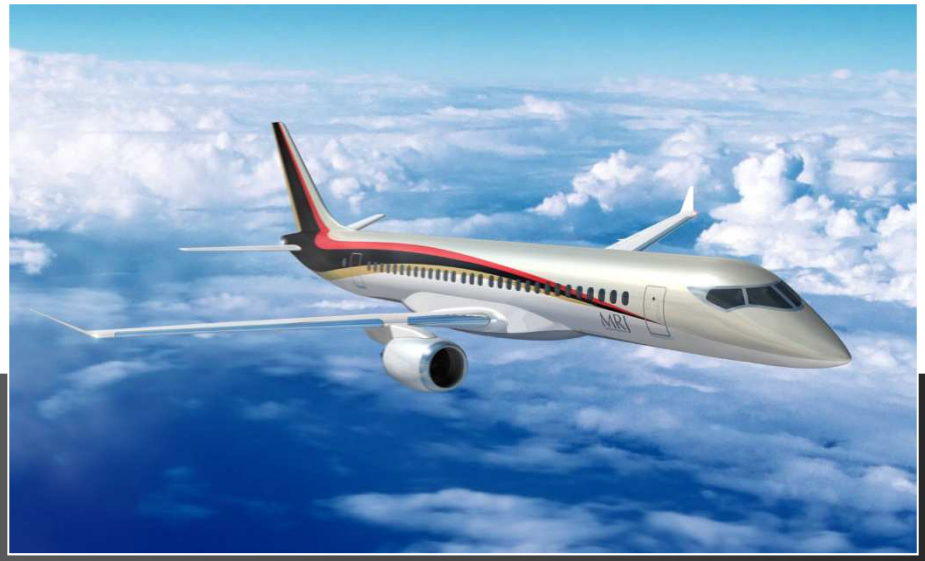
MRJ Features and Navigation Perspective



February 19, 2013

MRJ
Mitsubishi Regional Jet

MITSUBISHI AIRCRAFT CORPORATION

Information in this report is PROPRIETARY to Mitsubishi Aircraft Corp.
This report must not be reproduced or distributed in whole or in part to a third party without prior express permission in writing from Mitsubishi Aircraft Corp.

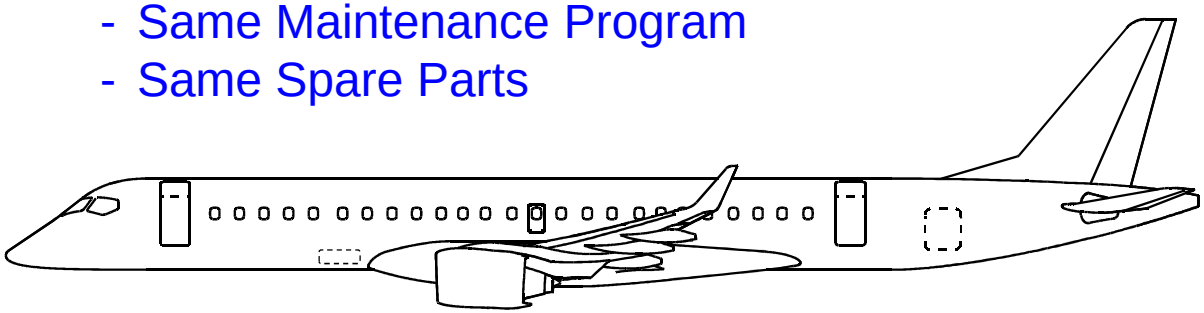
Contents

MRJ Family

- Benefits of Commonality
  - Same Pilot Type Rating
  - Same Engines
  - Same Maintenance Program
  - Same Spare Parts

MRJ100X (Plan)

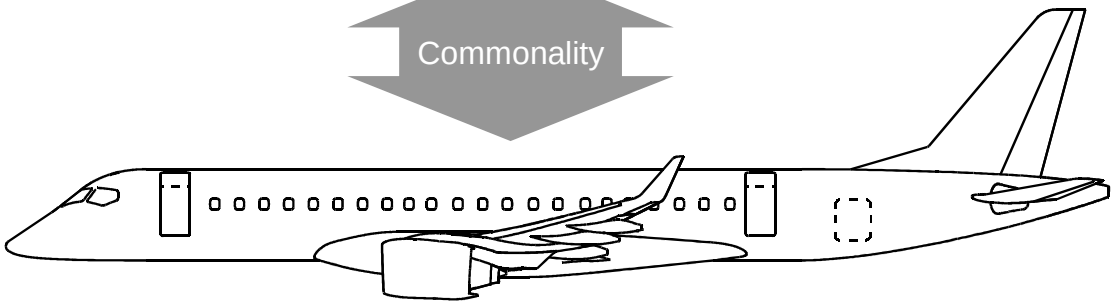
100 seats



Commonality

MRJ90

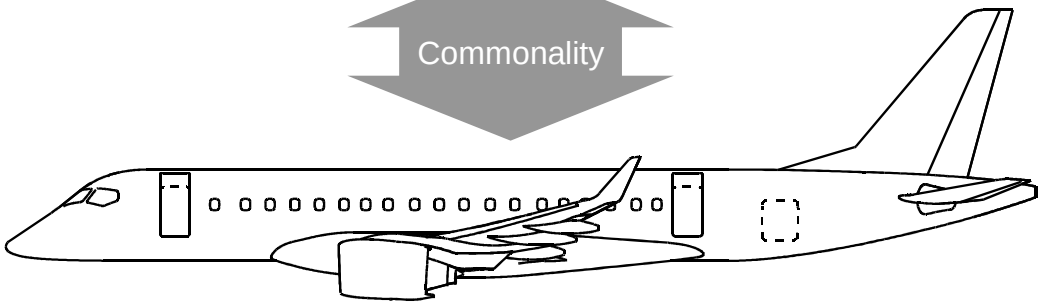
92 seats



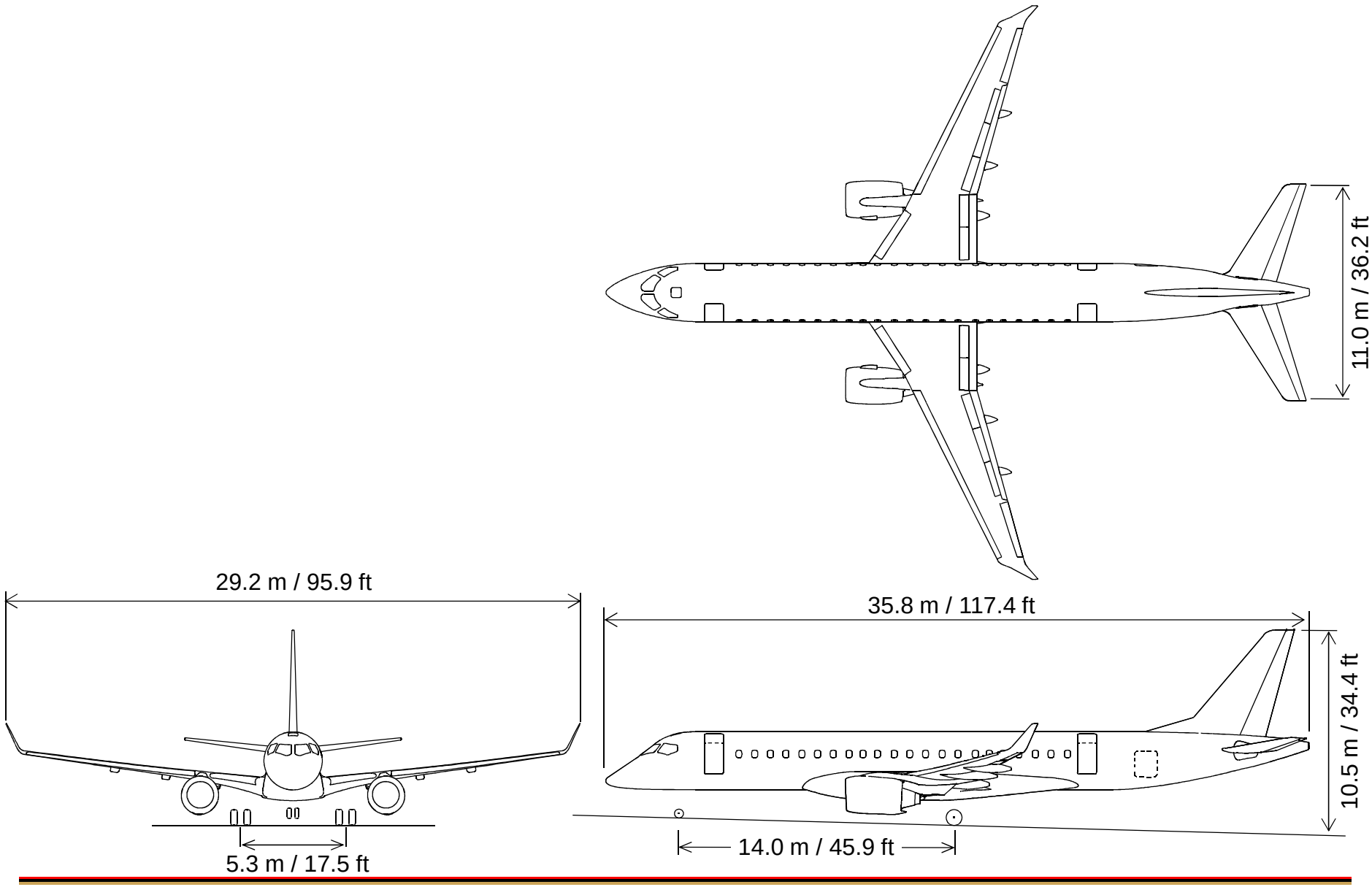
Commonality

MRJ70

78 seats



General Arrangement - MRJ90



Principal Characteristics - MRJ90

		MRJ90STD	MRJ90ER	MRJ90LR
Passengers		92 (Typical single class)		
Cargo compartments	m^3 (ft^3)	18.2 (644)		
Engine		PurePower® PW1217G Engine		
Thrust	kN (lbf)	78.2 (17,600) x 2		
Maximum takeoff weight	kg (lb)	39,600 (87,303)	40,995 (90,378)	42,800 (94,358)
Maximum landing weight	kg (lb)	38,000 (83,776)	38,000 (83,776)	38,000 (83,776)
Maximum zero-fuel weight	kg (lb)	36,150 (79,697)	36,150 (79,697)	36,150 (79,697)
Operational empty weight	kg (lb)	25,100 (55,336)	25,100 (55,336)	25,100 (55,336)
Fuel capacity †	lit. (USG)	12,100 (3,200)	12,100 (3,200)	12,100 (3,200)
Range * @92PAX x 102kg (225lb)	km (nm)	1,670 (900)	2,400 (1,290)	3,310 (1,780)
Maximum operating mach number		M 0.78	M 0.78	M 0.78
Maximum operating altitude	m (ft)	11,900 (39,000)	11,900 (39,000)	11,900 (39,000)
Takeoff field length (MTOW, SL, ISA)	m (ft)	1,490 (4,890)	1,600 (5,250)	1,740 (5,710)
Landing field length (MLW, Dry)	m (ft)	1,480 (4,860)	1,480 (4,860)	1,480 (4,860)
Approach speed (MLW)	km/h (kt)	252 (136)	252 (136)	252 (136)

† NOT include Unusable Fuel
* ISA, No Wind, LRC, Alternate 200nm

Range Capability from DENVER

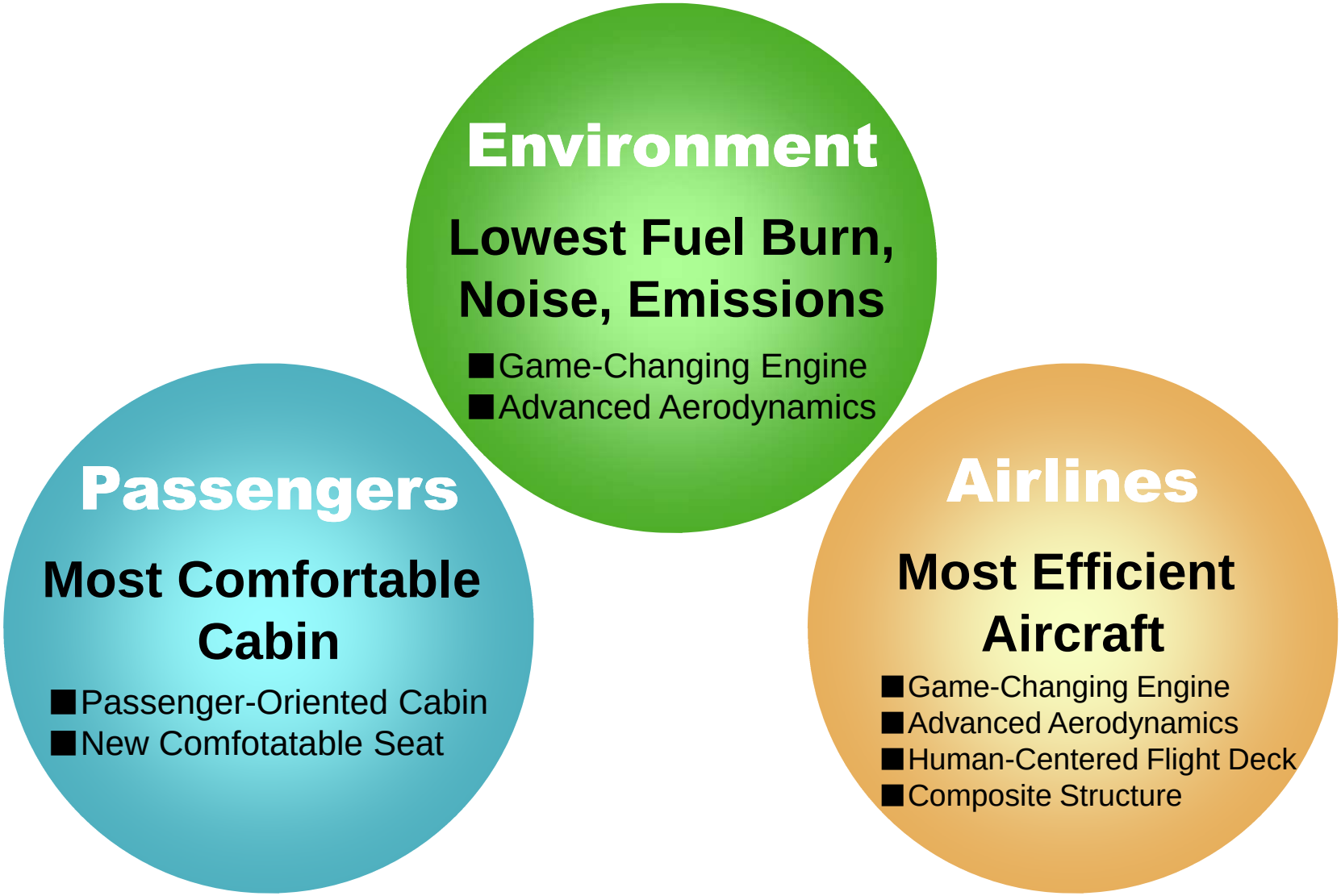
MRJ90

MRJ70

ISA, 85% Annual Wind, LRC @37,000ft, Alternate 200nm
Payload : MRJ90 92PAX X 102kg (225lb), MRJ70 78PAX X 102kg (225lb)

Contents

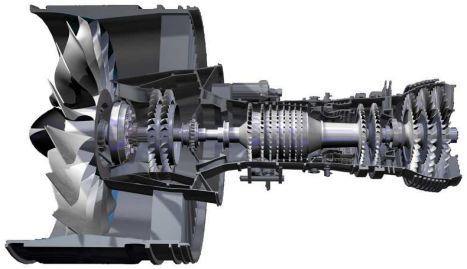
Key Concept


Environment
Lowest Fuel Burn, Noise, Emissions
■Game-Changing Engine
■Advanced Aerodynamics
Passengers
Most Comfortable Cabin
■Passenger-Oriented Cabin
■New Comfotatable Seat
Airlines
Most Efficient Aircraft
■Game-Changing Engine
■Advanced Aerodynamics
■Human-Centered Flight Deck
■Composite Structure

Four State-of-the Art Key Technologies

- Designed for lower fuel burn, noise and emission with state-of-the art technologies available

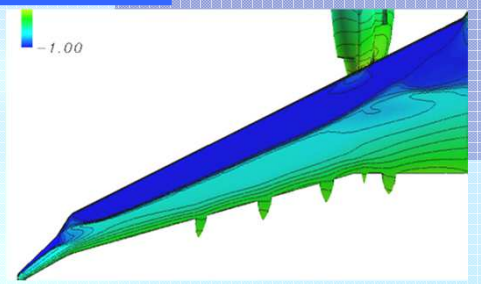
Engine PurePower® PW1000G



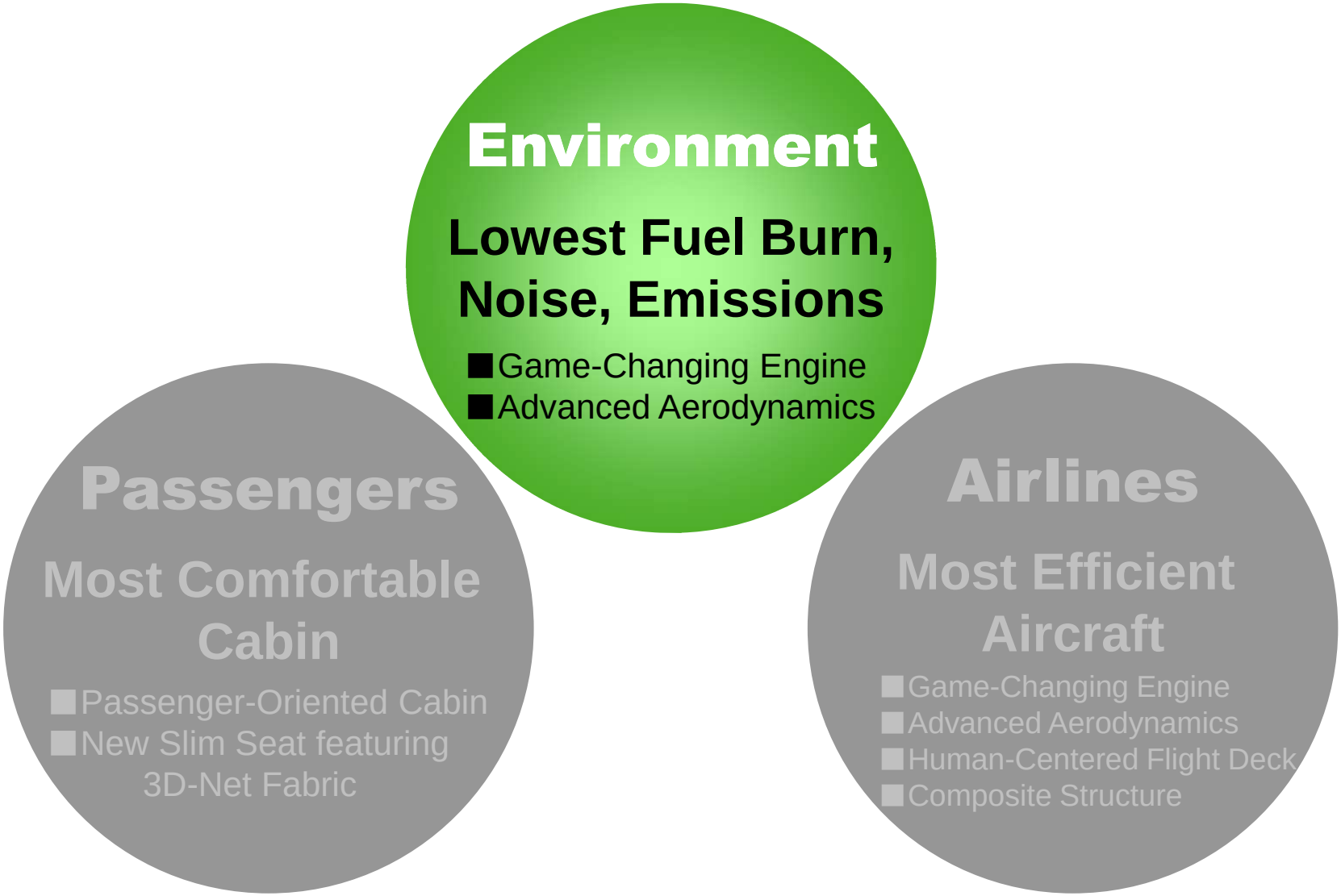
Structure & Materials

Composite

Aerodynamics Advanced CFD Design

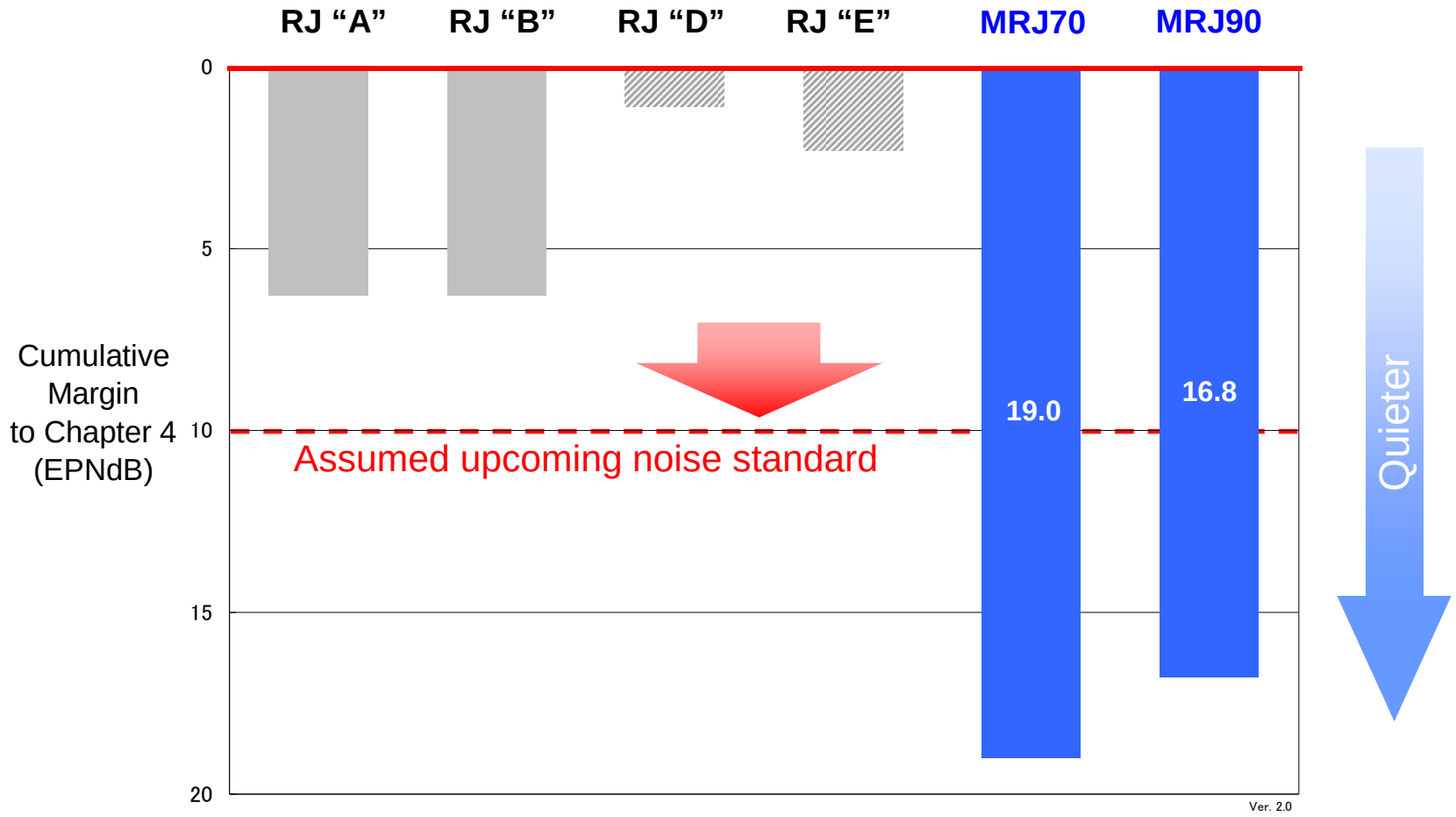


Systems FBW Technology


Environment
Lowest Fuel Burn, Noise, Emissions
■Game-Changing Engine
■Advanced Aerodynamics
Passengers
Most Comfortable Cabin
■Passenger-Oriented Cabin
■New Slim Seat featuring 3D-Net Fabric
Airlines
Most Efficient Aircraft
■Game-Changing Engine
■Advanced Aerodynamics
■Human-Centered Flight Deck
■Composite Structure

Quietest Regional Jet

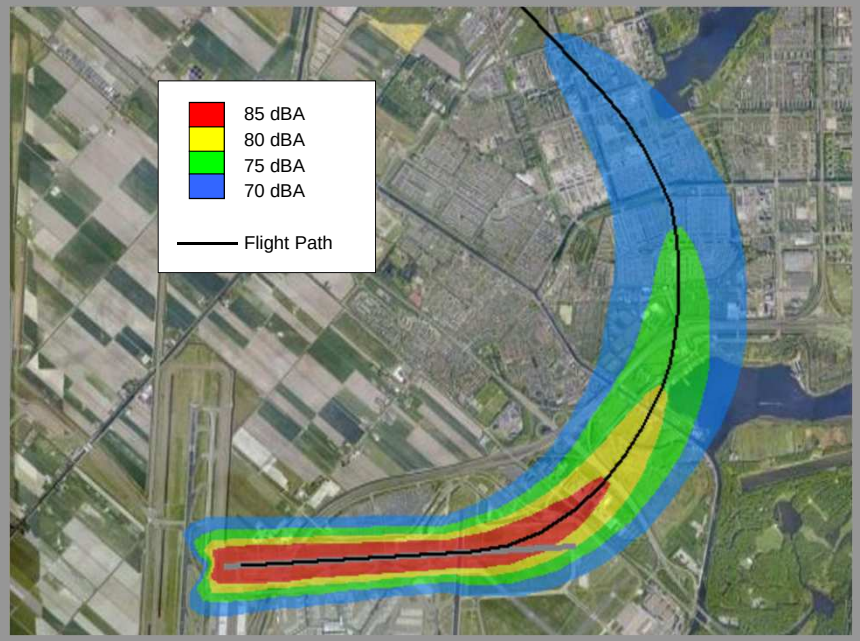
Quietest in its class



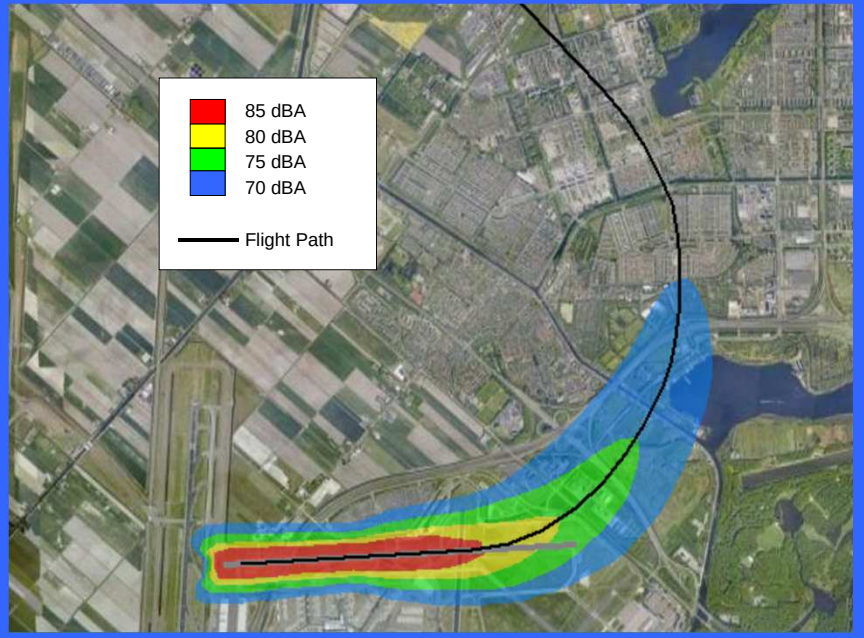
Significant Noise Reduction

- MRJ90 noise footprint 52% smaller versus RJ “E”
- Airlines can take advantage of lower community noise:
  - Lower noise charges
  - Extending operations into noise-related curfews
  - Operational savings by avoiding noise abatement flight tracks
  - Taxi time shortened by using preferred runways

RJ “E”



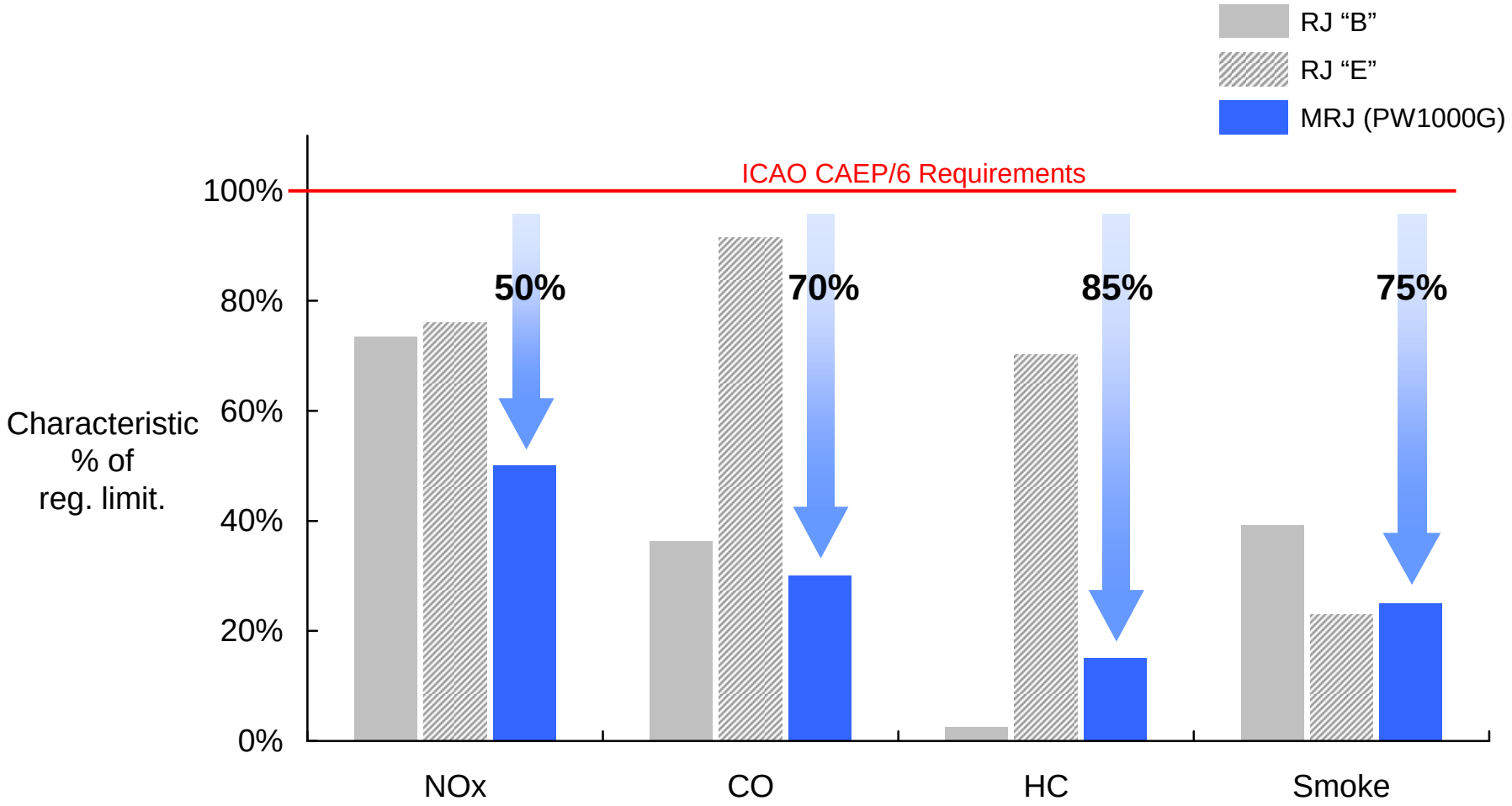
MRJ90



* Mitsubishi Aircraft Estimation at Schiphol Airport (AMS)

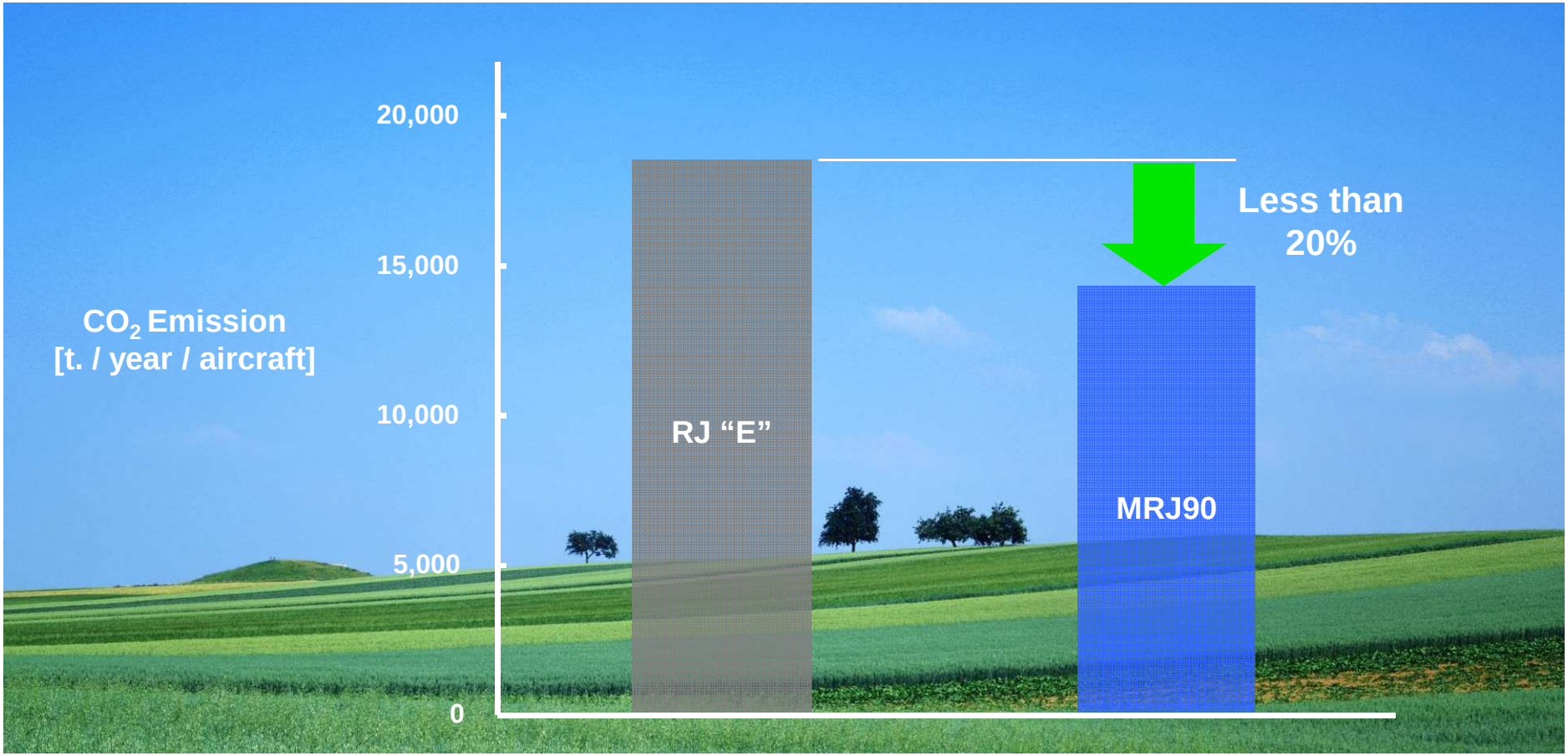
Most Environmentally Friendly

Greenest in class & meeting future environmental requirements

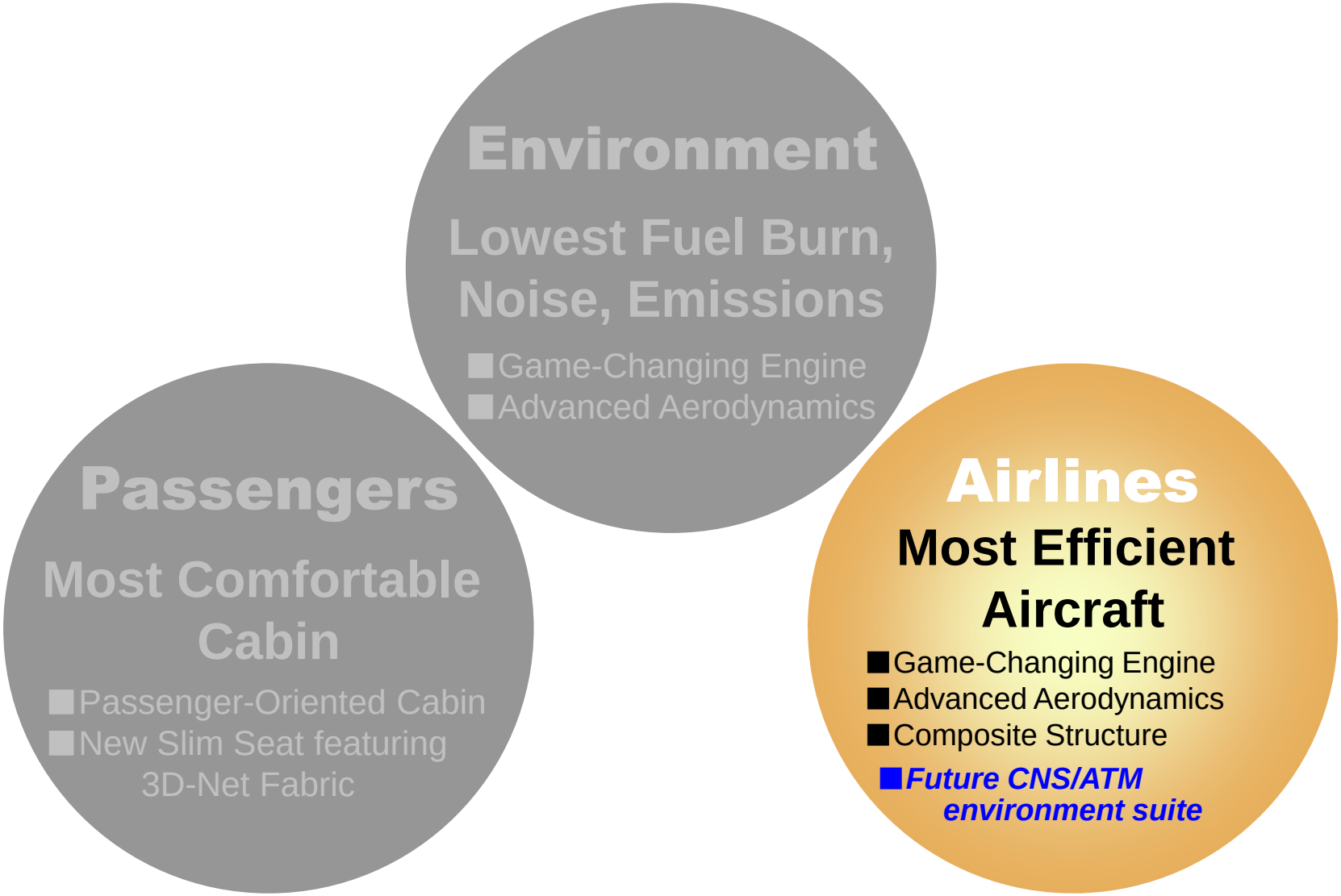


Significantly Lower CO_2 Emissions

- Lower CO_2 emissions mean:
  - Contributing to preventing global warming
  - CO_2 trading cost benefits
  - Enhancing corporate value

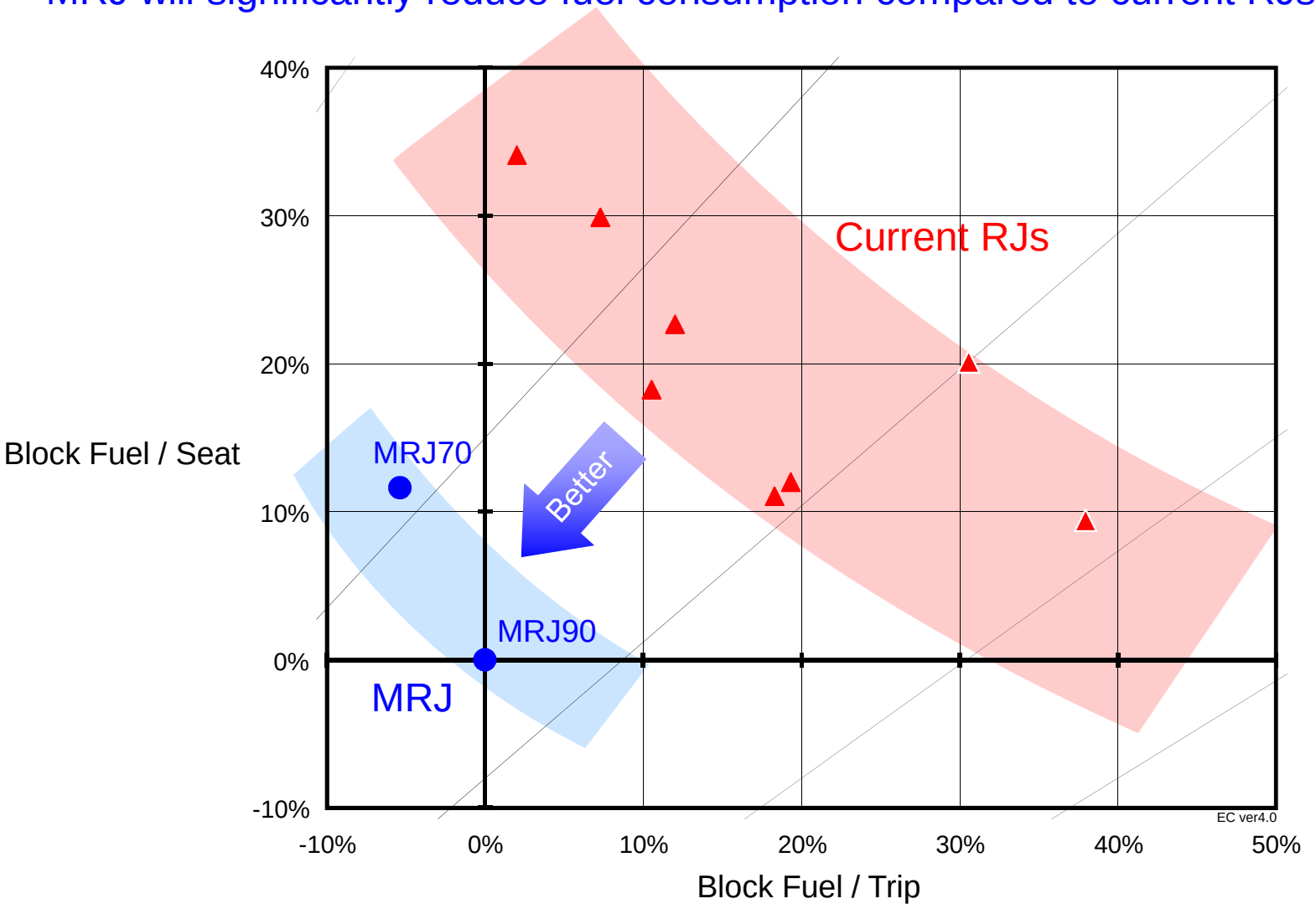


*Mitsubishi Aircraft estimation, 500nm Trip, 2,200 cycle/year


Environment
Lowest Fuel Burn, Noise, Emissions
■Game-Changing Engine
■Advanced Aerodynamics
Passengers
Most Comfortable Cabin
■Passenger-Oriented Cabin
■New Slim Seat featuring 3D-Net Fabric
Airlines
Most Efficient Aircraft
■Game-Changing Engine
■Advanced Aerodynamics
■Composite Structure
■Future CNS/ATM environment suite

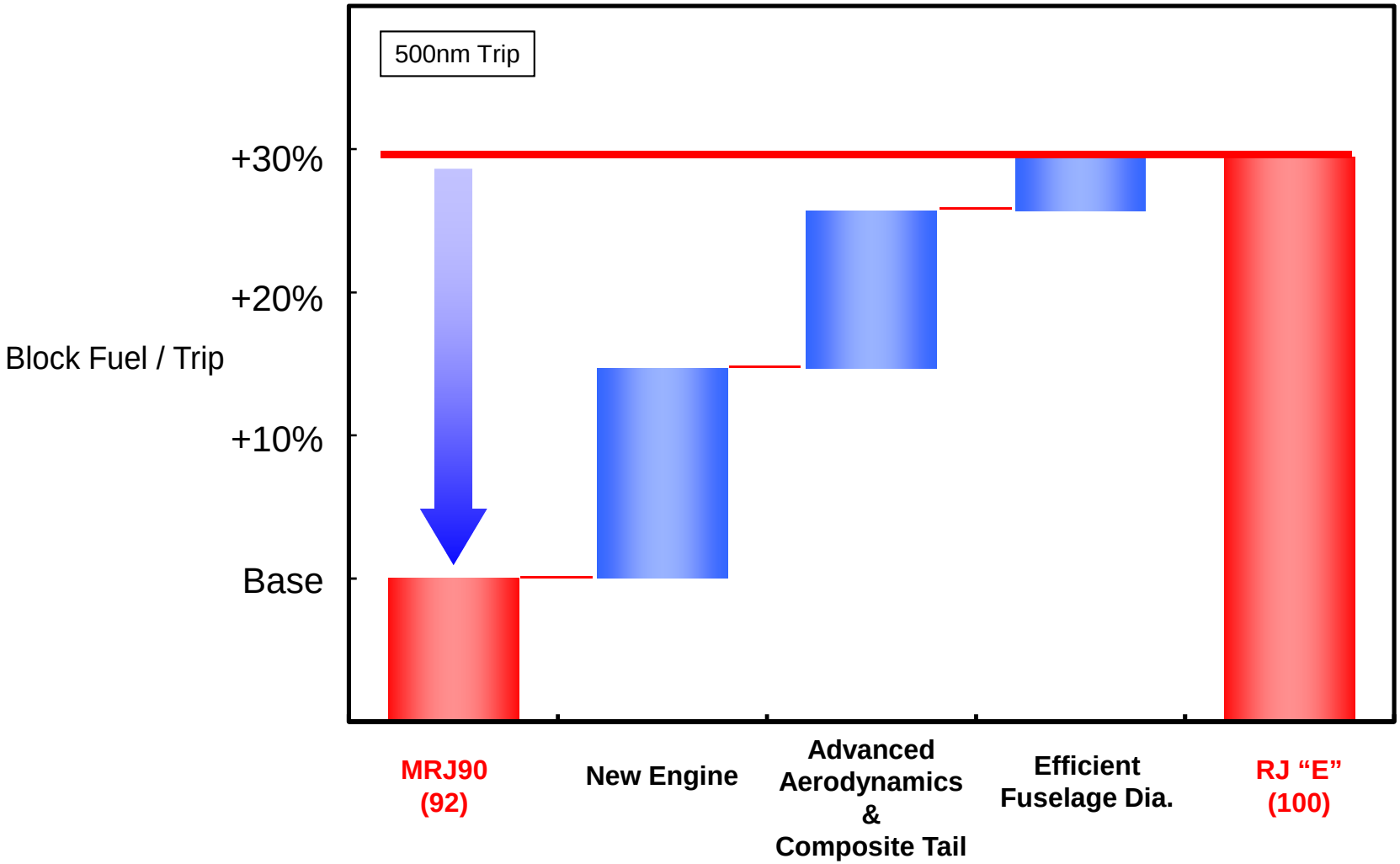
Game Changing Fuel Efficiency

- MRJ will significantly reduce fuel consumption compared to current RJs.

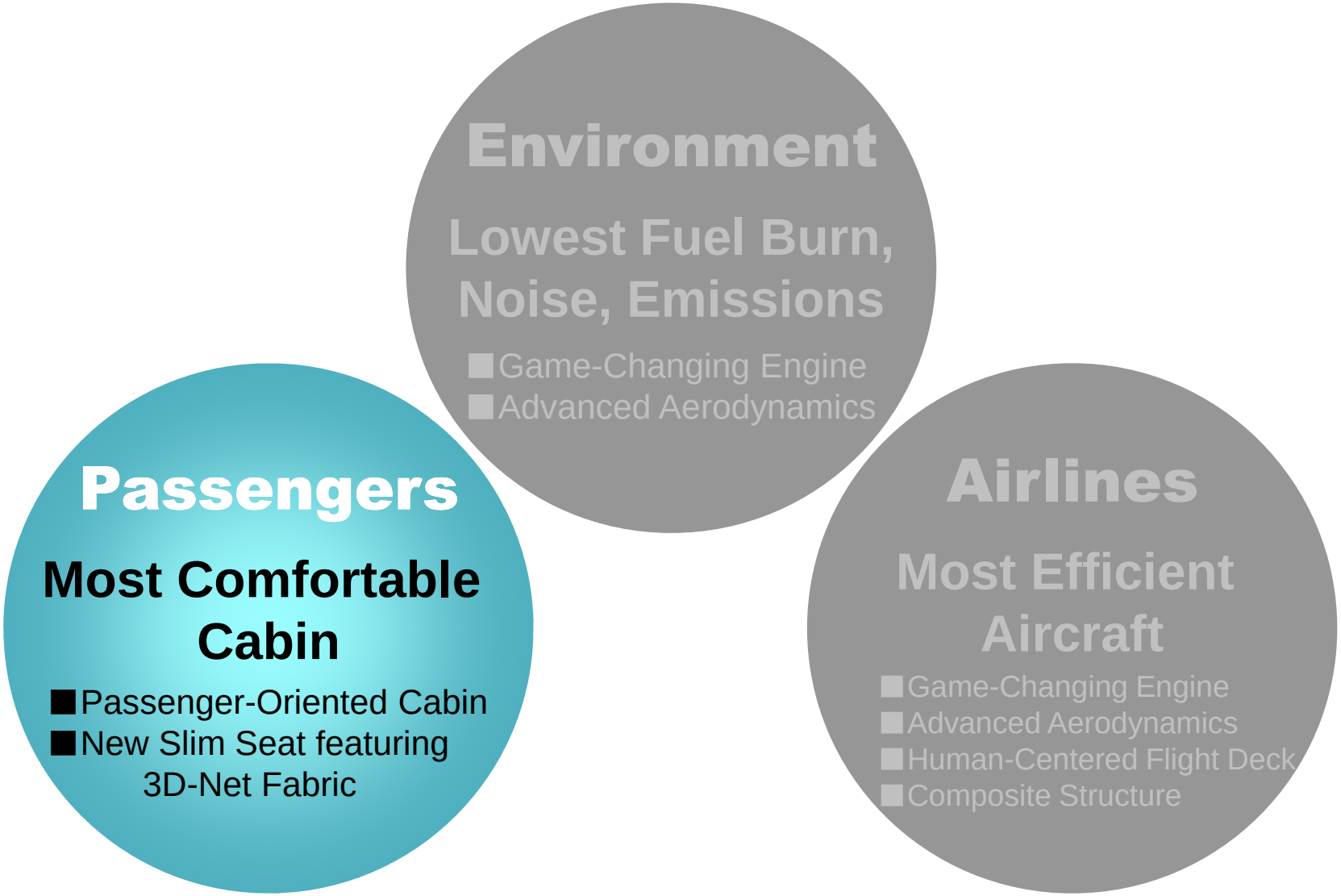


* Mitsubishi Aircraft Estimation, Single Class Typical Seat, LRC, 500nm Trip

Contributors to Block Fuel Reduction

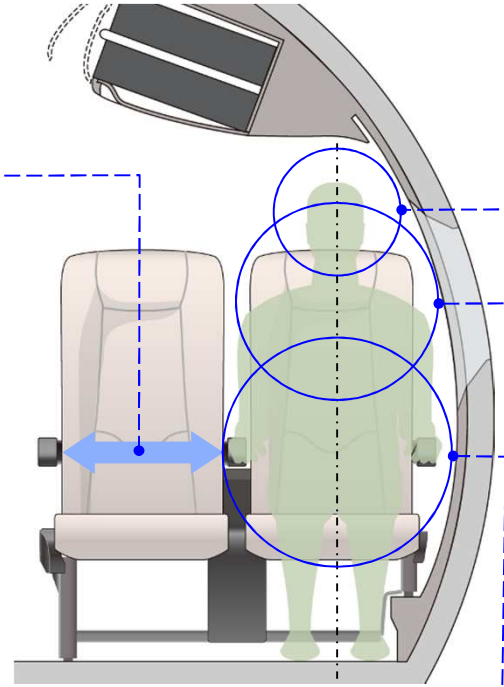


* Mitsubishi Aircraft estimation

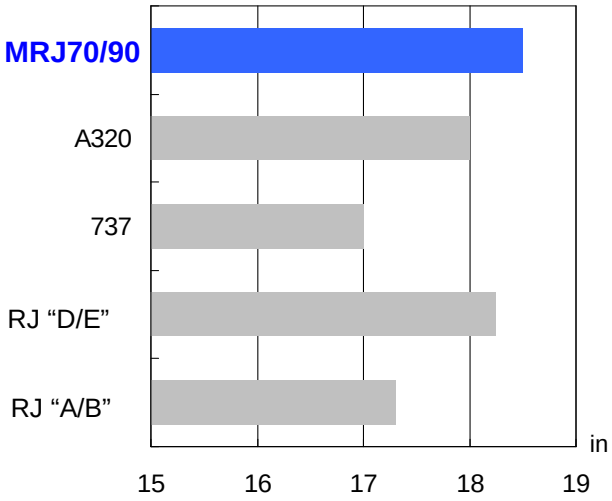

Environment
Lowest Fuel Burn, Noise, Emissions
■Game-Changing Engine
■Advanced Aerodynamics
Passengers
Most Comfortable Cabin
■Passenger-Oriented Cabin
■New Slim Seat featuring 3D-Net Fabric
Airlines
Most Efficient Aircraft
■Game-Changing Engine
■Advanced Aerodynamics
■Human-Centered Flight Deck
■Composite Structure

Most Spacious Room At Window Seat

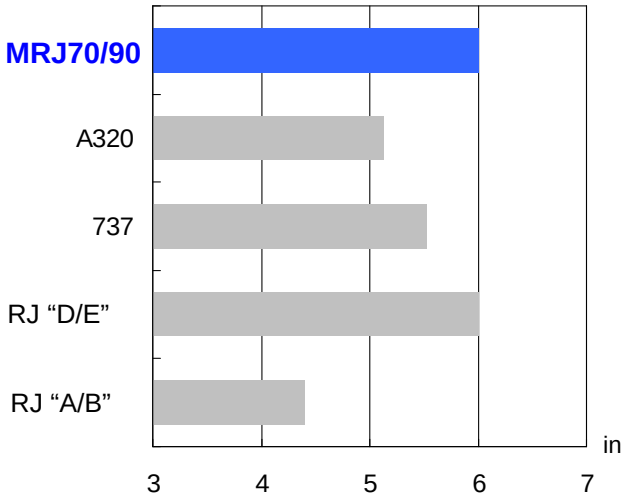
- More side wall space, more shoulder room.



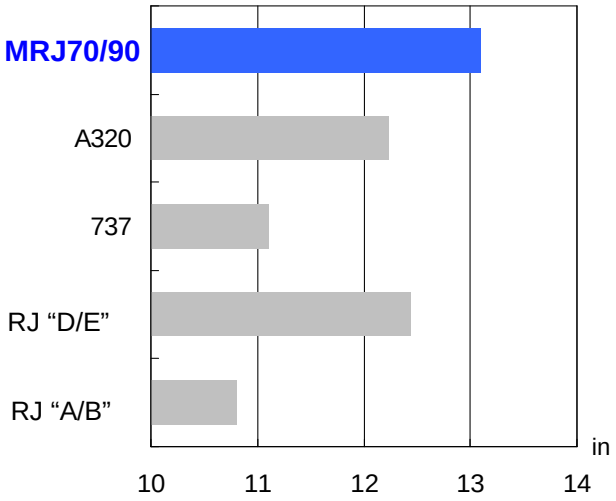
Seat width



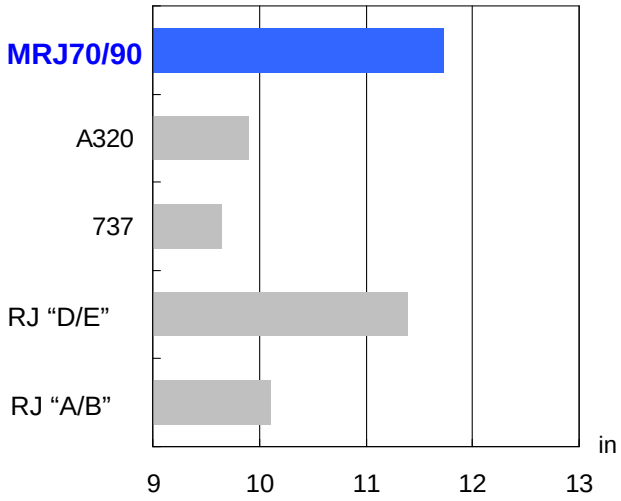
Head clearance to side wall



Arm clearance to side wall



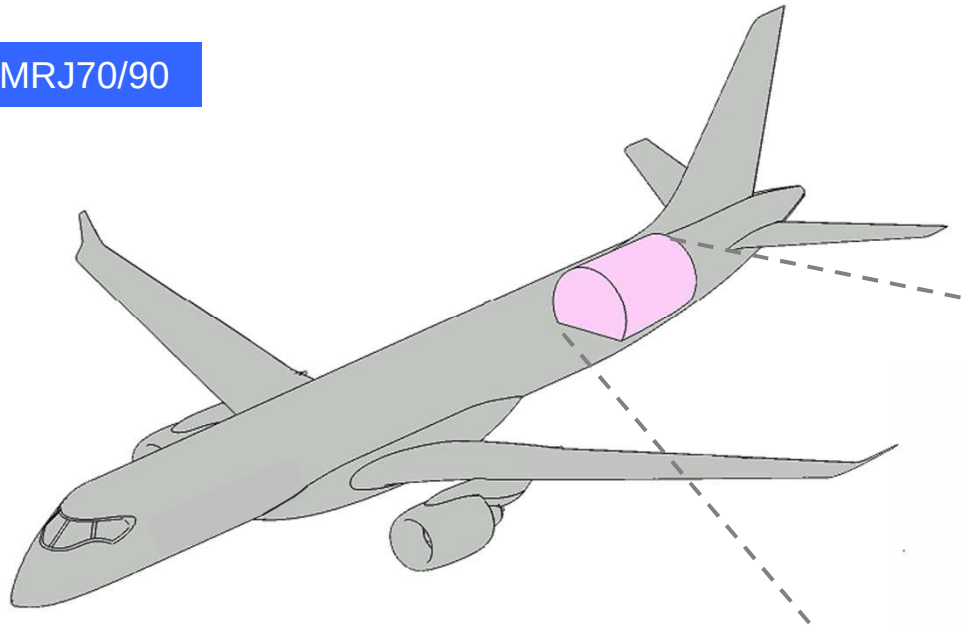
Shoulder clearance to side wall



Cargo Compartment

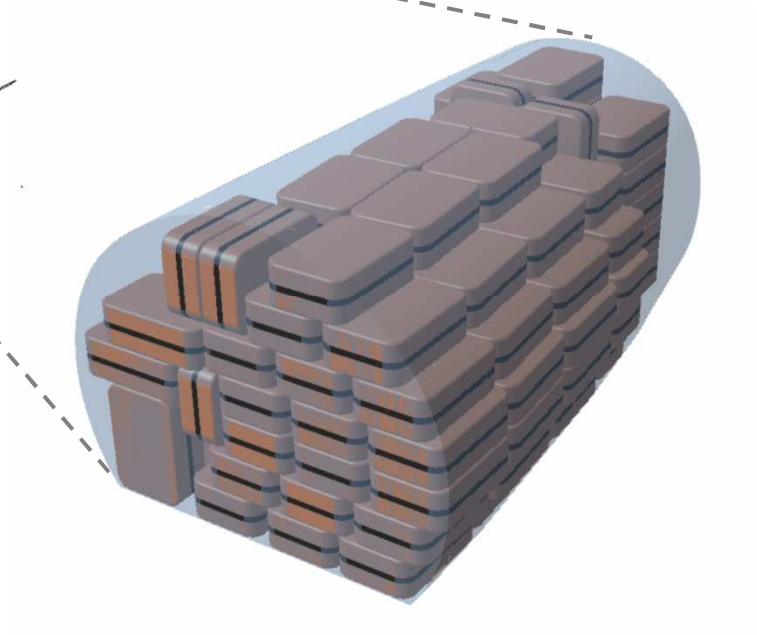
- MRJ can accommodate 106 checked-in bags

MRJ70/90



AFT Cargo

Volume: 644ft^3(18.2m^3)
106 bags* can be loaded



*Bag size (cm): 79(L)x 53(W)x 28(H)

Contents

Fitting To New CNS/ATM Environment

✓ **Airlines said:**

"Understand benefit of new CNS/ATM technologies, but …"

*"Our business is very sensitive to **cost vs. benefit** in nature"*

*"Retrofitting is too **costly** than expected benefit"*

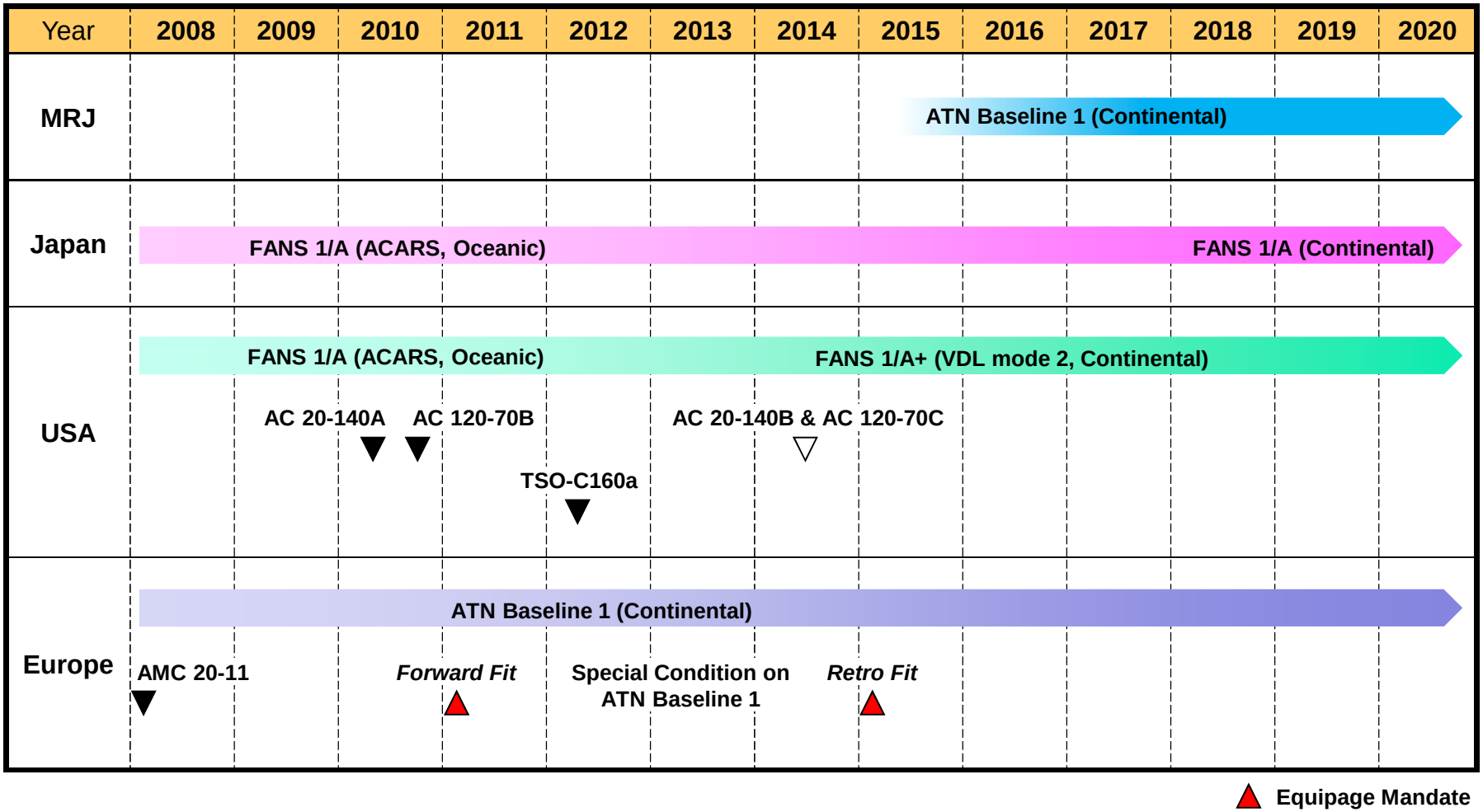
Introduction of **new aircraft** is **better solution** than retrofitting additional function one by one to the legacy aircraft

✓ **Airlines Expect:**

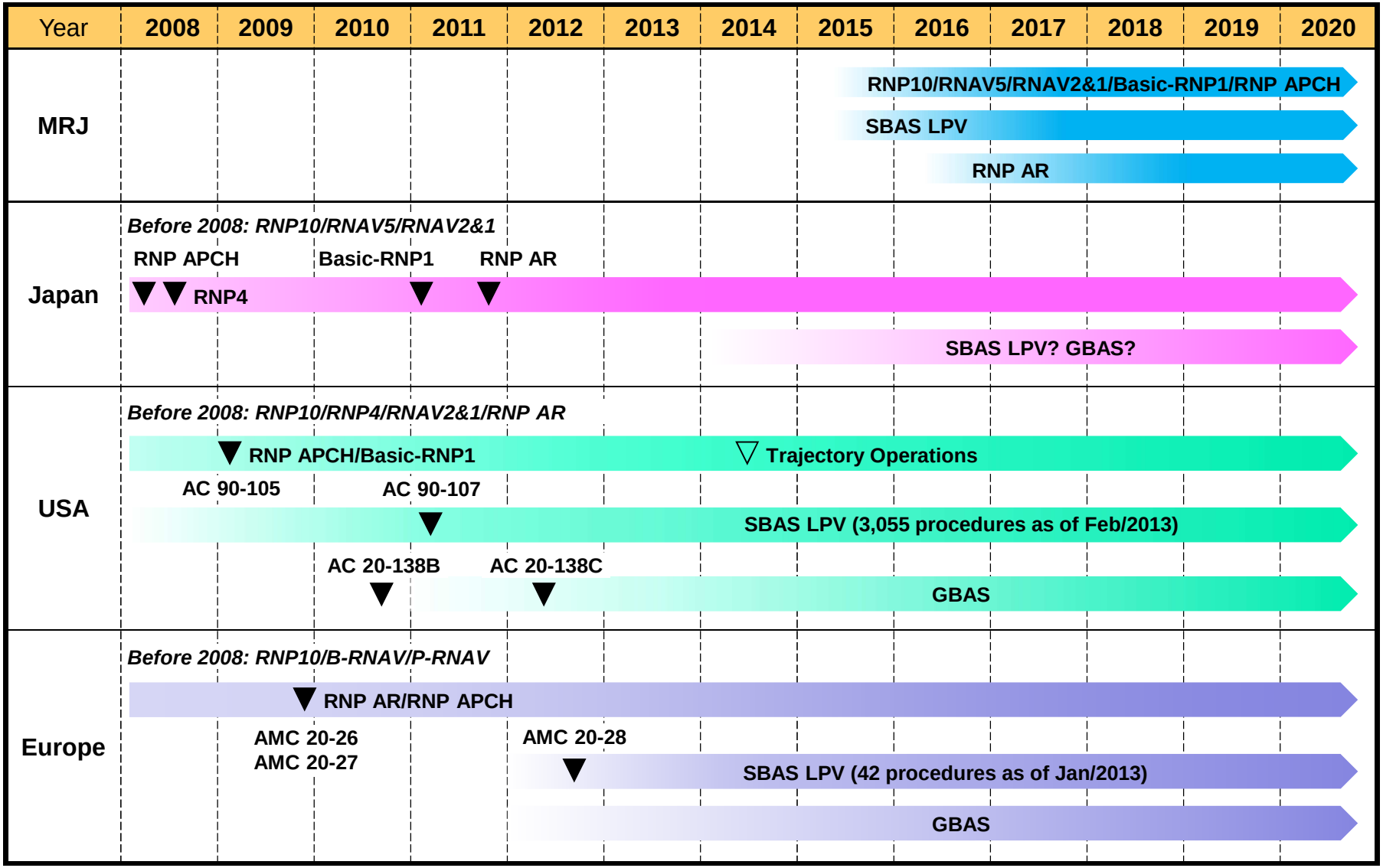
New aircraft **equip all possible foreseen function** for new ATM

MITSUBISHI AIRCRAFT CORP. PROPRIETARY

Data Communication



Navigation

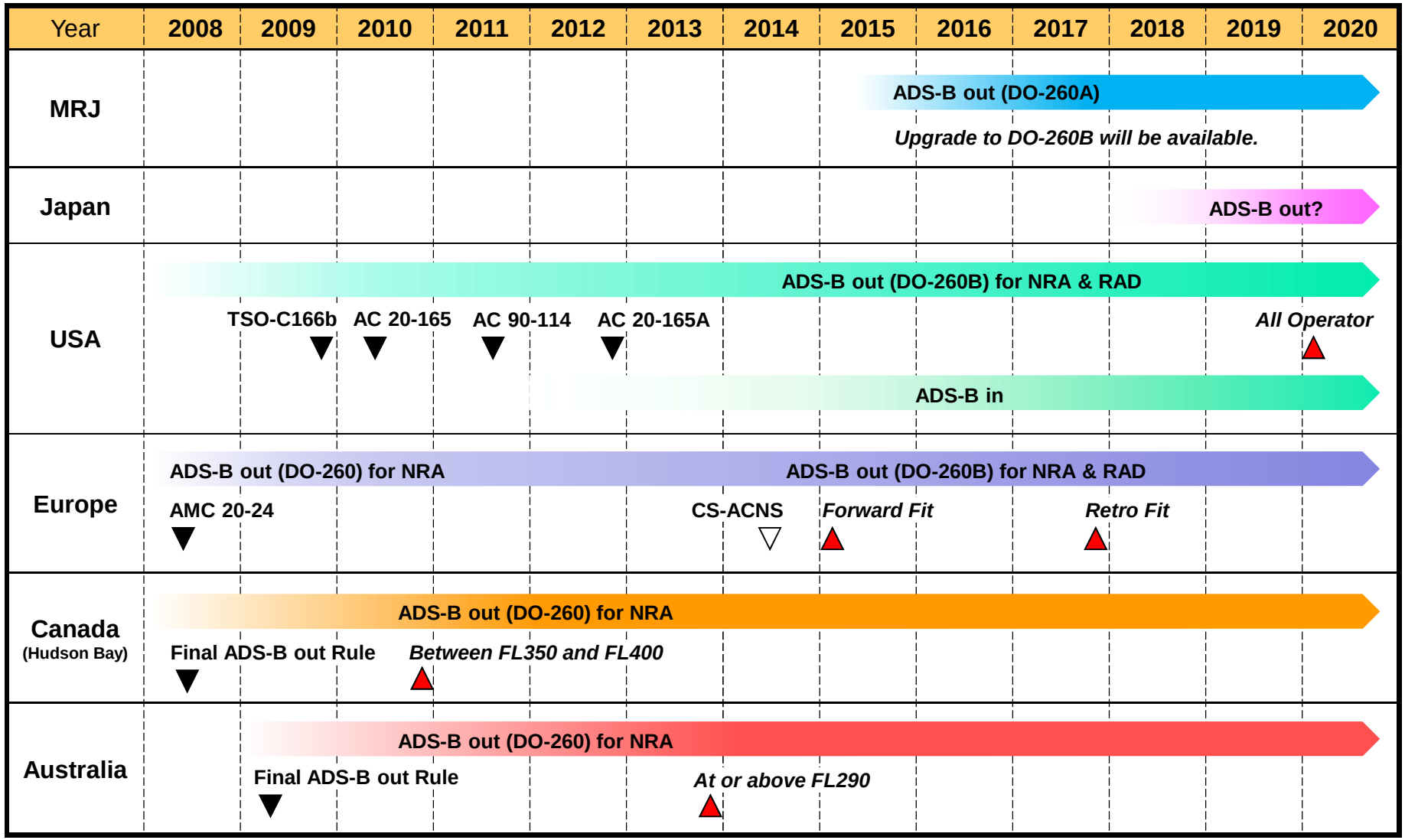

Year
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
MRJ
RNP10/RNAV5/RNAV2&1/Basic-RNP1/RNP APCH
SBAS LPV
RNP AR
Japan
Before 2008: RNP10/RNAV5/RNAV2&1
RNP APCH
Basic-RNP1
RNP AR
RNP4
SBAS LPV? GBAS?
USA
Before 2008: RNP10/RNP4/RNAV2&1/RNP AR
RNP APCH/Basic-RNP1
Trajectory Operations
AC 90-105
AC 90-107
SBAS LPV (3,055 procedures as of Feb/2013)
AC 20-138B
AC 20-138C
GBAS
Europe
Before 2008: RNP10/B-RNAV/P-RNAV
RNP AR/RNP APCH
AMC 20-26
AMC 20-27
AMC 20-28
SBAS LPV (42 procedures as of Jan/2013)
GBAS

Navigation

Navigation	Guidance		
	Japan (JCAB)	USA (FAA)	Europe (EASA/JAA)
RNAV/RNP Operations	Permission Standard and Check Procedure for RNAV operation	AC 20-130A* AC 20-138A*	—
- RNAV 10 (RNP 10)	- Appendix 1	Order 8400.12B	EASA AMC 20-12
- RNAV 5 (B-RNAV)	- Appendix 2	AC 90-96A	EASA AMC 20-4
- RNAV 2	- Appendix 3	AC 90-100A	—
- RNAV 1 (P-RNAV)	- Appendix 3 and 4	AC 90-96A AC 90-100A	JAA TGL 10 Rev. 1
- Basic-RNP 1	- Appendix 7	AC 90-105	—
- RNP APCH	- Appendix 5	AC 90-105	EASA AMC 20-27
LPV	—	AC 20-138A*	EASA CRI F-18
Baro-VNAV	Operational Standard for Baro-VNAV approach	AC 20-129* AC 90-105	EASA AMC 20-27
VNAV for Non-Precision Approach	Approval Standard for the use of VNAV function by FMS equipment under non precision approach	AC 20-129*	—
GPS Operations under IFR	Operational Standard for the use of GPS when flying under Instrument Flight Rules	AC 20-130A* AC 20-138A*	EASA AMC 20-5

* Application of AC 20-138B is under consideration.

Surveillance



Contents

Avionics & Flight Deck Concept

- ***Suite for Next Generation of regional aircraft operations:***
  - ✓ **Future CNS/ATM Environment**
    - Data link, RNP, Required Time of Arrival, ADS-B, etc.
  - ✓ **Improvement for Situation Awareness**
    - Higher integration of display information; Aircraft Sensor Information and ATM Data
    - User friendly operation and graphical display to reduce human error

→ leading to Higher level of flight safety

- ✓ **Large Landscape Displays**
- ✓ **Graphical Flight Planning/Cursor Control**
- ✓ **Vertical Profile Display**
- ✓ **Overlaid information on MAP/PFD**

Other Avionics & Flight Decks

RJ "A/B"

RJ "D/E"

MRJ

- **Pro Line Fusion™: 2010s technology**
  - Four 15.1 inch Large Landscape LCD
- **Lower LRU count**
- **Higher Situational Awareness**
  - To overlay Navigation and ATM information on MAP
  - To overlay Sensor information(TAWS,Windshear etc.) on PFD

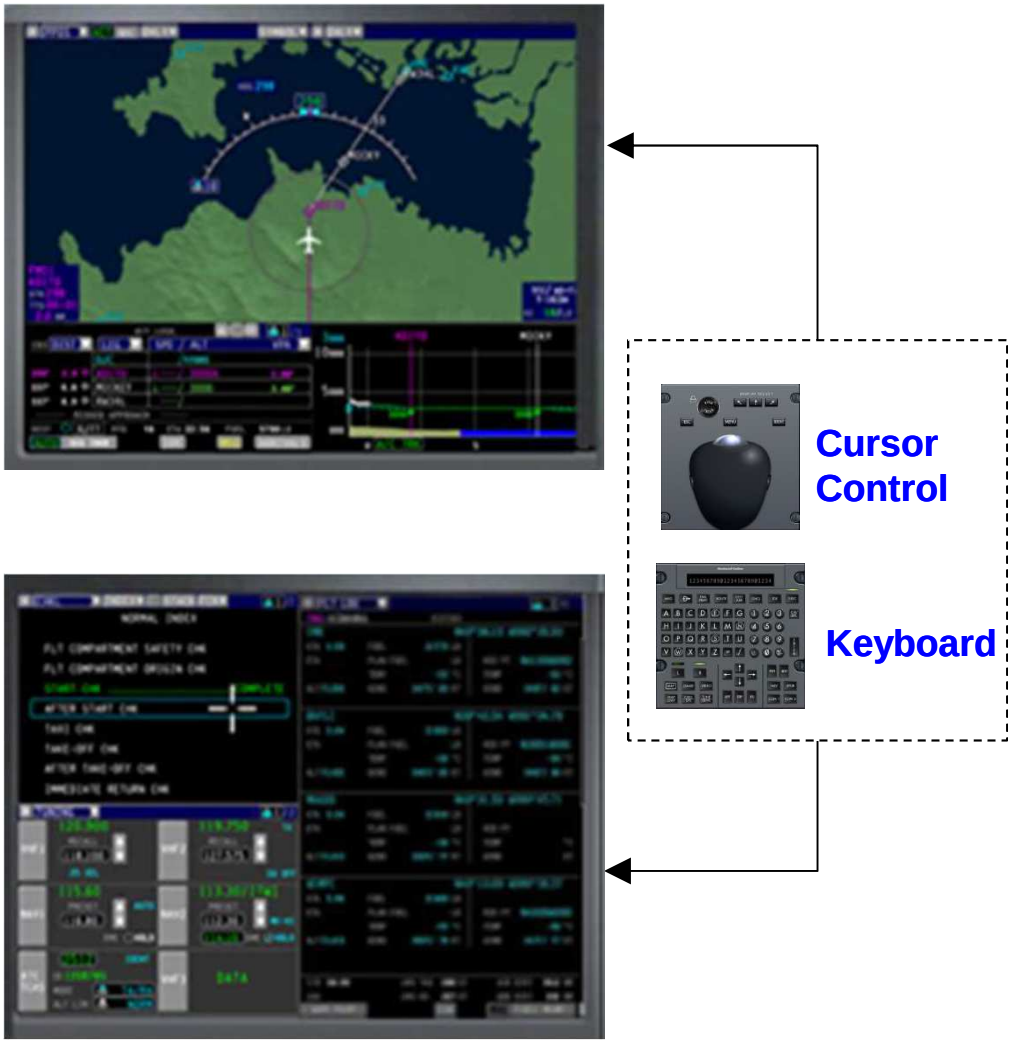
Avionics System

- **Our Avionics system which including Adaptive Flight Display, CNS system and others are based on "Pro Line Fusion™" developed and TSO-certified by Rockwell Collins.**

- **Avionics system based four large landscape LCD displays' operation:**
  - Outer panels: "Flight Task Indications" . Its display integrated on two outboard displays which consist ADI, HIS, EICAS etc.
  - Inner panels: "Mission Task Indications" (i.e. MAP, ROUTE window, RADIO TUNE, FMS, CHECK- LIST etc.)

MFW (Multi Function Windows)

- ***MFW enables:***
  - ✓ COM/NAV Tune
  - ✓ ACARS, **CPDLC**
  - ✓ Map
  - ✓ Route
  - ✓ Vertical Situational Display
  - ✓ **FMS**
  - ✓ System (Synoptic) Pages
  - ✓ Electronic Checklist
  - ✓ Video Surveillance, etc.



MITSUBISHI AIRCRAFT CORP. PROPRIETARY

FMS (Flight Management System)

FMS integrates all navigation functions and has the capability to control RNAV/RNP and SBAS (WAAS) operations to suit the next generation CNS/ATM environment.

VSD (Vertical Situation Display), large map used by GFP (Graphical Flight Planning) and Route Window which displaying flight plan progress on real time, these window contribute to a higher level of situational awareness.

ARRIVAL DIALOGBOX

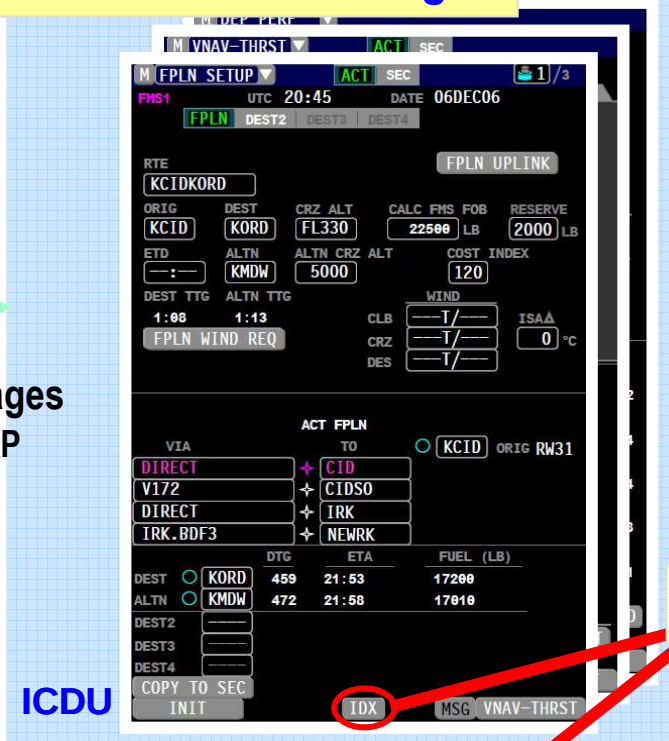
MFW (Multi Function Windows) - *i.e. FMS ICDU*

With CCP and MKP, avionics system function operations are possible via windows on MFW. This functionality ensures simple pilot action and enhances situational awareness; moreover, these benefits lead to safe and efficient flight operations.

10 ICDU pages, 1 Route Windows & 35 Dialog Boxes for advanced setting

Over *90* CDU/ MFD text pages without GFP Capability on MAP

Legacy style FMS CDU



ICDU

CCP

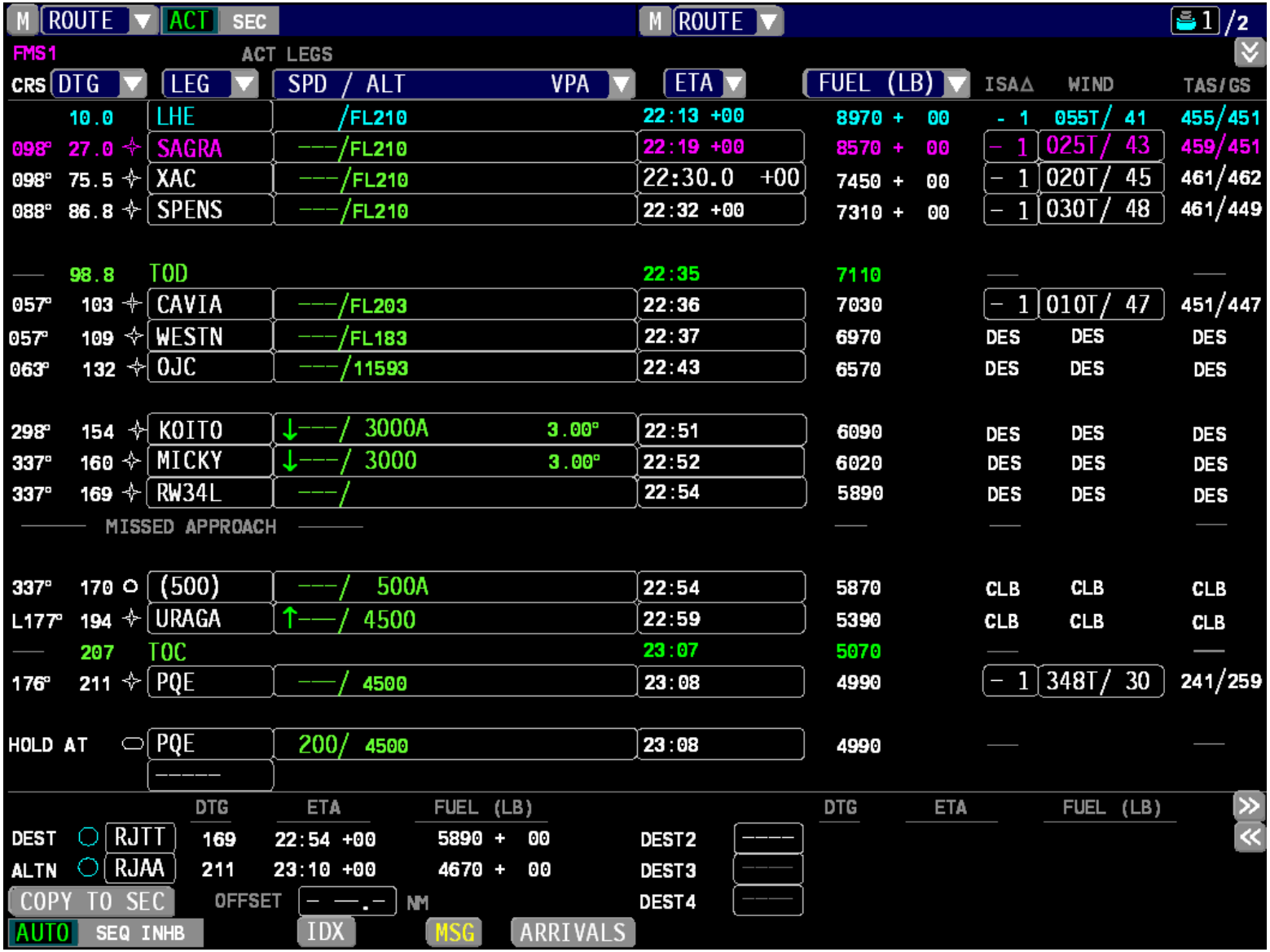
MKP

INDEX menu

FLIGHT ROUTE WINDOW

DIALOG BOX

Flight Route Window



Contents

Major Milestones

- ✓ Mar 2008 Launch
- ✓ Apr 2008 Mitsubishi Aircraft Corporation Commenced Operation
- ✓ Apr 2009 PDR (Preliminary Design Review)
- ✓ Sep 2010 CDR (Critical Design Review)
- ✓ Sep 2010 First Metal-Cutting – Production Commenced
- ✓ Apr 2011 First Riveting – Assembly Work Commenced
- ✓ Apr 2012 PW1217G Engine Test Flight Commenced
- 2013 First Flight
- 2015 First Delivery


MRJ
Mitsubishi Regional Jet
Flying into the future.
Mitsubishi Regional Jet, an advanced concept and prominent technologies
from Japan for the skies of the world.
MRJ
http://www.mrj-japan.com/

SBAS Approach Specification

- Currently, MRJ will have "RNP APCH (with Baro-VNAV)" and "SBAS (WAAS) LPV" capability in the Basic Specification.
- Both features are categorized in Approach Procedure with Vertical Guidance (APV) which is capable of Vertical Guidance even though it is Lateral Guidance.
- LPV is not Precision Approach (ILS, MLS, etc.) and is base on a RNP concept; however, it is capable of accuracy greater than 40m for Vertical Guidance.

Approach Type		RNP APCH (w/Baro-VNAV)	SBAS (WAAS) LPV
FAA Guidance		AC90-105	AC20-138B
Concept		RNP concept	Non-RNP concept
Flight Guidance	Lateral	Based on GPS	Based on GPS with SBAS (WAAS, etc.)
	Vertical	Based on baro-altitude info.	
Horizontal Alert Limit (HAL)		0.3 NM (556m)	40m
Vertical Guidance		YES	YES
RF Leg		N/A*	N/A

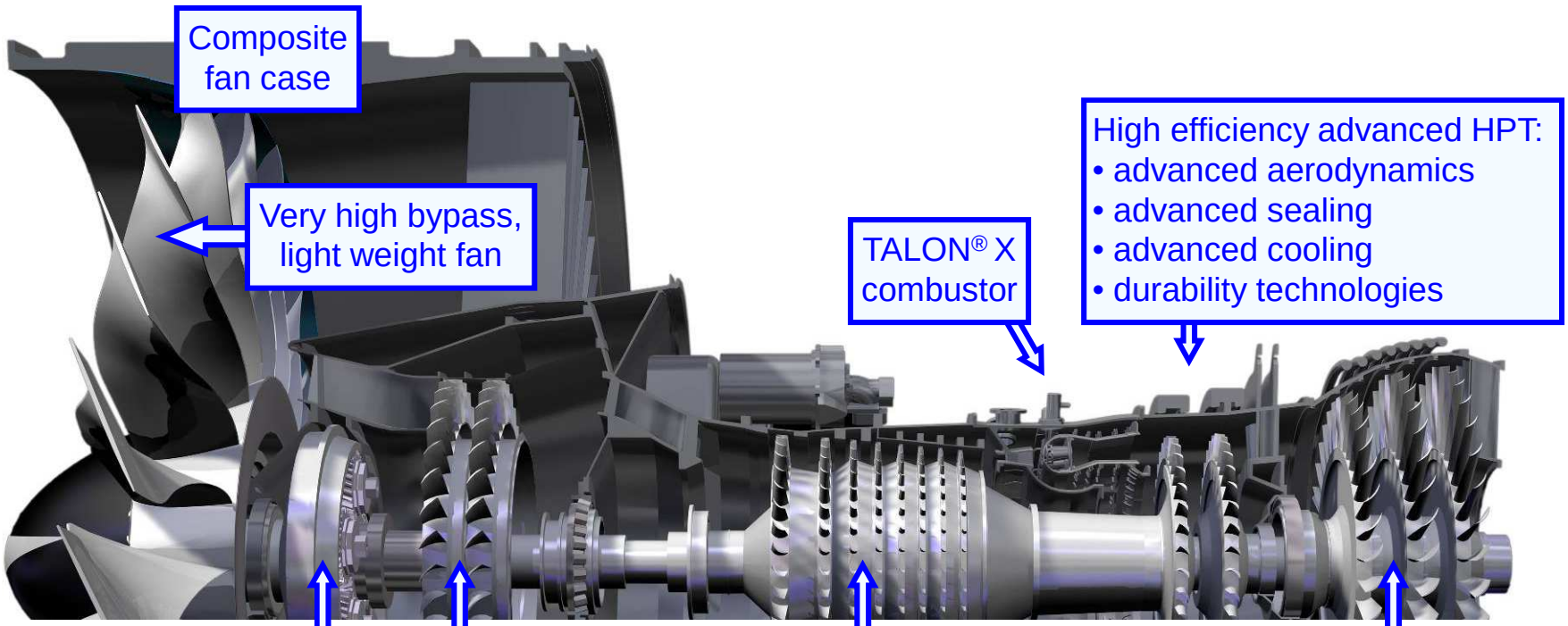
*On MRJ, "RF Leg" can be used without approach phase.

Back Up Slides

Latest Avionics Technology

- Latest avionics technology enhances safety, maintainability, economical operations

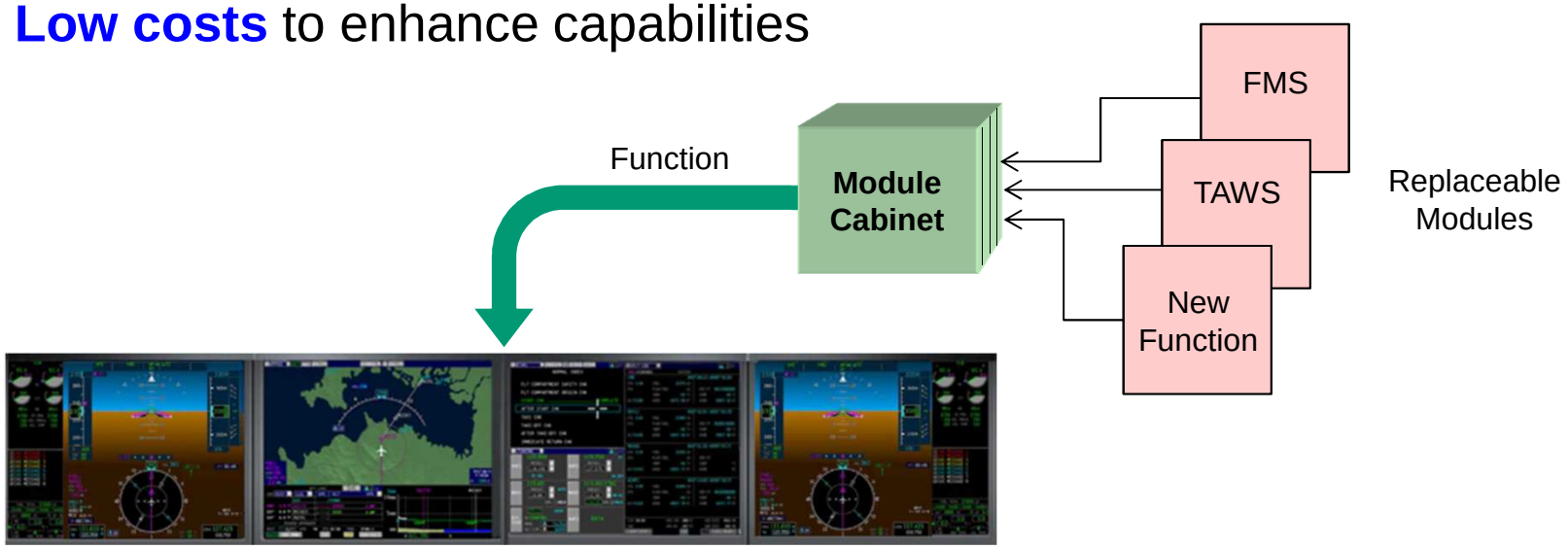
PurePower® PW1217G Engine Architecture



Comprehensive suite of technologies – much more than just the gear

Cost-Effective System Architecture

- ***Integrated Modular Avionics enables:***
  - ✓ **Advanced** performance throughout life cycle
  - ✓ **Easy** upgrades or modifications
    - Replacement of separate modules
    - Simple software downloads
  - ✓ **Low costs** to enhance capabilities



MITSUBISHI AIRCRAFT CORP. PROPRIETARY

Major Partners

- Industry-leading partners working with us.

Engine

Pratt & Whitney
A United Technologies Company

Electrical Power, Air Management, APU, Fire Protection

Hamilton Sundstrand
A United Technologies Company

Avionics (Incl. Flight Control Computer)

Rockwell Collins

Landing Gear

SPP
Sumitomo Precision Product

AIDC

Slats, flaps, belly fairing, rudder, elevator

Hydraulic System

Parker Aerospace

Passenger, service and cargo doors

eurocopter
an EADS Company

Pylon

SPIRIT AEROSYSTEMS

Main Structure Flight Deck Final Assembly

MITSUBISHI HEAVY INDUSTRIES, LTD.

Flight Control Actuator

Nabtesco

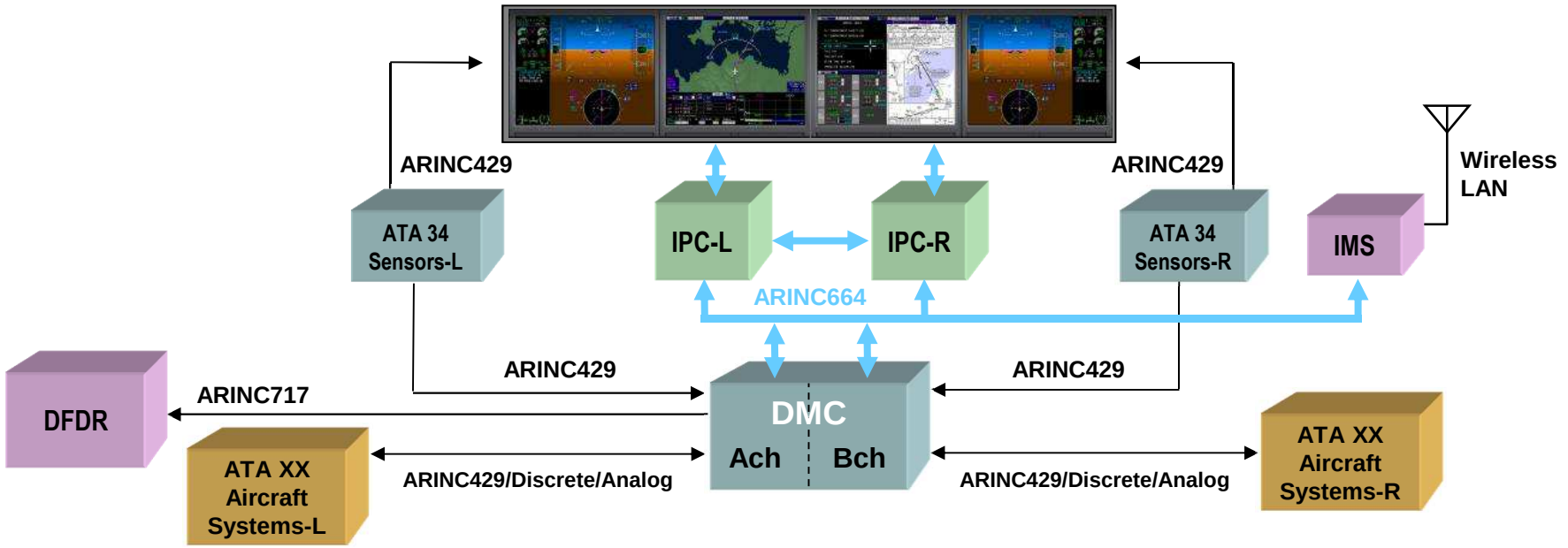
Payload Systems

HEATHTECNA

Avionics System Structure & BUSs

- Display system consists of four large 15.1” LCD, a dual-channel DMC (Data Concentrator Unit Module Cabinet) which interfaces with other systems, and two IPCs (Integrated Processing Cabinet) which provide the switching hub function for ARINC 664 databus.
- Displays, IPC and DMC are connected with avionics high speed databus (ARINC 664). Other devices (navigation sensors, air data sensors, engine (FADEC), hydraulic system etc.) are connected to DMC via ARINC429.
- Digital Flight Data Recorder “DFDR” is connected via ARINC717
  - Solid state type recorder: Minimum recording time 25hr, Recording rate 512WPS*
  - DFDR complies with the latest FAA 14 CFR amendment, and is installed separately from CVR.

*WPS - Words Per Second

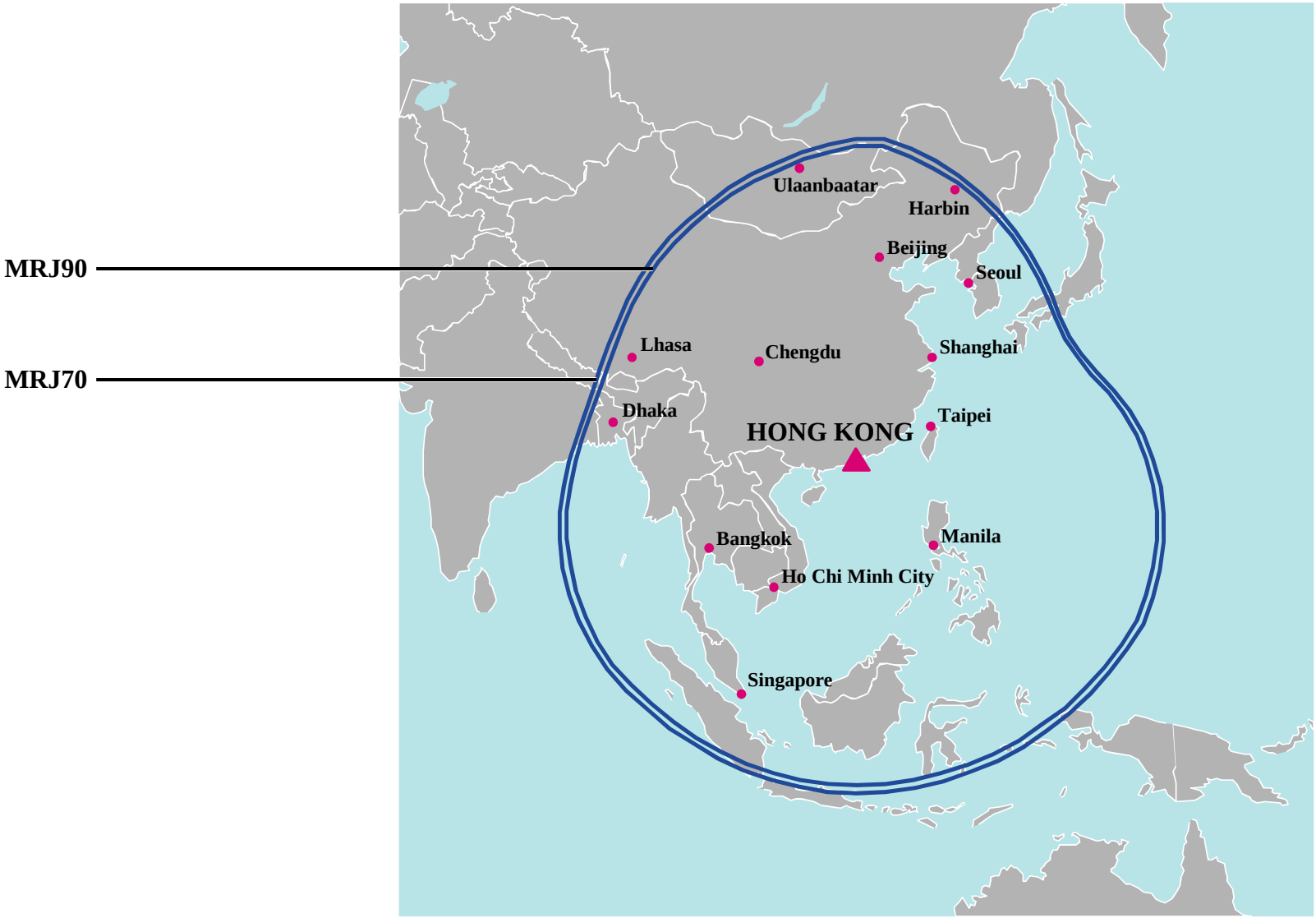


Supplemental Remarks for Cat III

- CatIII operation available via flight director guidance, etc.

- Once basic T/C is achieved, aircraft characteristics will be reflected in the flight simulator (a process that takes approximately one (1) year). Auto land capability is planned to be offered as an option in 2016 or later if customer commitments are received by 2011.

Range Capability from HONG KONG



ISA, 85% Annual Wind, LRC @37,000ft, Alternate 200nm
Payload : MRJ90 92PAX X 102kg (225lb), MRJ70 78PAX X 102kg (225lb)

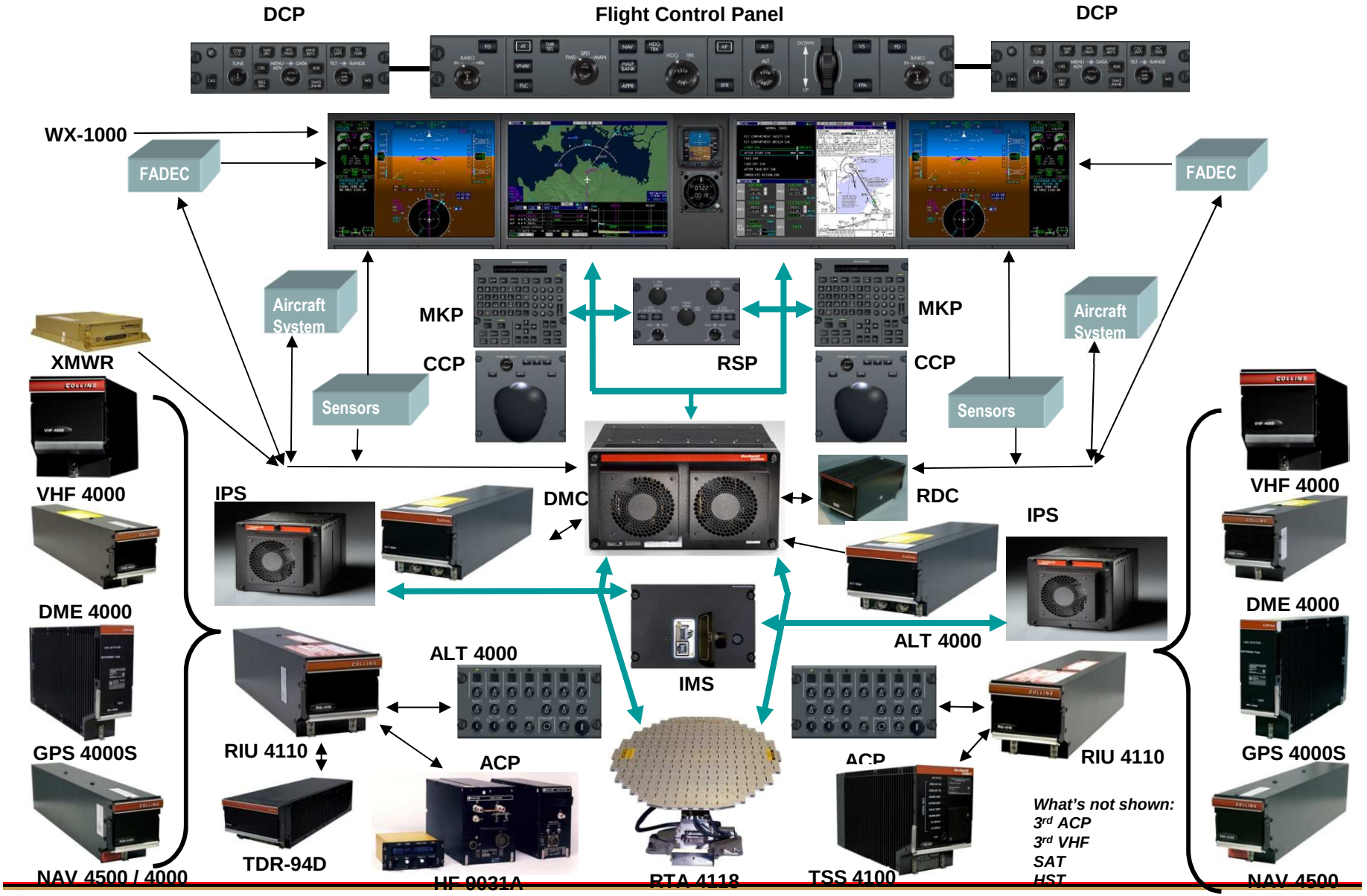
Range Capability from PARIS

MRJ90

MRJ70

ISA, 85% Annual Wind, LRC @37,000ft, Alternate 200nm
Payload : MRJ90 92PAX X 102kg (225lb), MRJ70 78PAX X 102kg (225lb)

Avionics Components

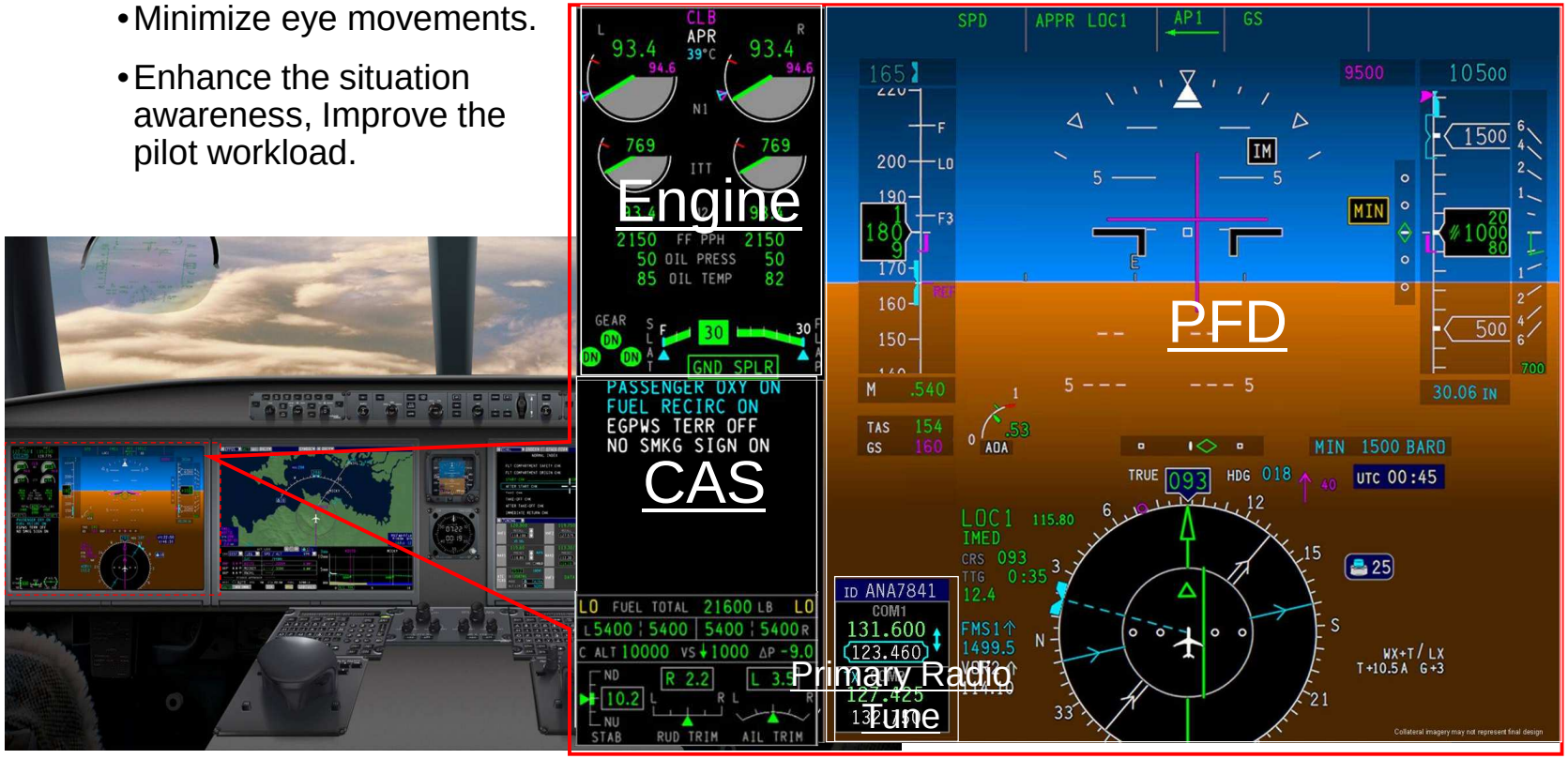


Display Arrangement

- Integrate “Flight Task Indications” to pilot’s front display
  - PFD
  - Engine Indication (not “conventional center position”)
  - CAS window
  - Primary Radio Tune window

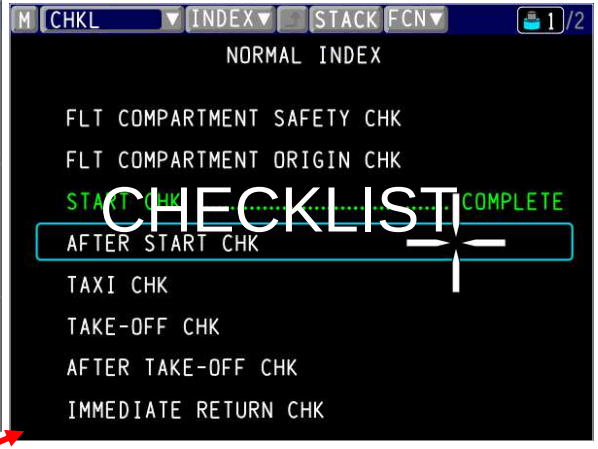
➡ Pilot can obtain all essential flight information through this single display.

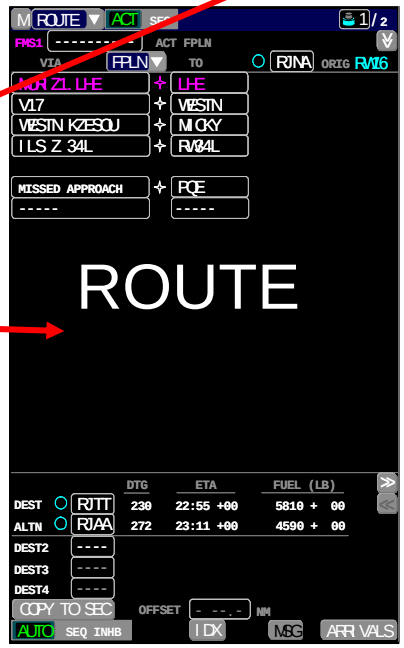
- Minimize eye movements.
- Enhance the situation awareness, Improve the pilot workload.

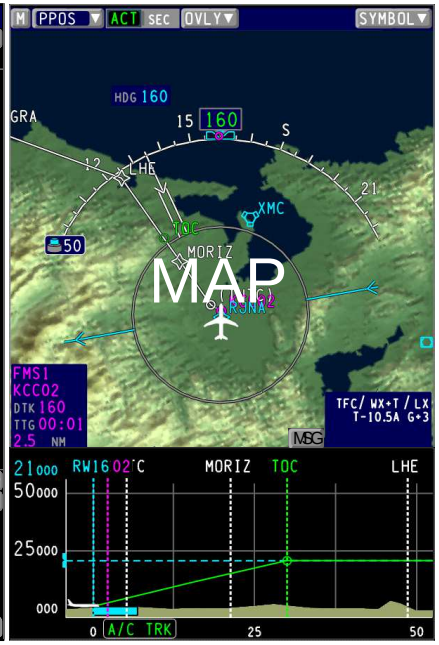


Display Arrangement

- Integrate “Mission Task Indications” to inboard display
  - Multifunction windows:
    - MAP
    - ROUTE
    - RADIO TUNE
    - CHECKLIST
    - FMS ICDU, etc







What Category of LPV?

Approach Procedure with Vertical Guidance (APV)

- As per “ICAO Annex 6 Part 1”, APV is one of Instrument Approach Procedures (IAPs) and includes “RNP APCH w/ Baro-VNAV”, “RNP SAAAR”, “WAAS LPV”, etc.
- ICAO goal is to implement APV by 2016, either as the primary approach, or as a back-up for precision approaches.
- LPV is not necessary for ground infrastructure (ILS, MLS, etc.). It is fully suited for regional jet operations.

	Instrument Approach Classification		*Lateral Guidance*	*Vertical Guidance*	*Example*
Instrument Approach Procedure (IAP)	Non-Precision Approach		Yes	No.	• LOC, LOC BCRS • VOR, VOR/DME • NDB • ASR • PAR • RNP APCH (LNAV only), etc.
	Approach Procedure with Vertical Guidance (APV)		Yes	Yes, but it doesn’t meet the requirements for precision approach	**- RNP APCH w/ Baro-VNAV** **- WAAS LPV (-RNP SAAAR), etc.**
	Precision Approach	CAT I	Yes	Yes, with minima as determined by each category.	- ILS - MLS - GBAS CAT I, etc.
		CAT II			
		CAT IIIA			
		CAT IIIB			
		CAT IIIC			

SBAS Approach Specification

- WAAS LPV (Localizer Performance with Vertical Guidance)
  - More Accurate

    Horizontal Alert Limit: **RNP 0.1 (186m) > WAAS LPV (40m)**

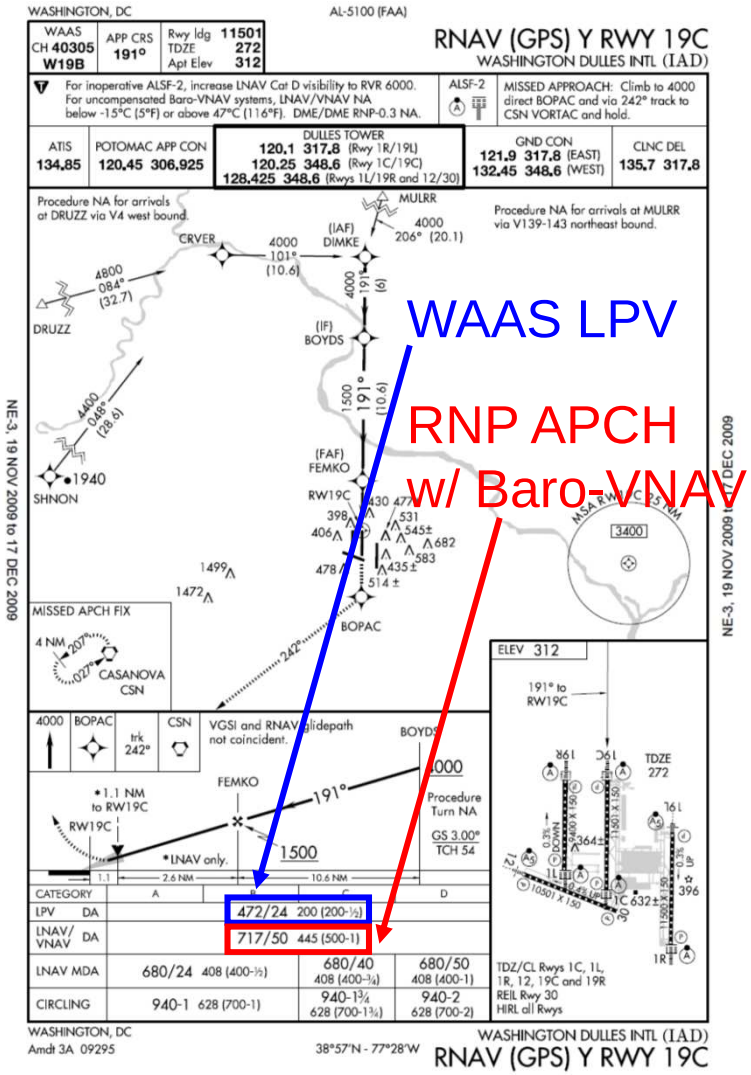
  - Improved Low Visibility Operations

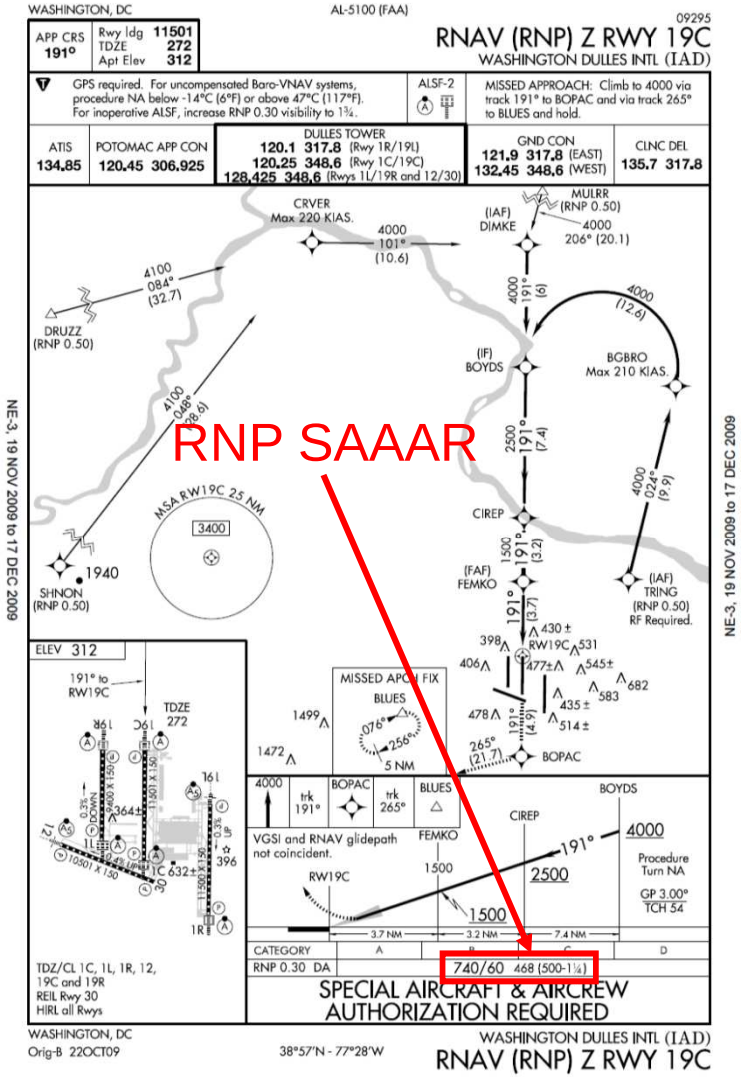
    Minima: Usually **RNP APCH**, (RNP SAAAR) **> WAAS LPV**

Approach Type		**RNP APCH (w/ Baro-VNAV)**	**RNP SAAAR*** *Not for MRJ	**SBAS (WAAS) LPV**
FAA Guidance		AC90-105	AC90-101	AC20-138B
Concept		RNP concept		Non-RNP concept
Flight Guidance	Lateral	Based on GPS		Based on GPS with SBAS(WAAS etc.)
	Vertical	Based on baro-altitude info.		
Horizontal Alert Limit (HAL)		0.3 NM (556m)	0.1 - 0.3 NM (186-556m)	40m
Vertical Guidance		YES	YES	YES
RF Leg		N/A	Available	N/A

4-1. Washington (Dulles) RWY 19C

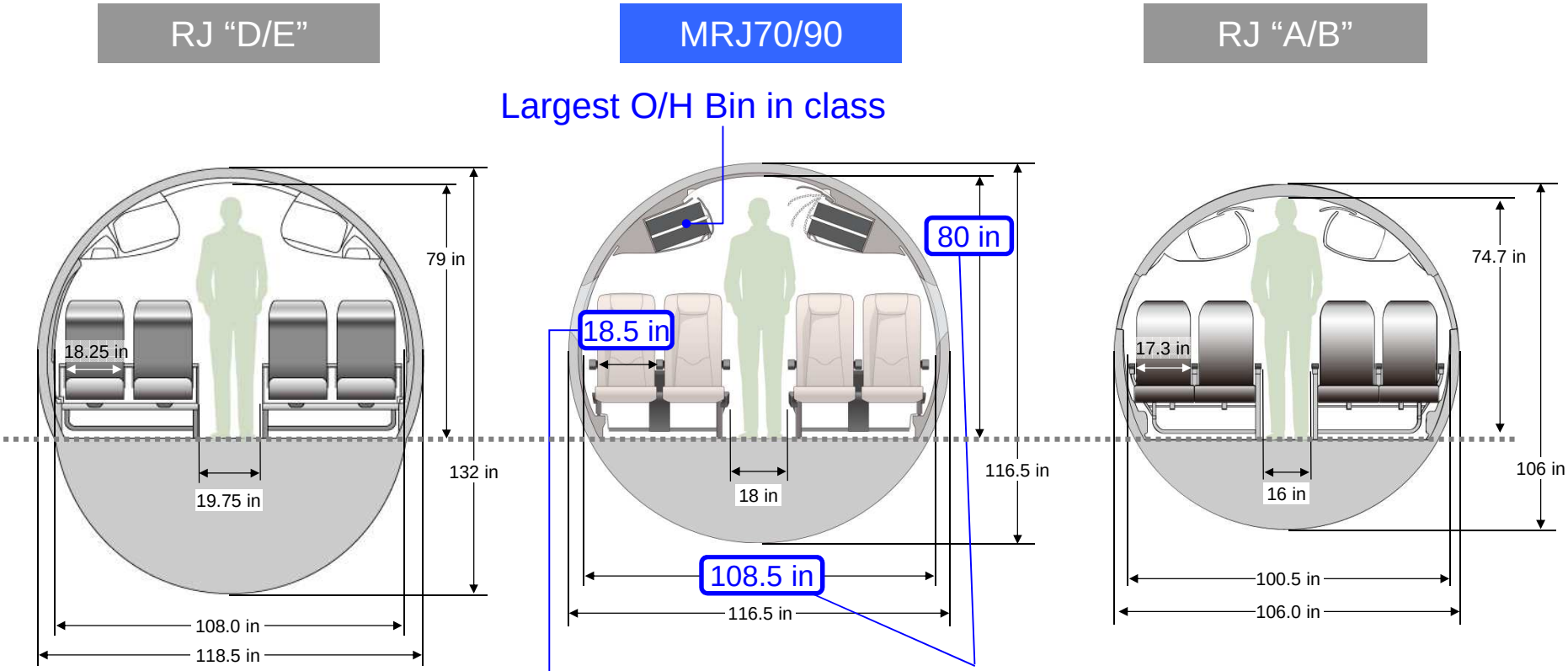
Lower minima is applicable for WAAS LPV.





Passenger-Oriented Design

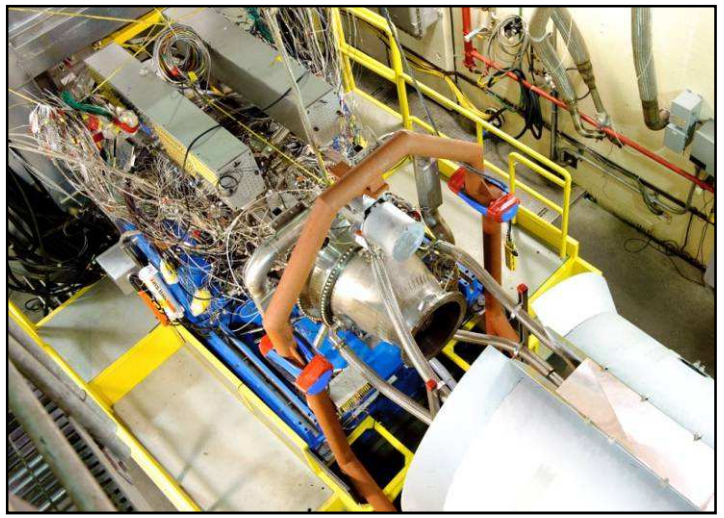
- Largest cabin space in class

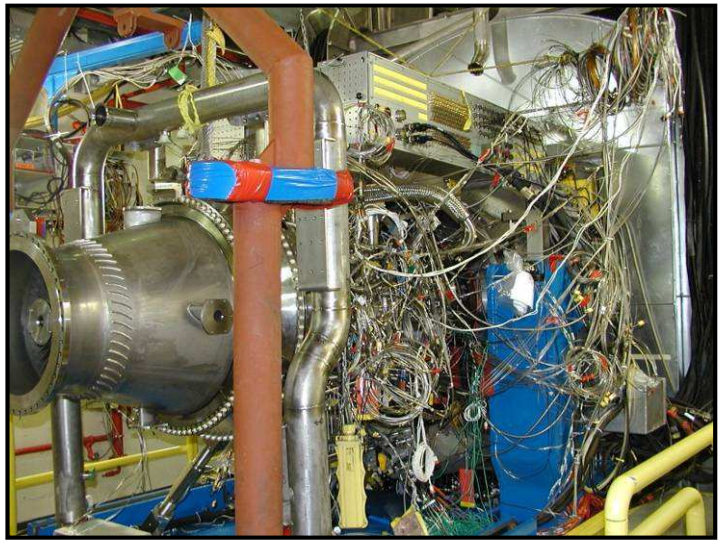


† IATA-recommended maximum size bag
(25 x 45 x 56 cm (9.8 x 17.7 x 22.0 in))
* Passenger Scale: 74 in (1.88 m) (US Male 97.5 %ile)

PW1000G Core Tests Completed

- Over 260 test hours completed
- Key Accomplishments
  - Component performance and operability met performance expectations
  - Dynamics Survey
  - Performance / Mapping & Optimization
  - Low Power Operability: Stall Mapping
  - High Power Operability: Surge & Distortion
  - Squeeze Test / HPT Performance





Core Performance Met All Requirements

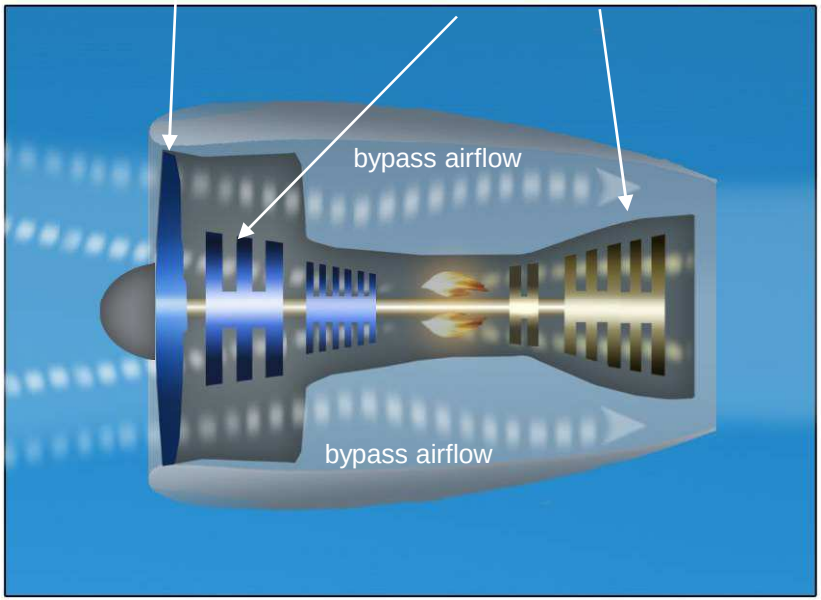
Pratt & Whitney
A United Technologies Company

Step Change in Efficiency

Conventional Turbofan

Fan speed constrained by low pressure spool

LPC & LPT speed constrained by fan

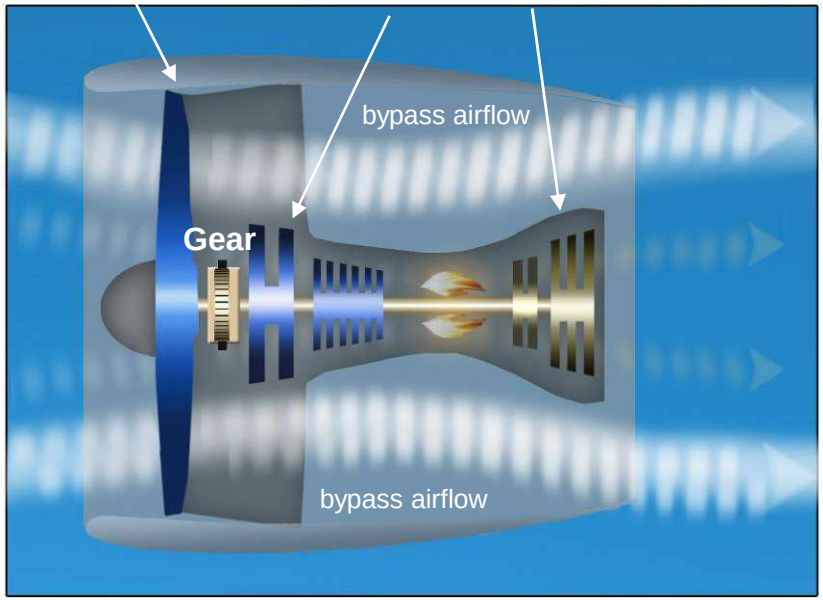


Incremental Improvement

PurePower® PW1000G Engine

Ultra-efficient, Light-weight, Low-speed fan

LPC & LPT speed optimized



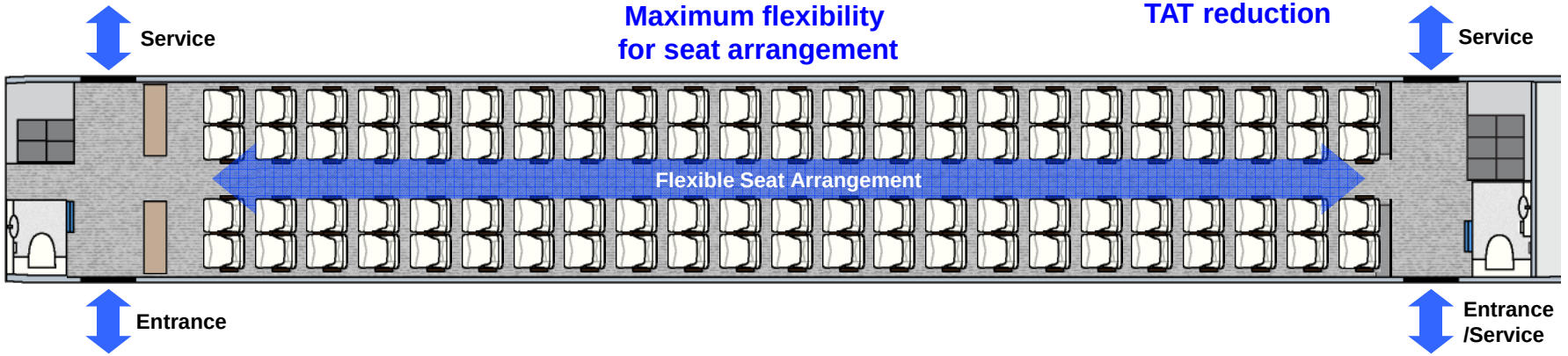
Step Change Improvement

LPC : Low Pressure Compressor
LPT : Low Pressure Turbine

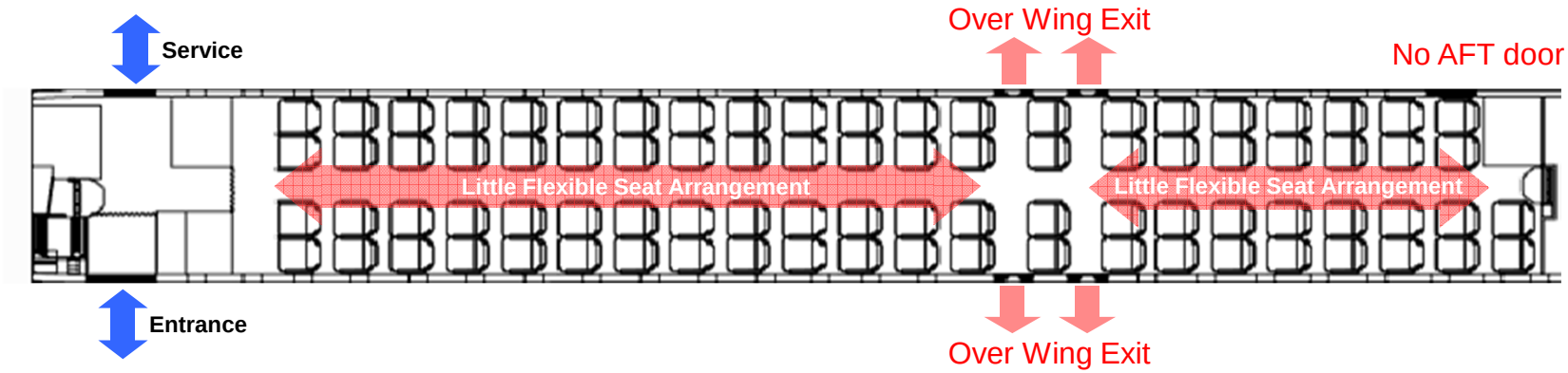
Flexible Interior Arrangement

- Flexible interior arrangement
- Shorter TAT

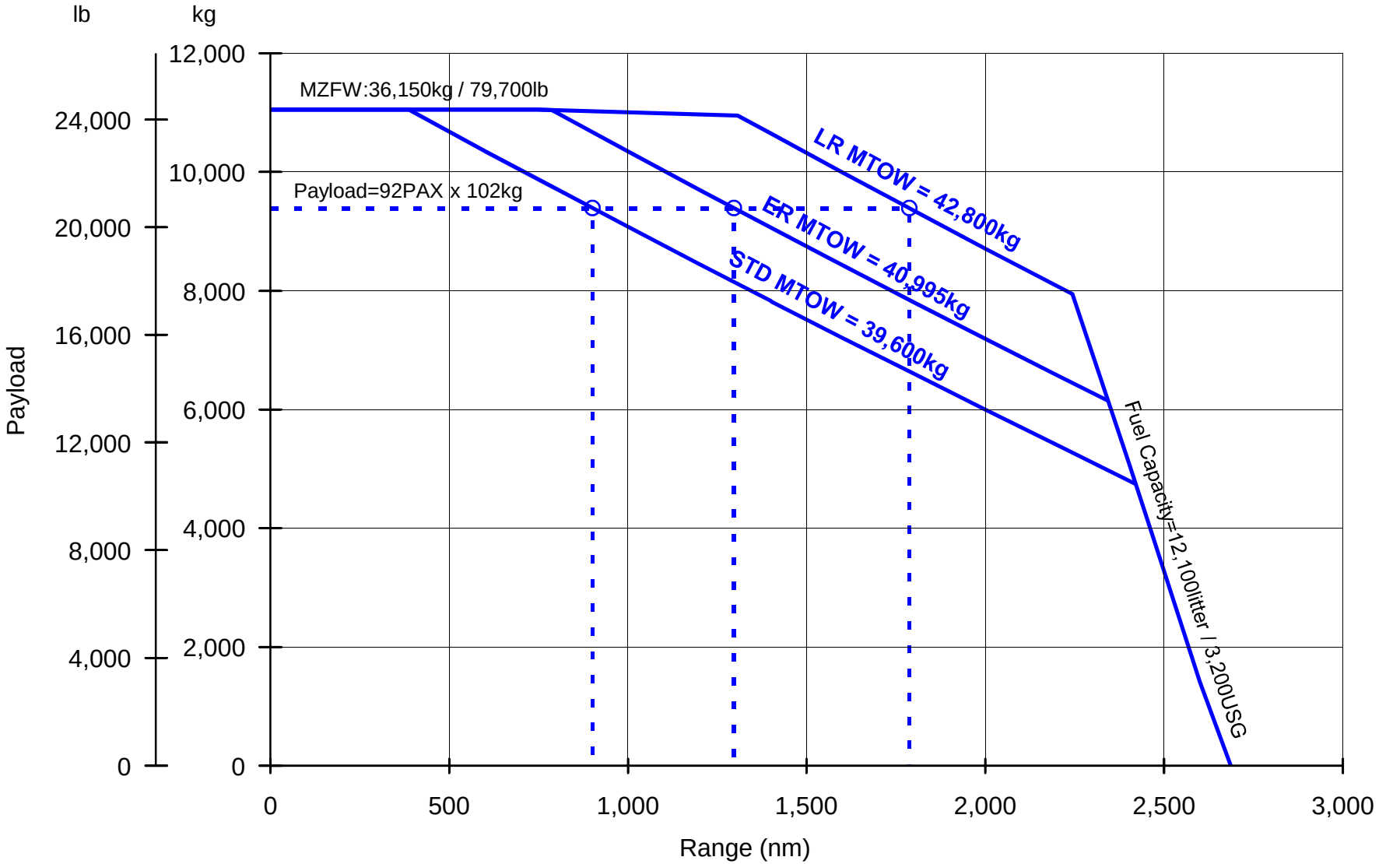
MRJ90



RJ “B”



Payload-Range Capability - MRJ90



ISA, No Wind, LRC, Alternate 200nm

Overhead Bin Comparison

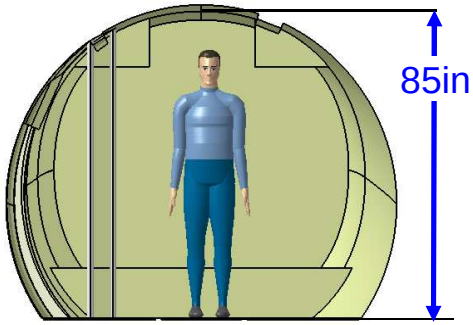
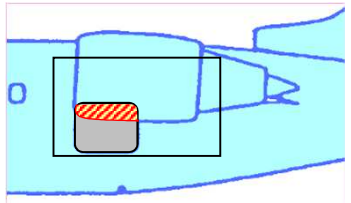
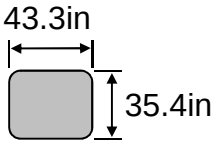
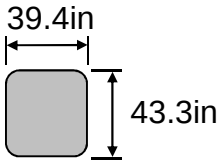
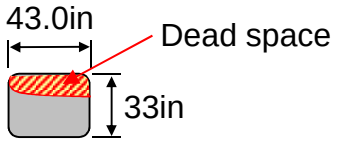
- MRJ O/H bin accommodates maximum-sized carry-on bags allowed by airlines.

MRJ can accommodate IATA-recommended maximum size bag

	Allowable Size (cm)			MRJ	RJ "A/B"	RJ "D/E"
	H	W	L			
IATA recommendation / American Airlines / British Airways	25	45	56	✓		
United / Continental Airlines	23	35	56	✓	✓	✓
Delta / nwa (Northwest Airlines) / US Airways	23	36	56	✓	✓	✓
Alaska Airlines	25	43	61	✓		
Air France / KLM	25	35	55	✓	✓	✓
Lufthansa	20	40	55	✓	✓	✓

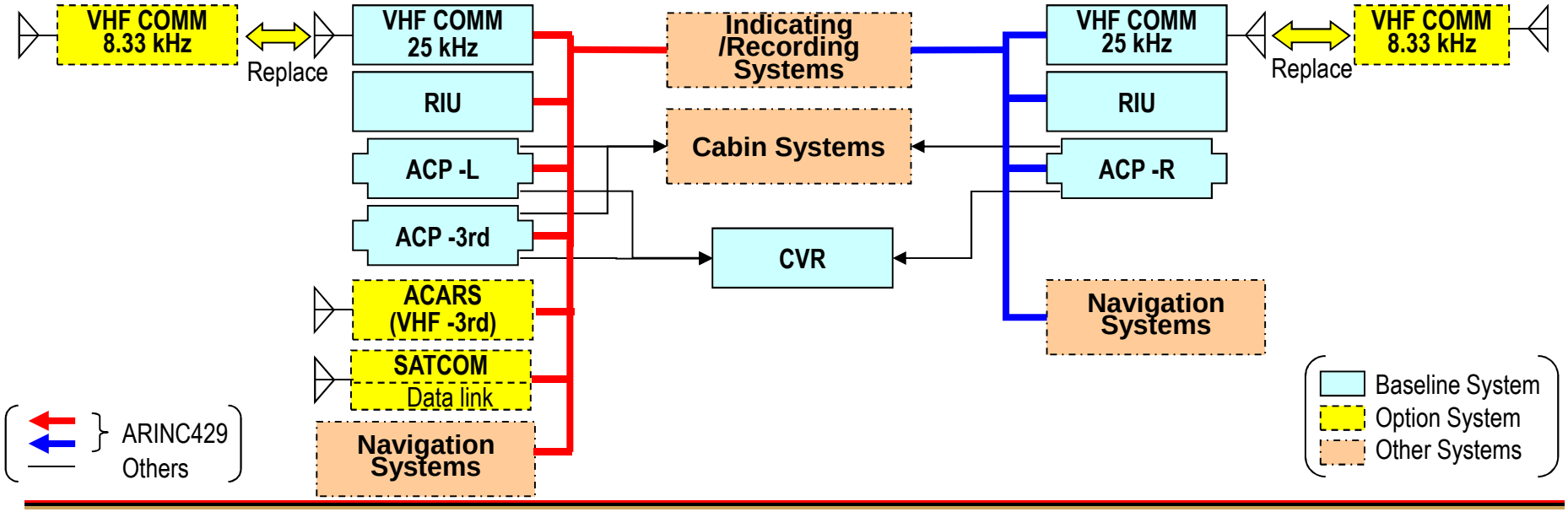
Cargo Compartment - Comparison

- MRJ utility beyond what current RJs can offer:
  - Higher workability
  - Large cargo door

	RJ "E"	MRJ90	RJ "B"
Workability	Non stand-up cargo compartment 	Stand-up cargo compartment  * Person Scale: 74 in (1.88 m) (US Male 97.5 %ile)	Uncommonly inaccessible cargo door 
Cargo Door	All cargo doors of insufficient size 	Large cargo door Sufficient space around door 	RJ "B" cargo door has dead space 

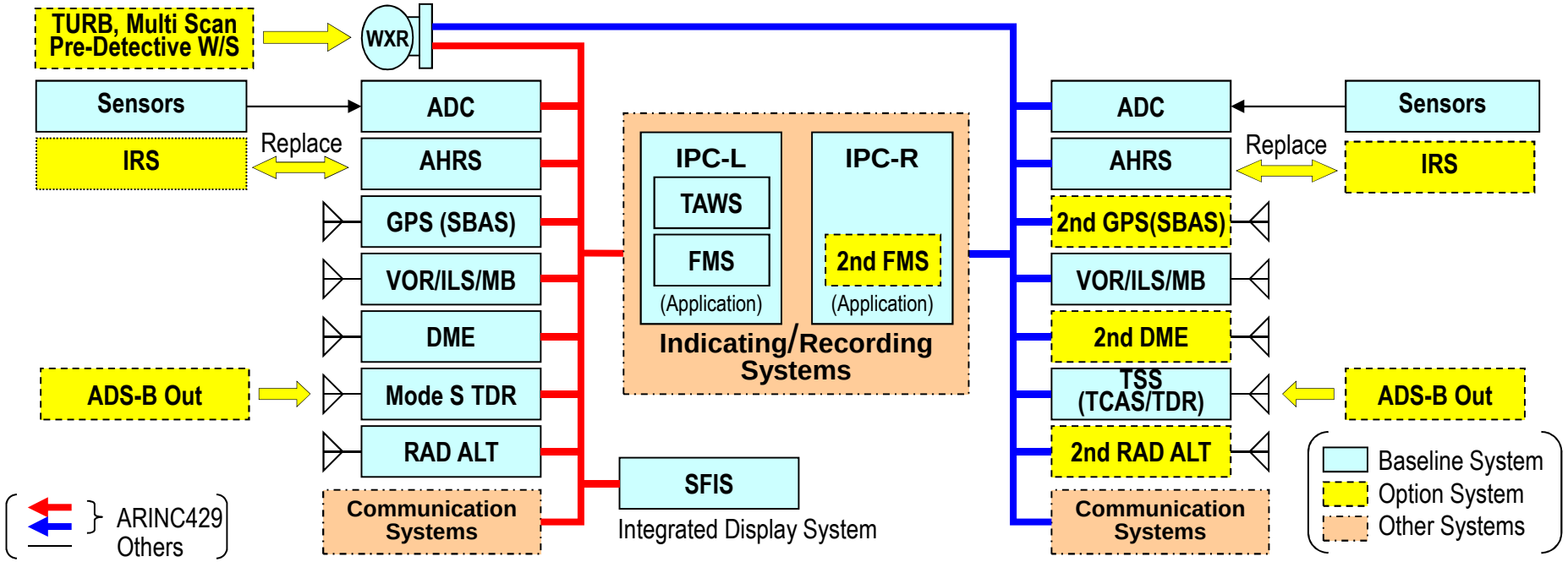
ATA23 Communications

- Communication System consists of subsystems such as VHF Communication System, Audio Integrating, Cockpit Voice Recorder, and Integrated Automatic Tuning.
- Solid state-type CVR recorder with a minimum recording time of 2hr.
- Major equipment is supplied by Rockwell Collins and is mostly TSO-approved.



ATA34 Navigation

- Navigation system includes the following subsystems:
  - flight environment data (ex: air data system)
  - attitude and direction (ex: attitude heading reference system)
  - landing and taxing aids (ex: radio altimeter)
  - independent position determination (ex: terrain awareness and warning system)
  - dependent position determination (ex: VHF navigation system)
  - flight management computing (flight management system)
- System has Cat II, RNP(0.3) and Baro V-NAV capability.
- Major equipment is supplied by Rockwell Collins and TSO-approved.



Contents

MRJ CNS System Concept

Communication Navigation and Surveillance (CNS) systems are strongly desired to adopt next generation **CNS/ATM** technologies for regional jet operations because these technologies enhance efficiency and safety of flight.

On the other hand, CNS systems have to integrate so many equipments from legacy radios to advanced technology components. All components are equally high reliablity and oprability.

Our CNS system are highly integrated based on new "ProLine Fusion system" However, each CNS components are carefully selected matured and well field-proven components for guaranteed safety of flight.

Future Basic CNS/ATM Environment

Communication

Data link communication

- CPDLC*

Broadband communication

- Swift Broadband SATCOM*

Navigation

Performance Based Navigation (PBN)

- RNAV & RNP (*greater than 0.3*)

WAAS (SBAS) navigation

- LPV

Surveillance

Improvement air traffic flow and safety of flight

- ADS-B out*

*Option

CNS systems consist of Baseline and Option subsystems, defined as:

Baseline: Regulation-mandated systems, or equipment that is required by the such systems.

Option: Systems required for specific operations and/or market-unique requirements.

CNS Options (1/3)

Communication System

Items	Descriptions
VHF Communications (8.33kHz Spacing)	For European specifications, baseline 25kHz spacing VHF transceivers can replace 8.33kHz versions.
ACARS	For VHF data link capability, 3rd VHF transceiver, antenna and printer are added and Radio Interface Unit is replaced by data link type RIU. The data link function provides VDL Mode A and Mode 2 capability. Data link capability requires subscribing to a data link service provider. (ACARS: Aircraft Communication Addressing and Reporting System)
CPDLC (ATN)	CPDLC software is added for 2-way data communication between pilot and ATC. Current CPDLC is not applicable for FANS. CPDLC requires 3rd VHF Comm/Data link (ACARS) option. (CPDLC: Controller Pilot Data Link Communications)
SATCOM with Swift Broadband	For Satellite Communication capability, SATCOM transceiver, Diplexer/Low Noise Amplifier, High Speed Transceiver and High Gain Antenna are added. It is possible to use ACARS and CPDLC data link in combination with ACARS and IRS options. Extended overwater communications require HF or SATCOM communication system.

CNS Options (2/3)

Navigation and Surveillance System

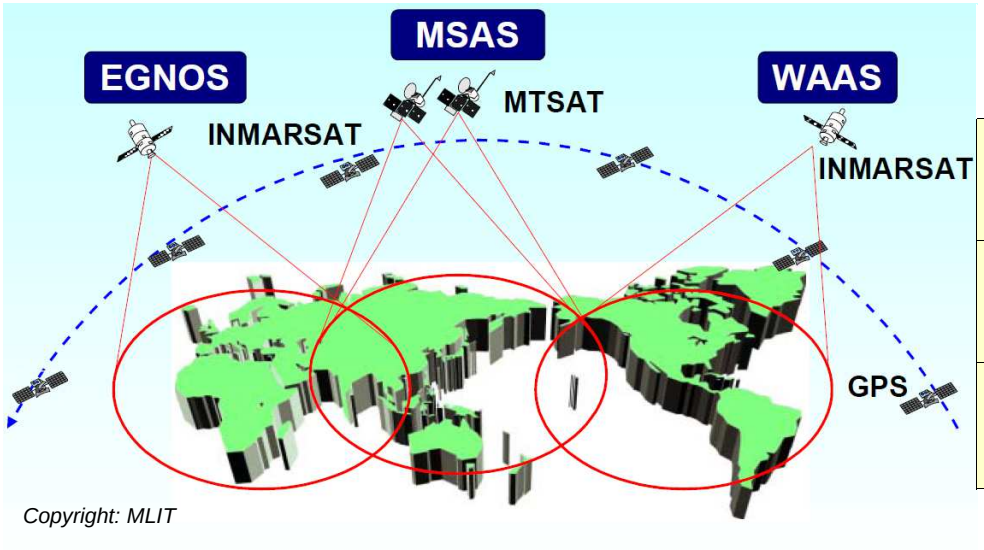
Items	Descriptions
IRS: Inertial Reference System (replaces AHRS)	For high accuracy and stability of attitude, heading and position data, two baseline AHRS are replaced by two IRS. AHRS complies with MRJ basic operations. Moreover, IRS enhances the following capabilities: • High accuracy navigation (HUD, RNAV10, VNAV, etc.) • SATCOM
Mode S Transponder with ADS-B out function	Baseline transponder is replaced by transponder capable of transmitting ADS-B data. ADS-B continuously broadcast messages including aircraft position, heading and velocity etc. (ADS-B: Automatic Dependence Surveillance - Broadcast)
Weather Radar System with Predictive Winds Shear	For Predictive Winds Shear capability, baseline WXR receiver/transmitter antenna is replaced by MultiScan/FLW Weather Radar. Predictive winds shear function provides appropriate visual and aural cautions, warnings and messages to the flight crew before the wind shear becomes an immediate threat to the aircraft. (WXR: Weather Radar, FLW: Forward Looking Wind Shear Radar)

CNS Options (3/3)

Items	Descriptions
FMS: 2nd Flight Management System with GPS and DME	For reliability improvement of FMS, Common Computing Module, 2nd FMS software, 2nd GPS receiver, 2nd GPS antenna, 2nd DME Transceiver and 2nd DME antenna are added. Cross-talk buses synchronize flight plan changes between the FMS systems. Sensor data is independently provided to each FMS.
HUD: Head Up Display System	For Improved Situational Awareness and Category II approach capability, Overhead Unit (OHU), Combiner and HUD Graphics Card are added, and necessary to replace two AHRS with two IRS. HUD is a flight information display system that presents information as a collimated image that is focused at optical infinity so that the pilot can simultaneously focus on the HUD image and outside the aircraft.

SBAS (Satellite-Based Augmentation System)

- SBAS (WAAS) improves position accuracy and availability. Its geostationary satellites provide aircraft augmentation information which is processed with differential correction and determines integrity using GPS frequencies.
- MRJ designed to operate with signals from any SBAS developed to RTCA DO-229( ).
- MRJ installed with GPS receiver and antenna which has the capability for three (3) types of SBAS (WAAS in US, MSAS in Japan, EGNOS in Europe).



Copyright: MLIT

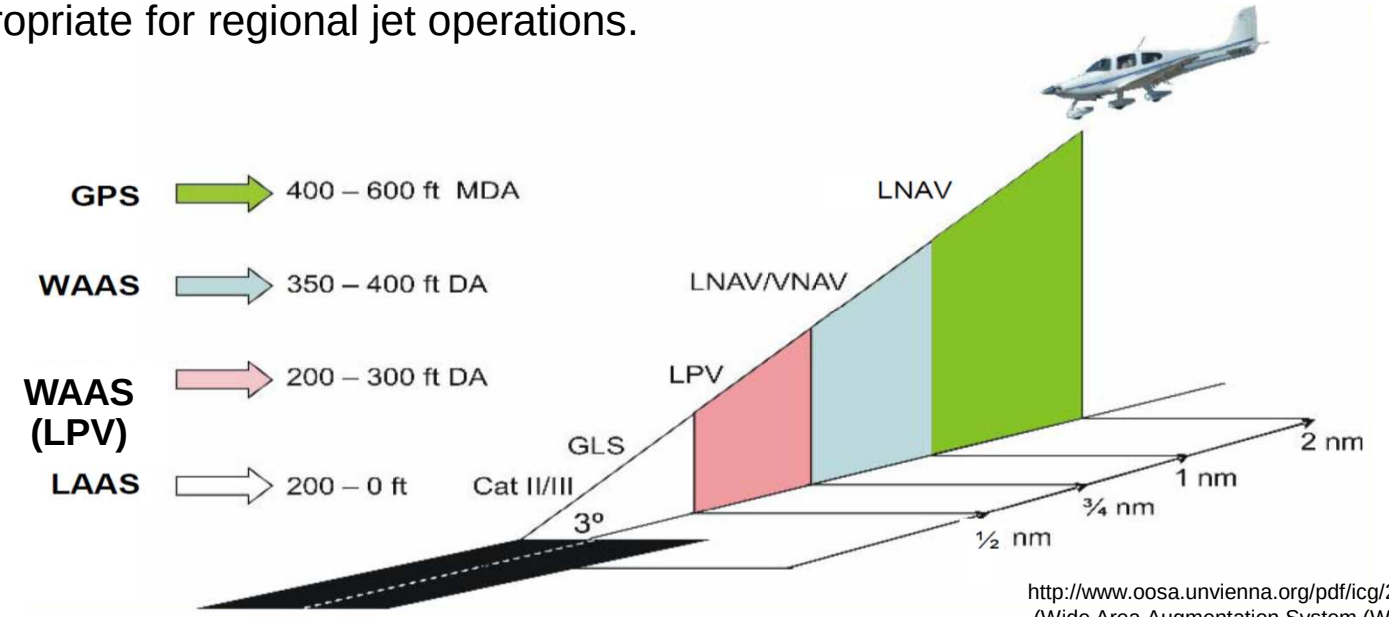
	US	Japan	EU
SBAS	**WAAS**	**MSAS***	**EGNOS****
Core system	**GPS**	**GPS**	**Galileo**
SBAS Augmentation Satellite	**INMARSAT**	**MTSAT**	**INMARSAT**

* *SBAS approach by MTSAT is under development in Japan.*

** *Galileo is under development and EU plans to begin system operations after 2014.*

SBAS (Satellite-Based Augmentation System)

- GPS receiver available for enrooted, terminal, and ocean RNAV and RNP operations. However, greater accuracy and integrity is required for approach phases.
- SBAS (WAAS) enhances and ensures GPS signal integrity to support ICAO/FAA Required Navigation Performance (RNP) criteria.
- MRJ has SBAS (WAAS) capability sufficient for "RNP Approach, with Baro-VNAV (greater than 0.3)" and "Localizer Performance with Vertical guidance (LPV)" approach as Cat I. "RNP SAAAR" is one of potential growth features for the MRJ.
- LPV approved by FAA in 2003. Approximately 500 US airports per year are adding LPV. LPV not necessary for costly ground infrastructure (ILS, MLS, etc.) and is much more appropriate for regional jet operations.



http://www.oosa.unvienna.org/pdf/icg/2008/expert/2-6b.pdf
(Wide Area Augmentation System (WAAS) July 15, 2008, FAA)

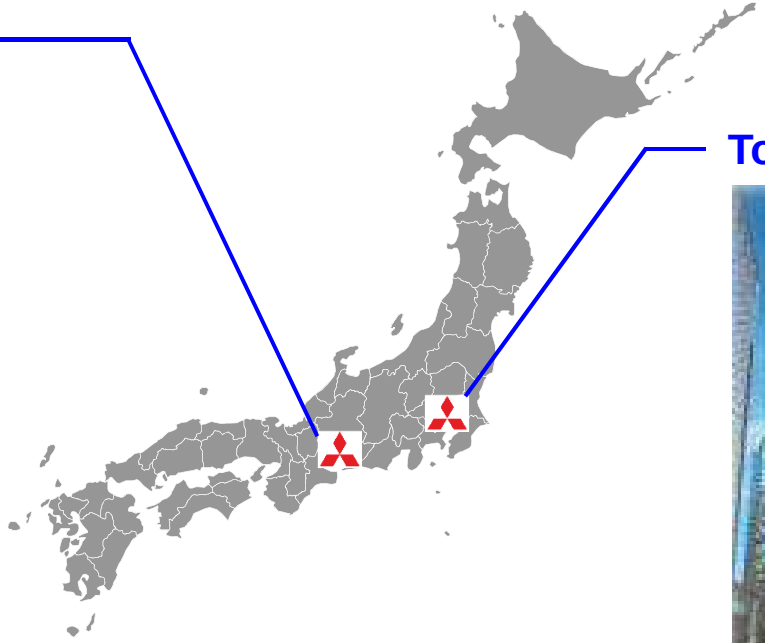
MRJ Capability for Future CNS/ATM

			MRJ
Communication	CPDLC (*ATN*)		○ (option)
Navigation	RNAV[1]	RNAV 10	○ (option)
		RNP 4	(under development for FANS)[2]
		RNAV 5	○
		RNAV 2	○
		RNP 2	○
		RNAV 1	○
		Basic-RNP 1	○
		RNP APCH	○
		RNP AR APCH	(under development)
		SBAS (inc. LPV)	○
		GBAS (GLS)	---
Surveillance	ADS-B out		○ (option)

Notes: [1]Based on FAA AC90-105, RTCA DO-128B, DO-236B
[2]CPDLC applicable for ATN, but not FANS.

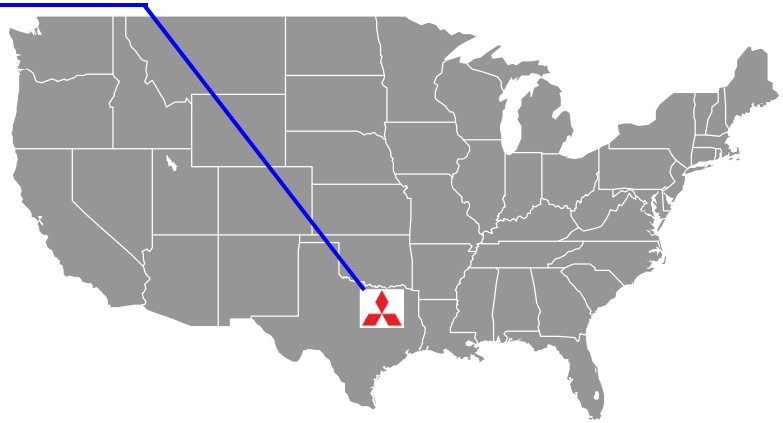
Mitsubishi Aircraft Corporation

Head Office (Nagoya)



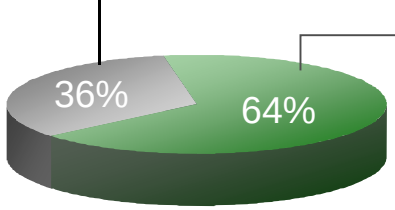
Tokyo Office

US Office (Addison/Dallas, Texas)



Business Structure & Investors

TOYOTA
Sumitomo Corporation
MITSUBISHI ELECTRIC
Mitsubishi Corporation
TOKIO MARINE NICHIDO
MITSUBISHI RAYON CO.,LTD.
MITSUI & CO., LTD.
JGC CORPORATION
DBJ Development Bank of Japan



MITSUBISHI HEAVY INDUSTRIES, LTD.

Capital : ¥100 billion ($1.0billion)

Invest

Customer

Sales
Aircraft Delivery
Customer Support

MITSUBISHI AIRCRAFT CORPORATION

1. Design
2. Procurement
3. Sales
4. Customer support

Manufacturing Order

MITSUBISHI HEAVY INDUSTRIES, LTD.

1. Manufacturing
2. Testing
3. Final assembly