat I	RNP AR	GLS Cat III	Multi Freq / Constellation GNSS	Global Cat I from Space
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					Aero/Met Info		



Air Transportation System Roadmap

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Airplane Population



Growing Fleet of Highly Capable Aircraft

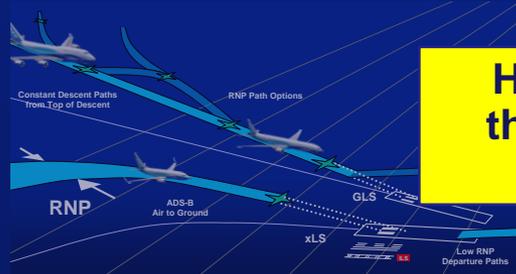
31% Of Today's Fleet Will Be Operating 20 Years From Now

Airspace Operations

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Pre-Defined Performance Based Airspace



Dynamic Performance Based Airspace



High surface throughput & efficiency

Key Capabilities

ATM Automation	Time-Based Arrivals	TRACON RPI	Extended TBFM	Surface Tool	Departure Tool	4D Trajectory Negotiation Tool
Conflict Detection		Arr/Dep/Surf Data Integration	Time-based RNP/RNAV Arrival			4D Conflict Resolution
Communication	FANS-1	Link 2000+	FANS-2	FANS-3	Continental RCP	
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OLDI ETMS AIDC RADNET						

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Key Points

- The AOD is divided into Near-Term and Mid-Term sections, containing descriptions of technology that can be implemented now **and** later.
- Depending on their individual situation and requirements, countries may implement the Boeing Airspace Operational Design differently.
- When considering using technologies to modernize airspace, it is best to choose which technology to use based on real operational requirements and benefits and not just because the technology is new.
- Benefits of new technology include:
 - Increased safety and airspace and airport capacity.
 - Reductions in noise, fuel usage, CO₂ emissions, flight times, and flight delays.