Overview of MRJ Program and Systems

ICAS Biennial Workshop – 2015

“Complex Systems Integration in Aeronautics”

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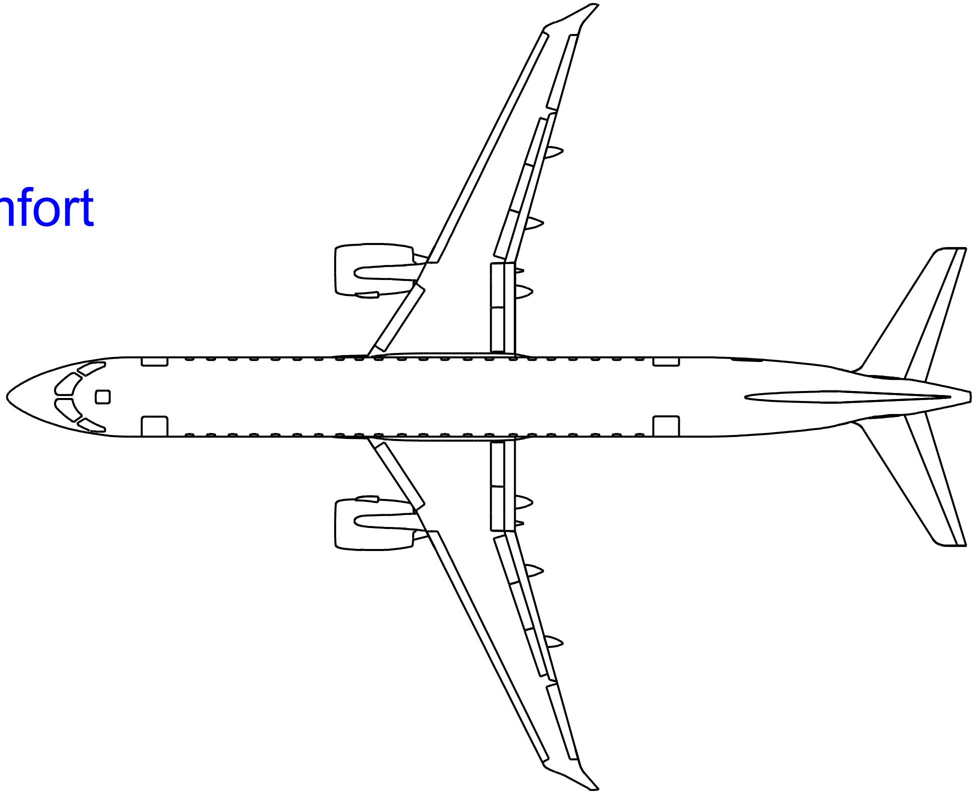
Program Status

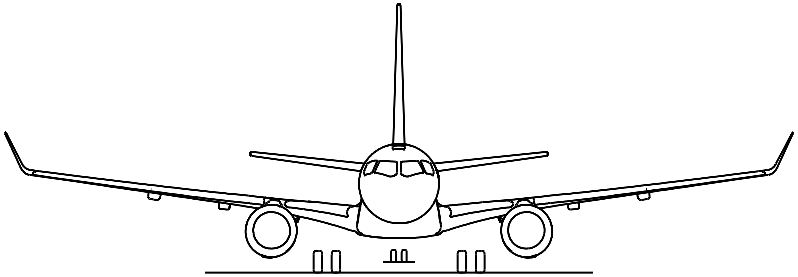
✓	2008	Launch
✓	2009	Preliminary Design Review
✓	2010	Critical Design Review
✓	2012	PW1217G Engine First Flight
✓	2013	Final Assembly Commenced
	2015	First Flight
	2017	First Delivery

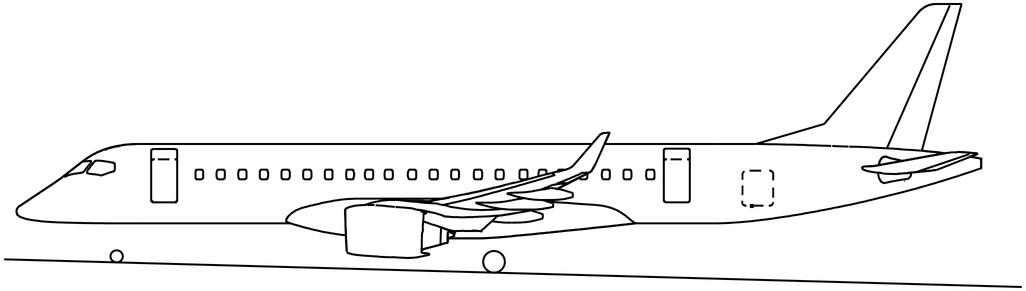
General Arrangement

- Fuel Efficiency
  without Compromising Cabin Comfort
  - High Aspect Ratio Wing
  - High Fineness Ratio Fuselage
  - Sharp Nose



- Innovative GTF Engine





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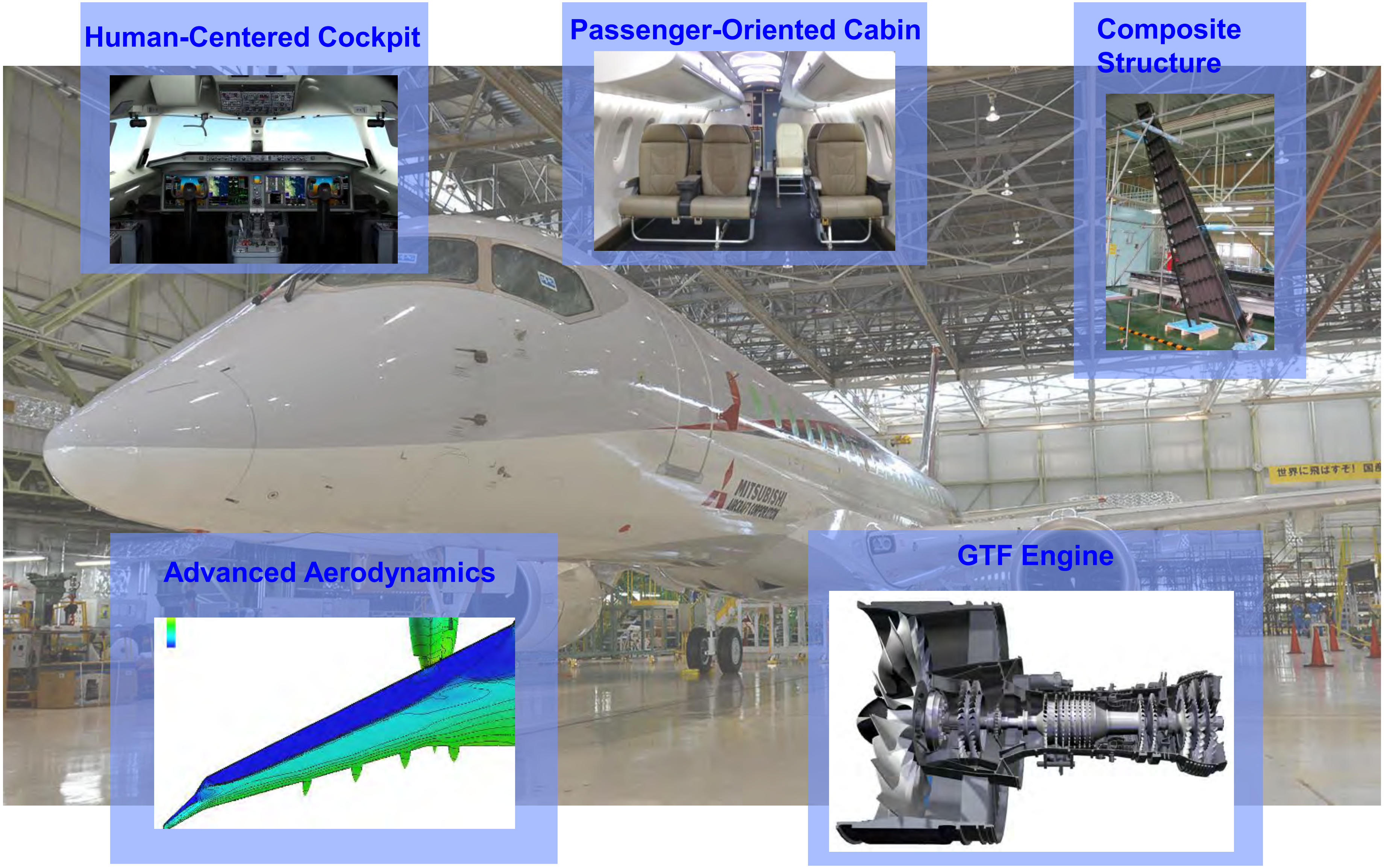
Key Features

Environment
Lowest Fuel Burn, Noise, Emissions

Passengers
Most Comfortable Cabin

Airlines
Most Efficient Aircraft

State-of-the-Art Technologies

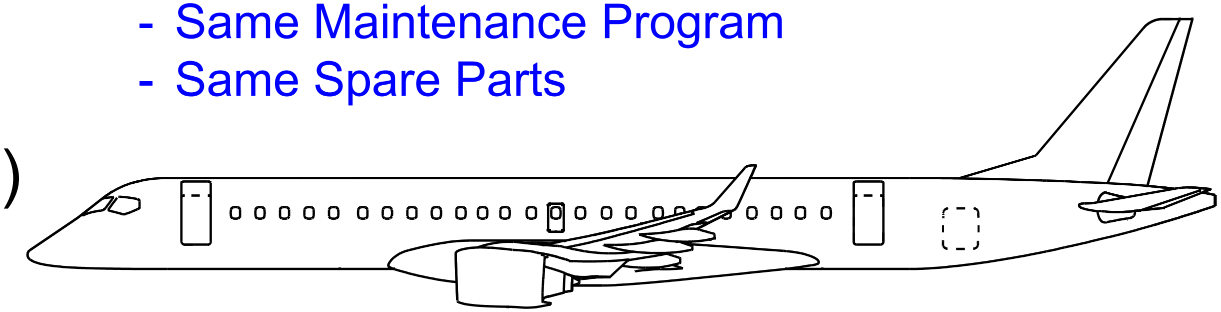


MITSUBISHI HEAVY INDUSTRIES, LTD.

- Ultimate Commonality
  - Same Pilot Type Rating
  - Same Engines
  - Same Maintenance Program
  - Same Spare Parts

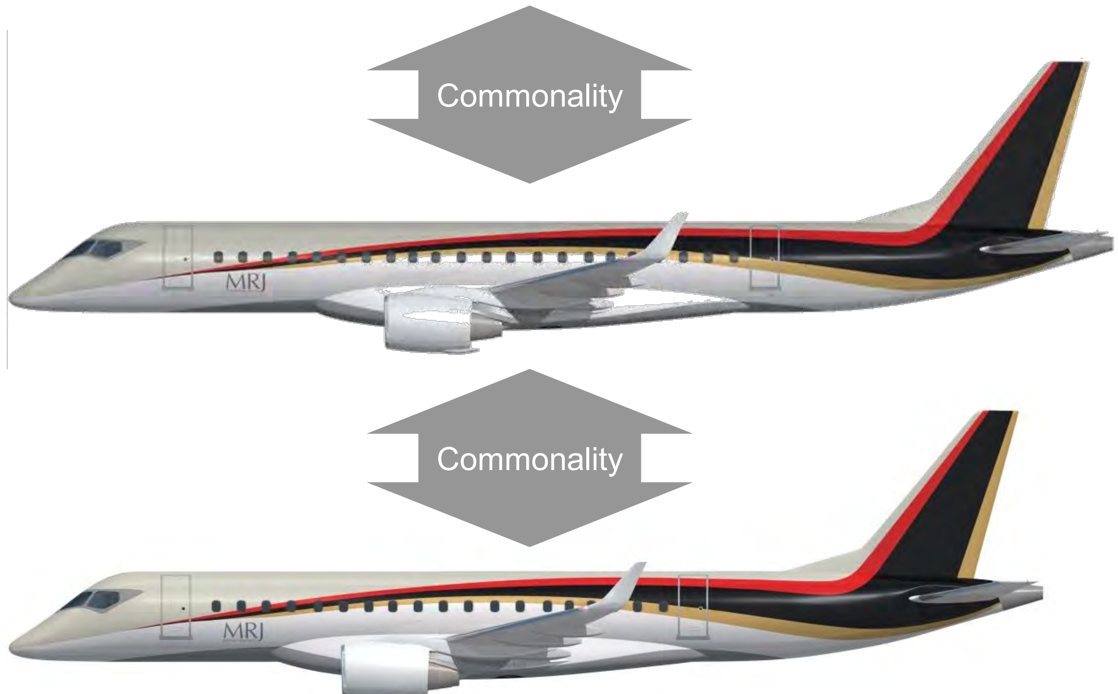
MRJ100X (Plan)

100 seats



MRJ90

88 seats



MRJ70

76 seats

Typical single-class seating at 31" pitch

Principal Characteristics - MRJ90

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		MRJ90STD	MRJ90ER	MRJ90LR
Passengers		88 (Typical single-class seating at 31” pitch)		
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 * @88PAX x 102kg (225lb)	km (nm)	2,120 (1,150)	2,870 (1,550)	3,770 (2,040)
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 100nm

Range Capability: PARIS

ISA, 85% Annual Wind, LRC @37,000ft, Alternate 100nm, 5% Airways Allowance
Payload : MRJ90 88PAX X 102kg (225lb), MRJ70 76PAX X 102kg (225lb)

Significant Noise Reduction

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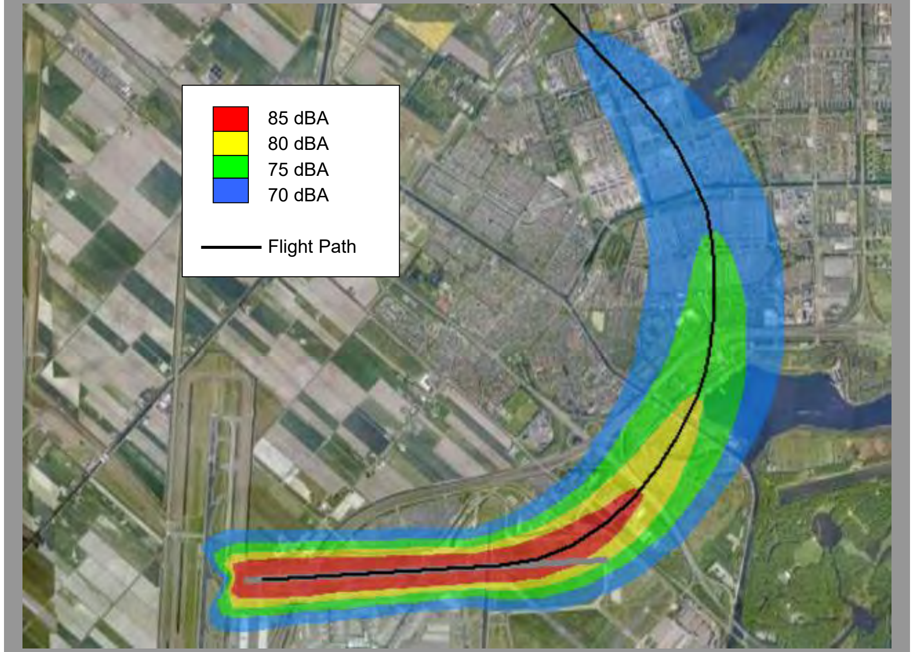
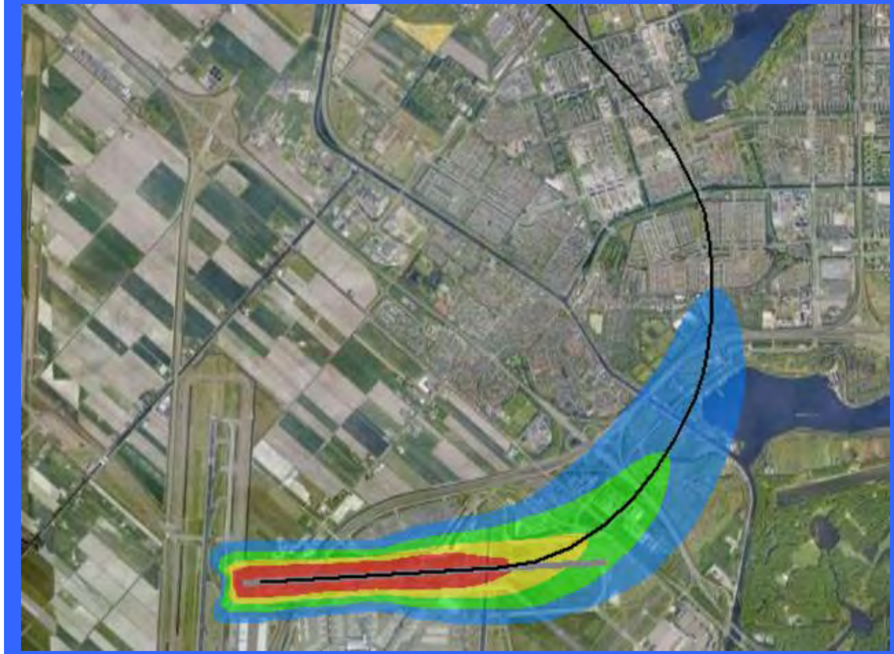
- Noise area reduced by 40%
- Great benefit by lower community noise
  - Lower noise charge
  - Extending operations into noise curfews
  - Free from noise abatement flight tracks and runways

E190

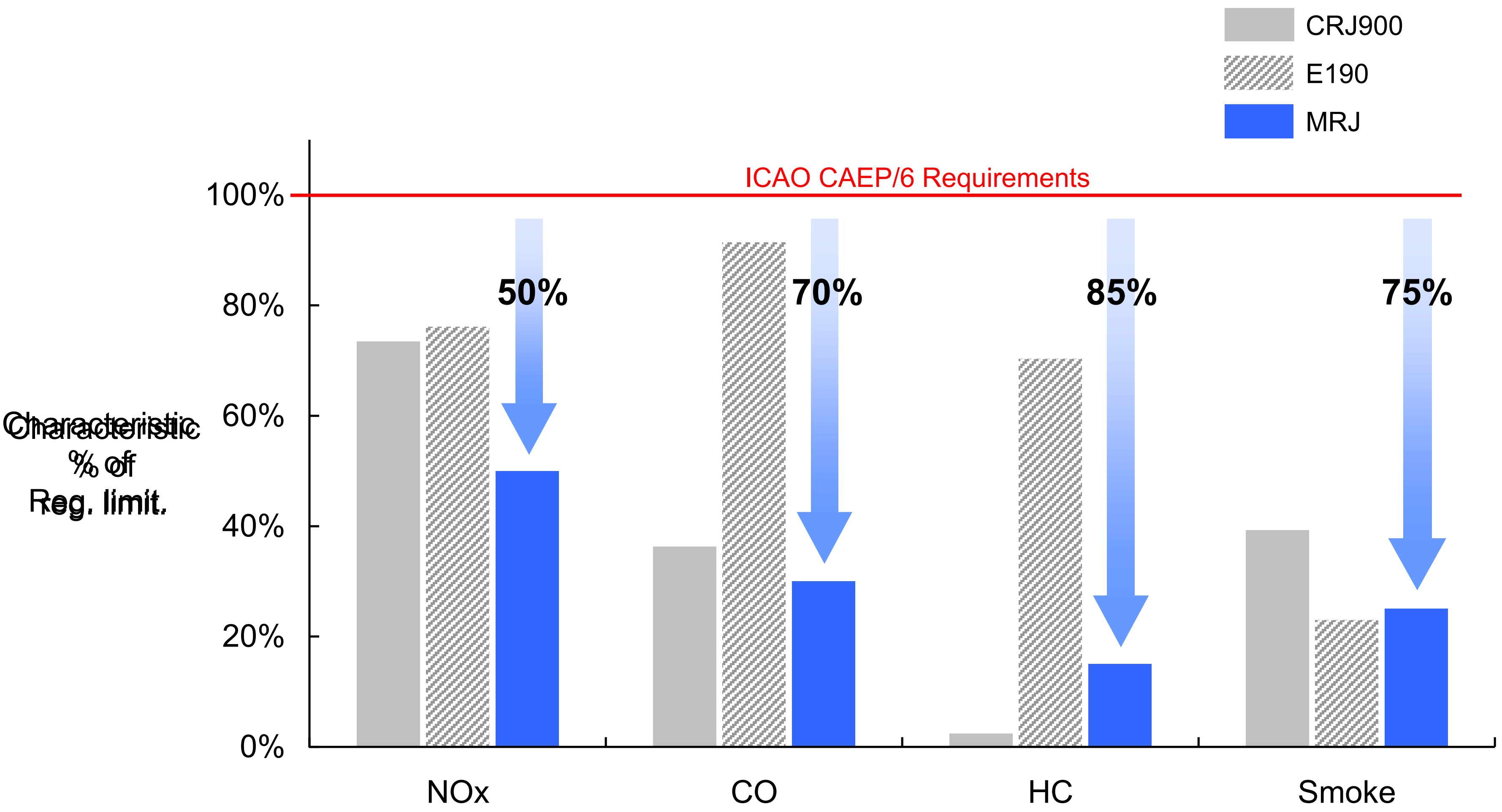


MRJ90

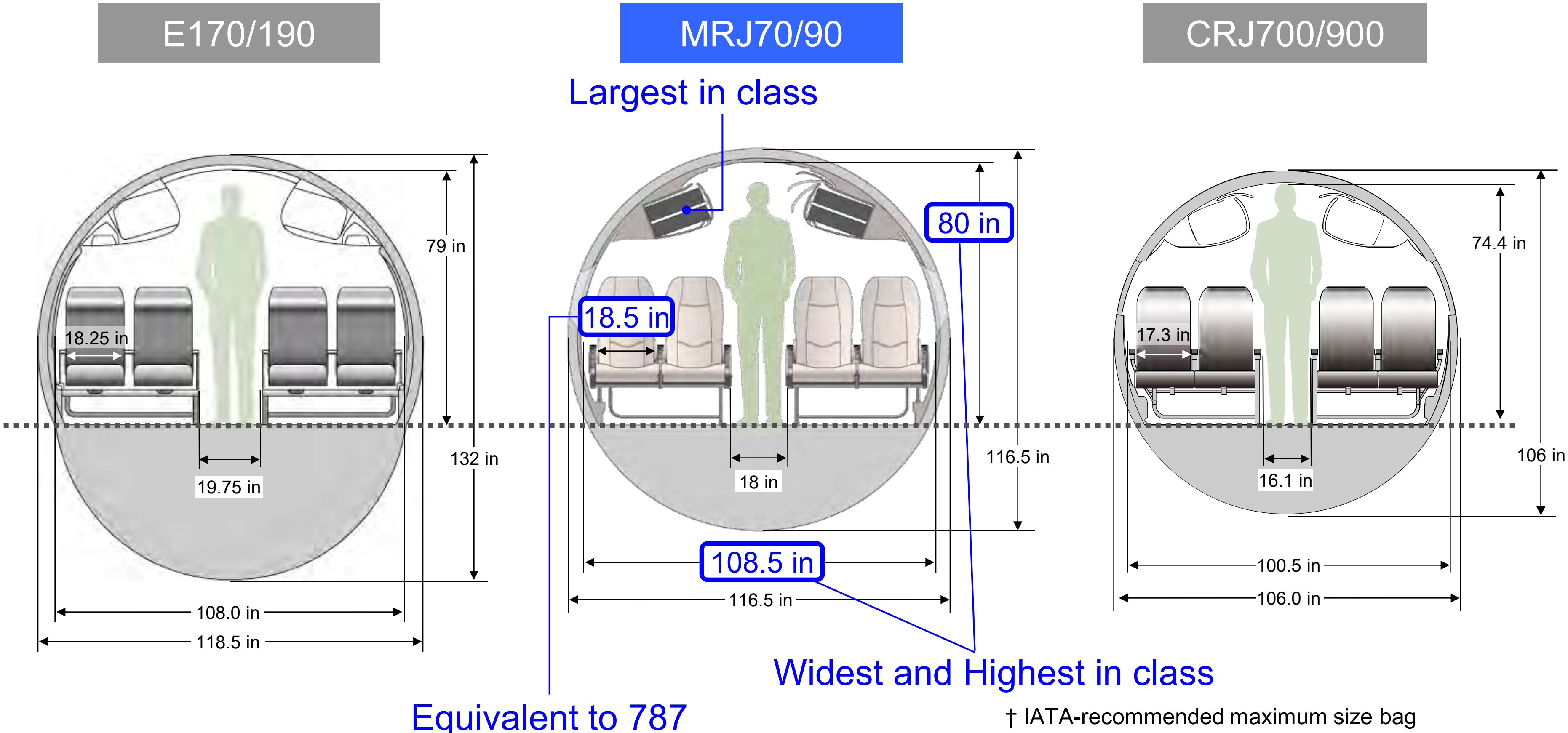


* Mitsubishi Aircraft Estimation at Schiphol Airport (AMS)

Greenest in class to meet future environmental requirement



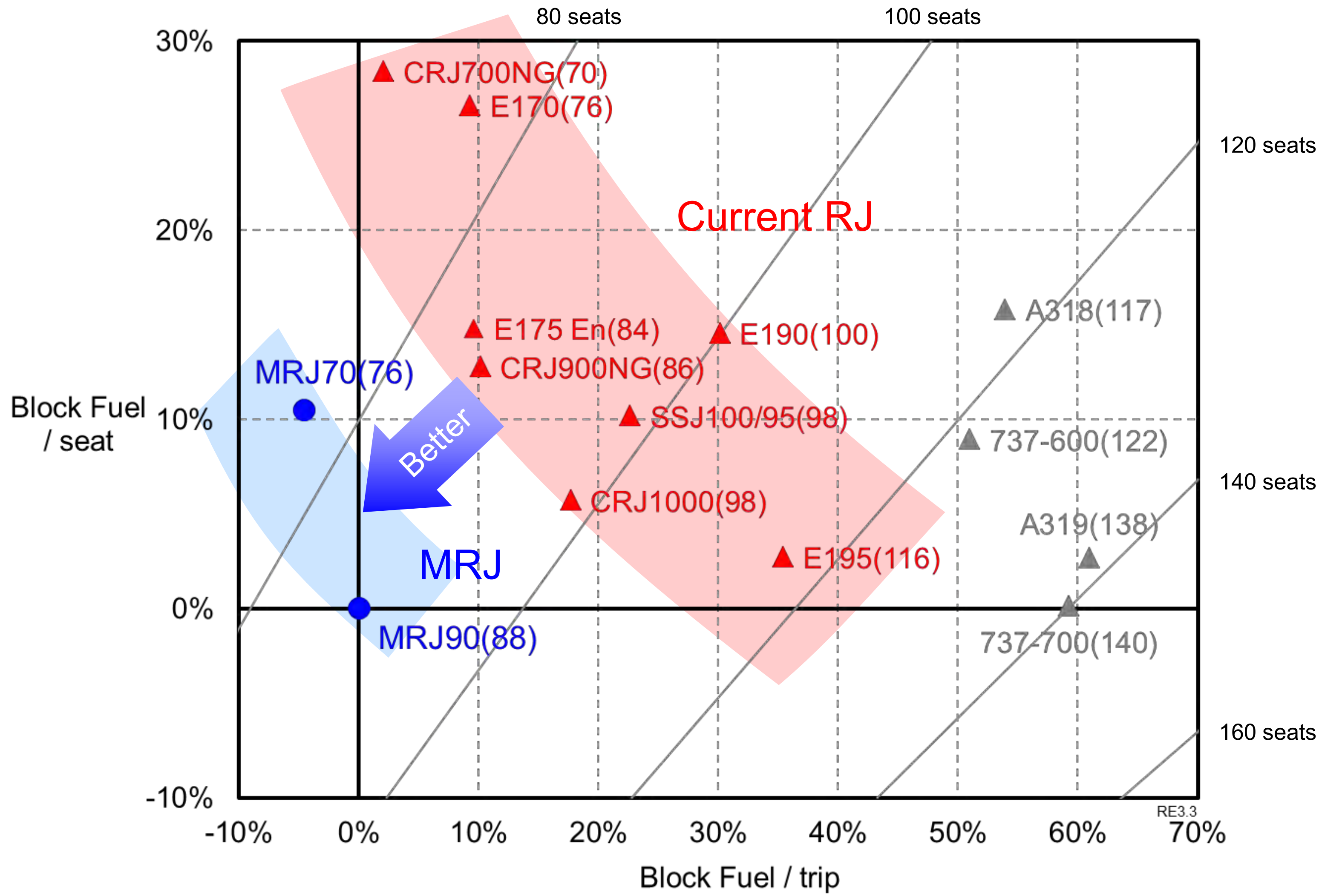
- *Widest and Highest Cross Section*
- *Widest Seat*
- *Largest Overhead Bin*



† IATA-recommended maximum size bag (56 x 45 x 25 cm (22 x 18 x 10 in))

* Passenger Scale: 74 in (1.88 m) (US Male 97.5 %ile)

Game Changing Fuel Efficiency



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

Orders Received

	Orders	Option/ Purchase Right
ANA	15	10
TRANS STATES HOLDINGS	50	50
SKYWEST, INC.	100	100
Air Mandalay	6	4
EASTERN	20	20
JAPAN AIRLINES	32	-
Total	223	184
	407	

Roll-out

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<u>2014.10.18</u>

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Low Speed Taxi Test

Diagram of Product Development

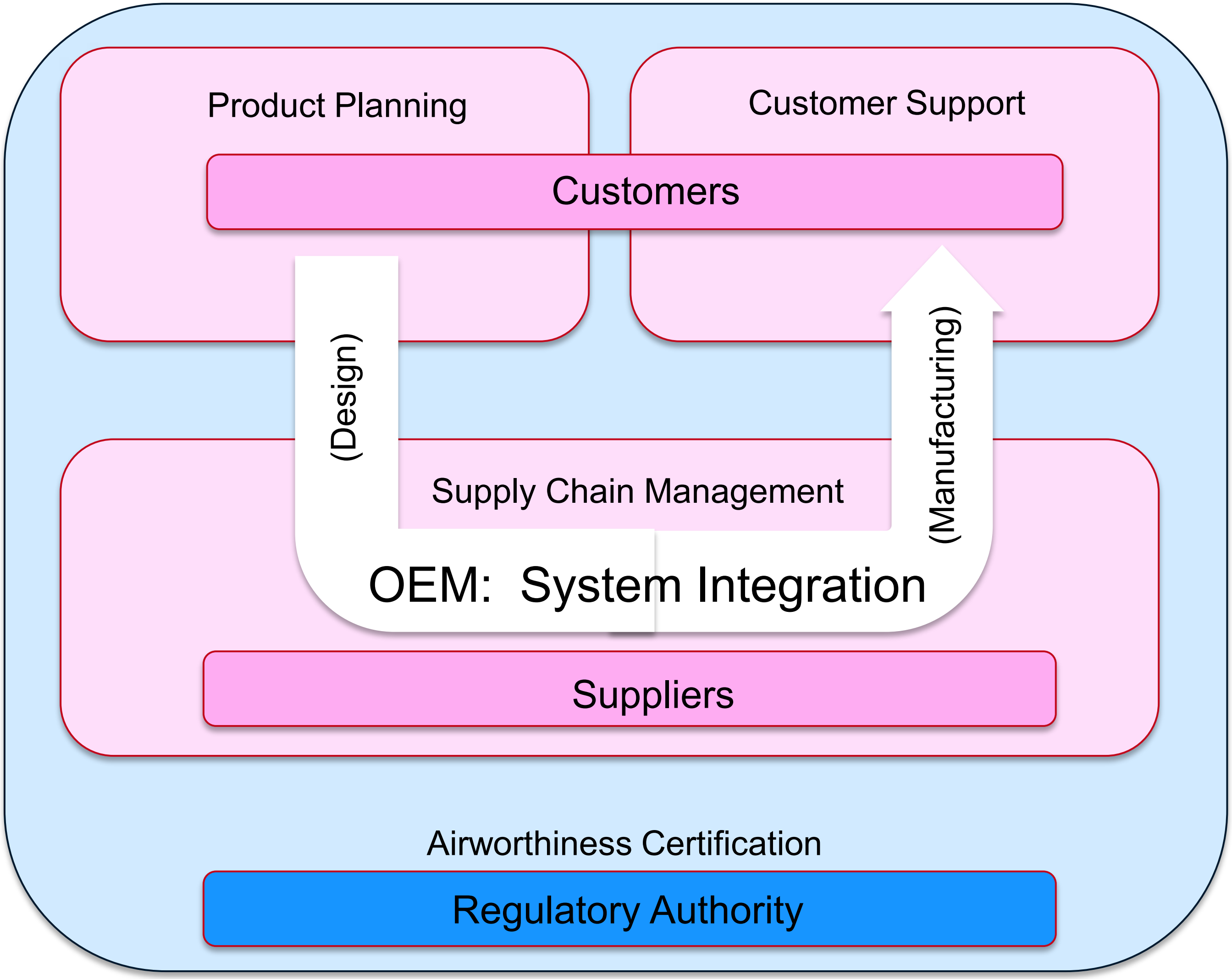

Diagram of System Integration (Design)

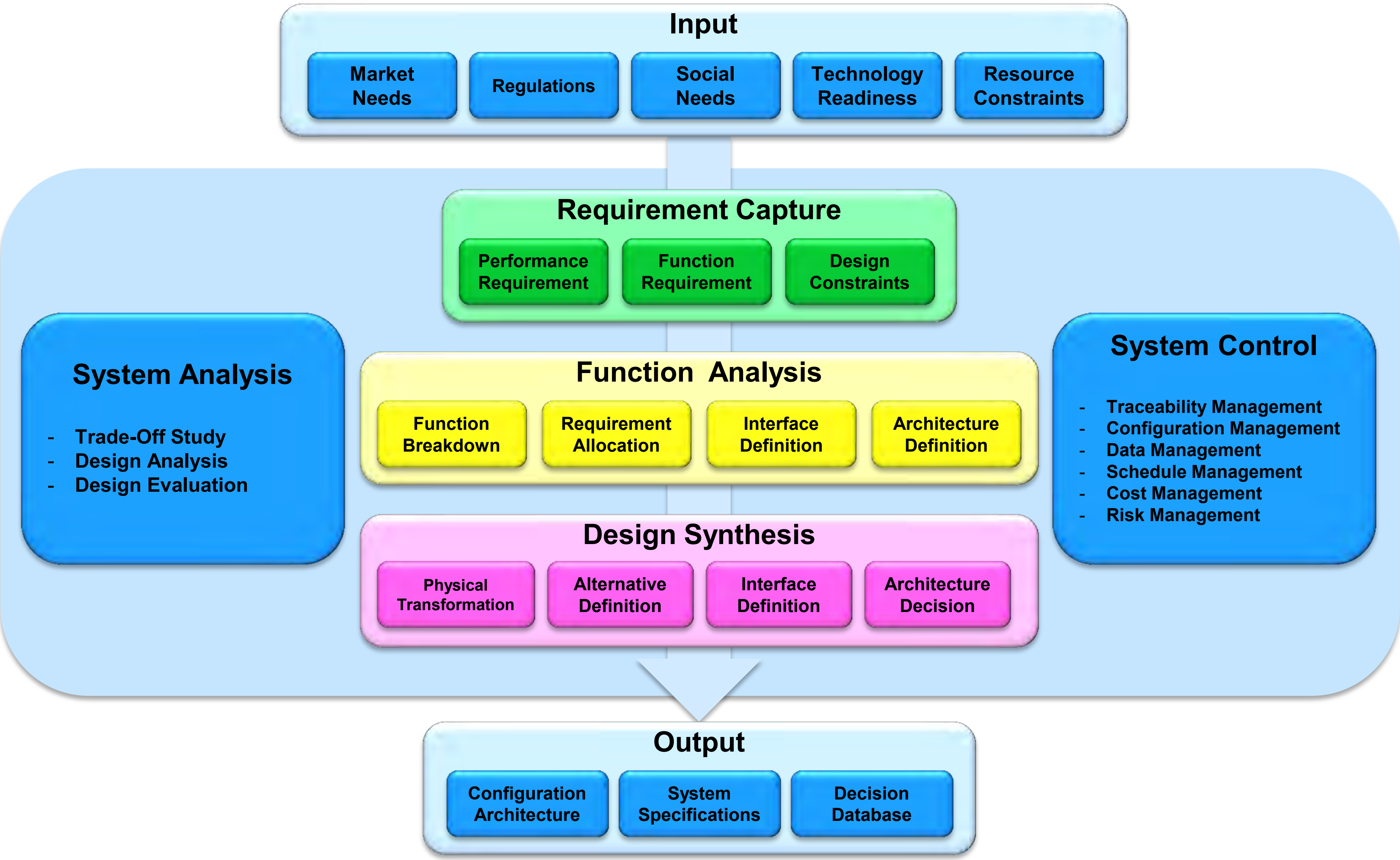

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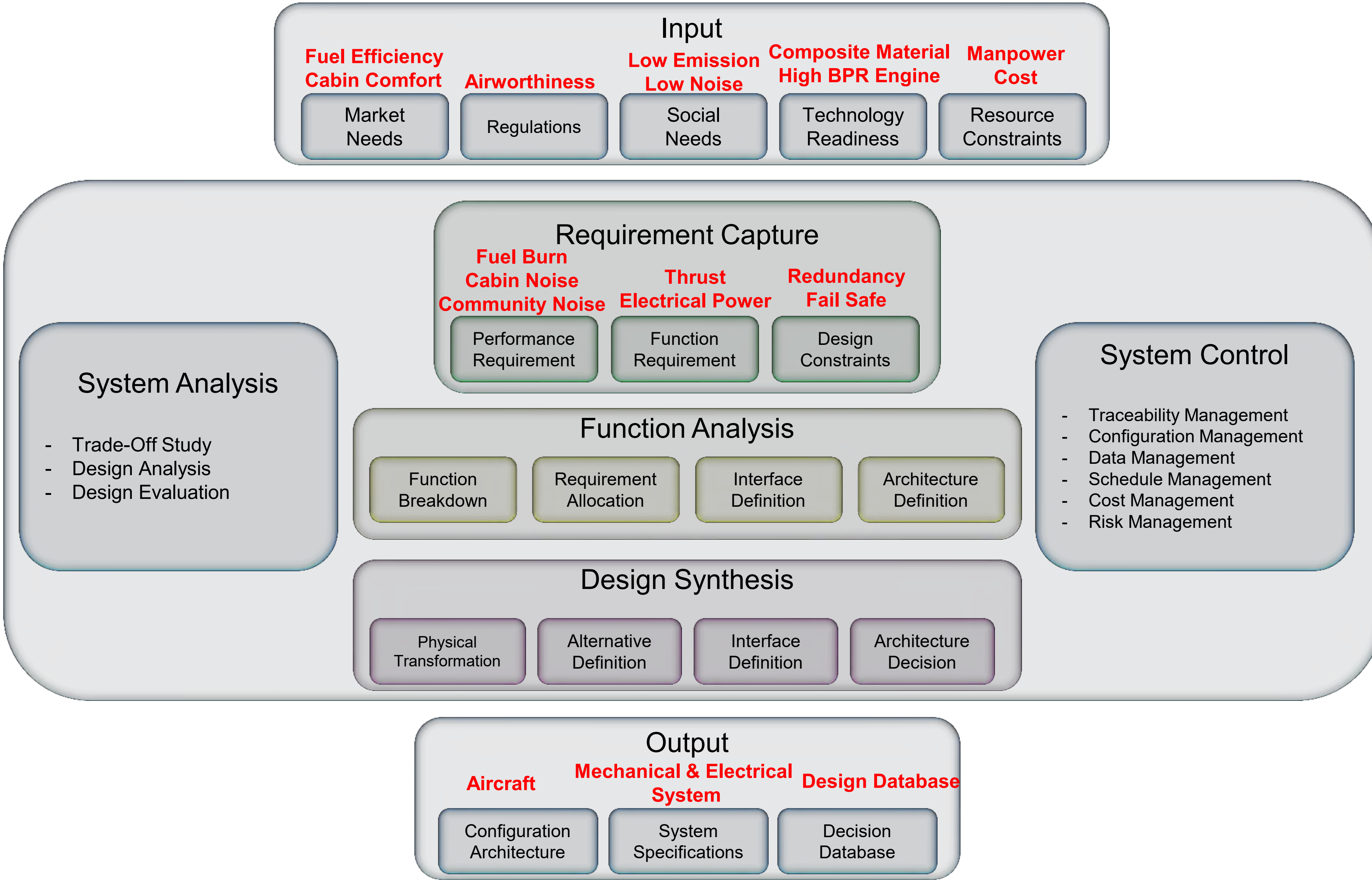
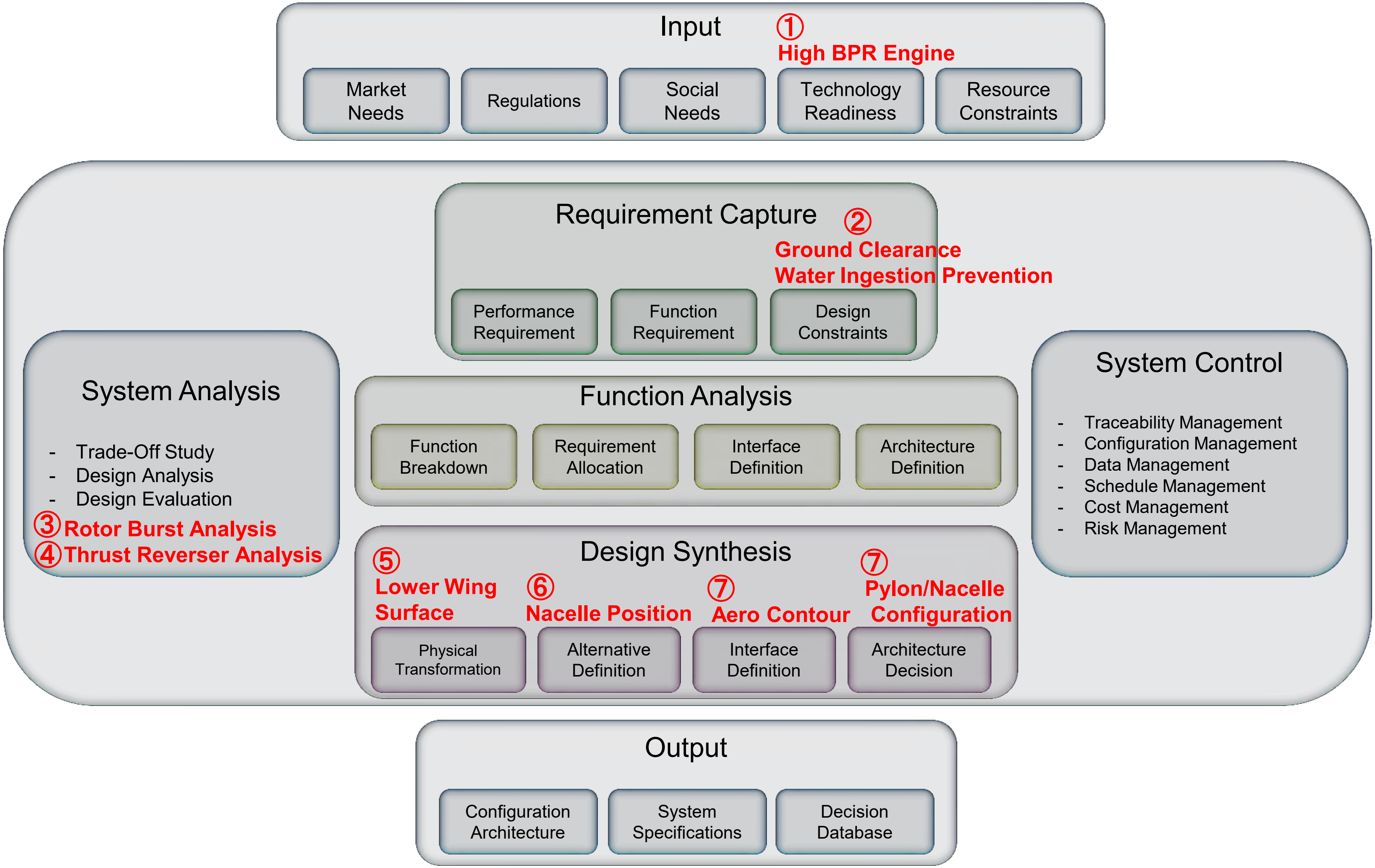
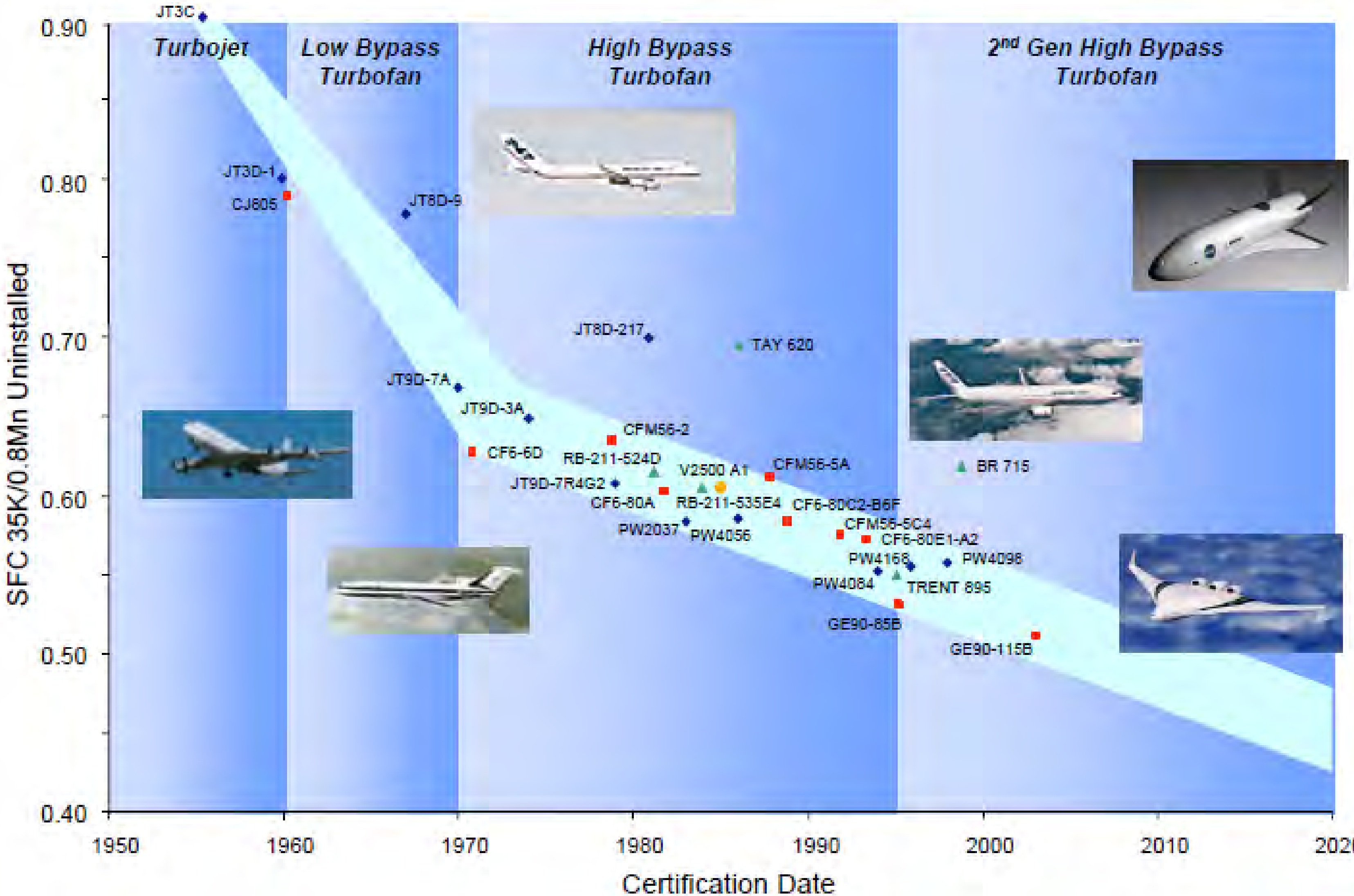
Diagram of System Integration (Design : Airplane System)



Example: Engine Integration



Geared Turbo Fan Engine has emerged for step change fuel efficiency



Source: http://www.aeronautics.nasa.gov/events/tgir/2003/ppt/maclin/maclin.pdf

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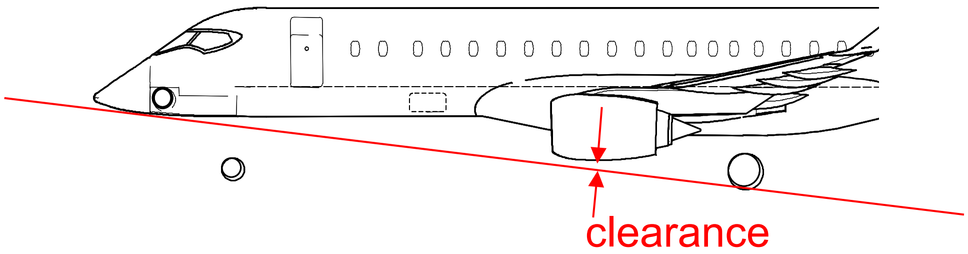
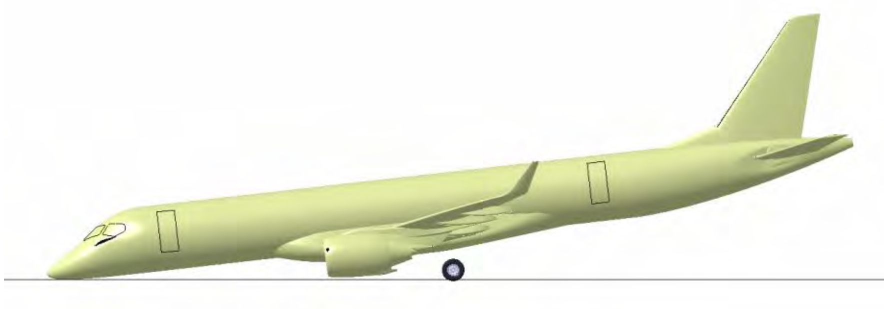
②Design Constraints

Ground Clearance (Nose Landing Gear Collapse)

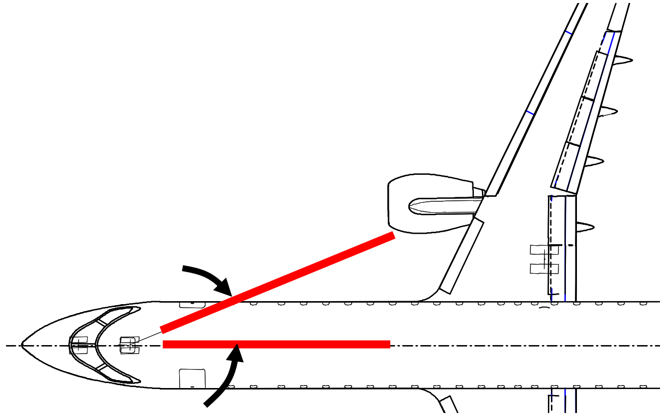
Avoid damage on engine at hazardous situation





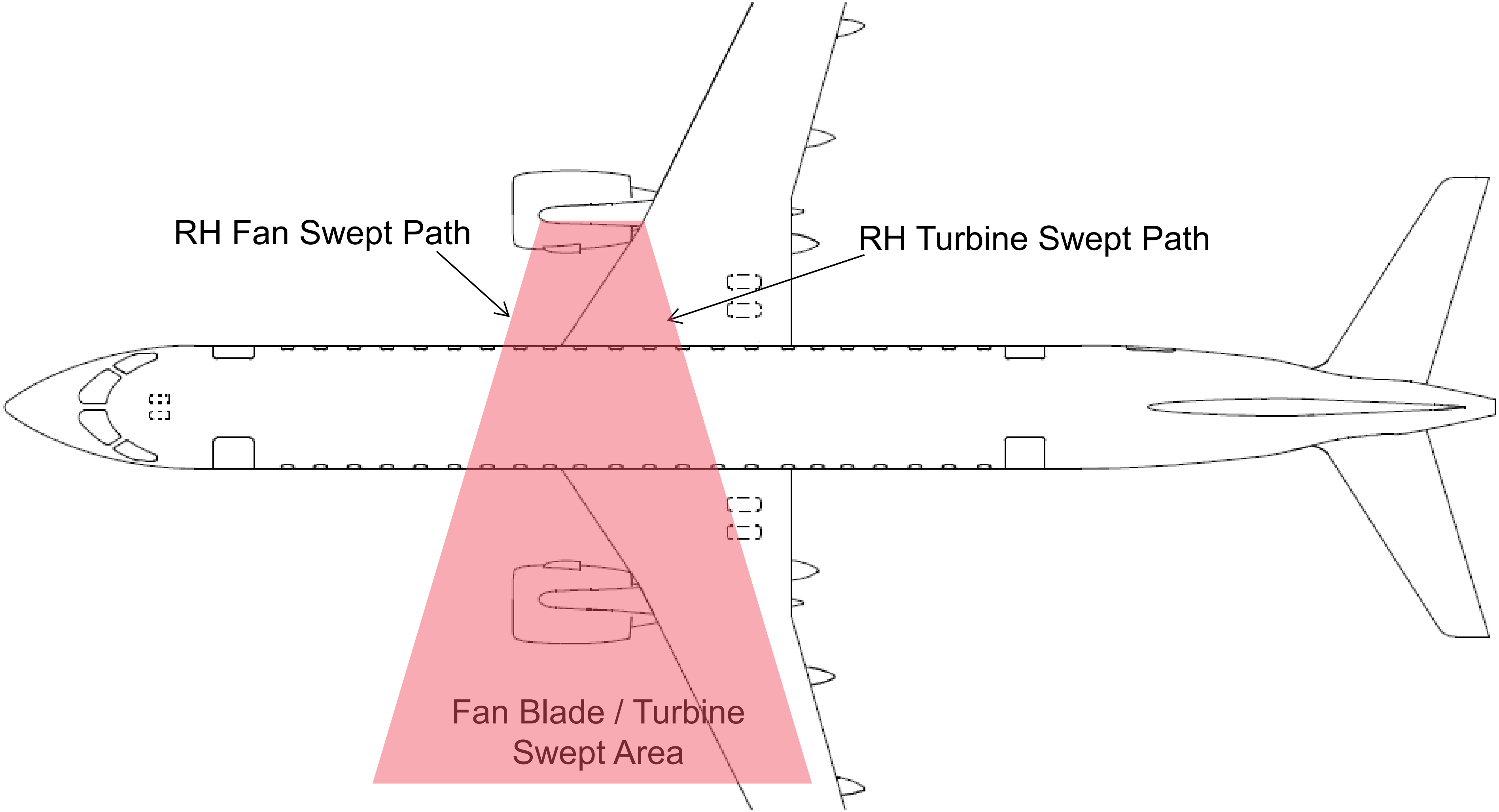
Water Ingestion Prevention

Avoid water ingestion into engine at landing on water contaminated runway



Source: http://www.a350xwb.com

Avoid simultaneous loss of system for continued safe flight and landing



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Evaluate performance and impact by thrust reverser airflow



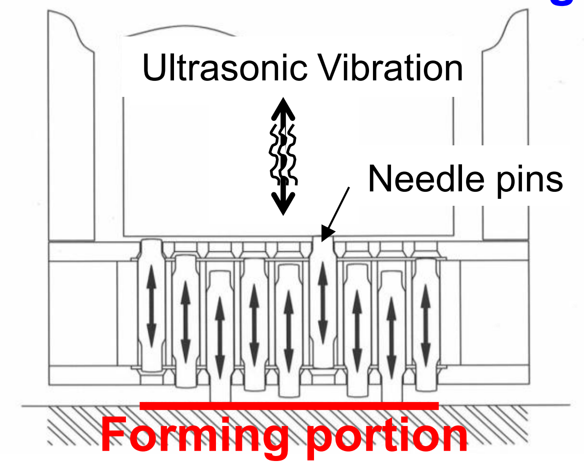
Isolated Test

Integrated Test

Thrust reverser performance and impact by thrust reverser airflow are evaluated by wind tunnel test and CFD

Complex lower wing contour made possible by advanced forming technology

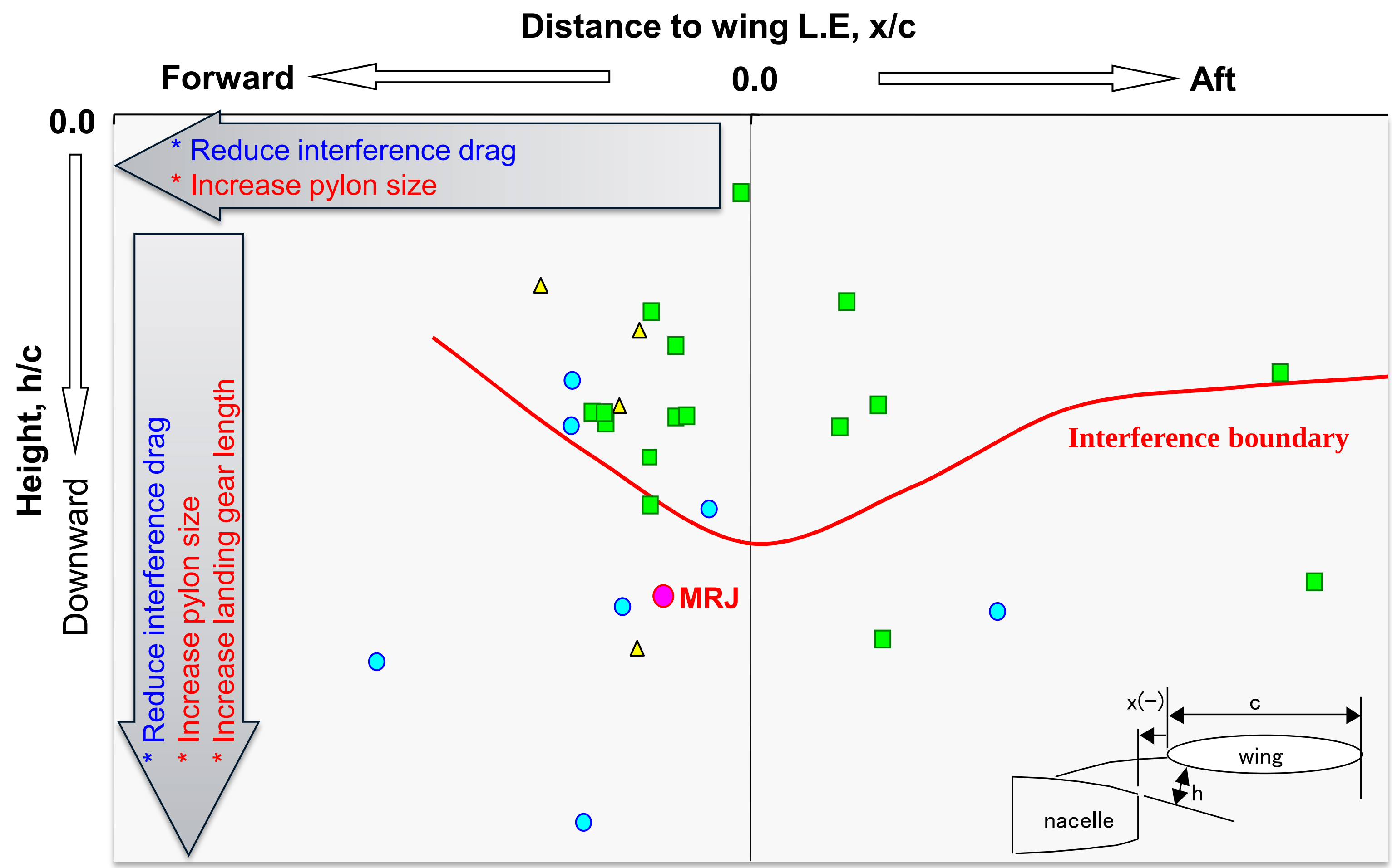
Ultrasonic Peen Forming



- Steep span-wise curvature to house large diameter engine with clearance
- Sophisticated chord-wise airfoil shape for excellent aerodynamic performance

⑥Design Synthesis: Nacelle Position

Optimized position for interference drag and structural weight

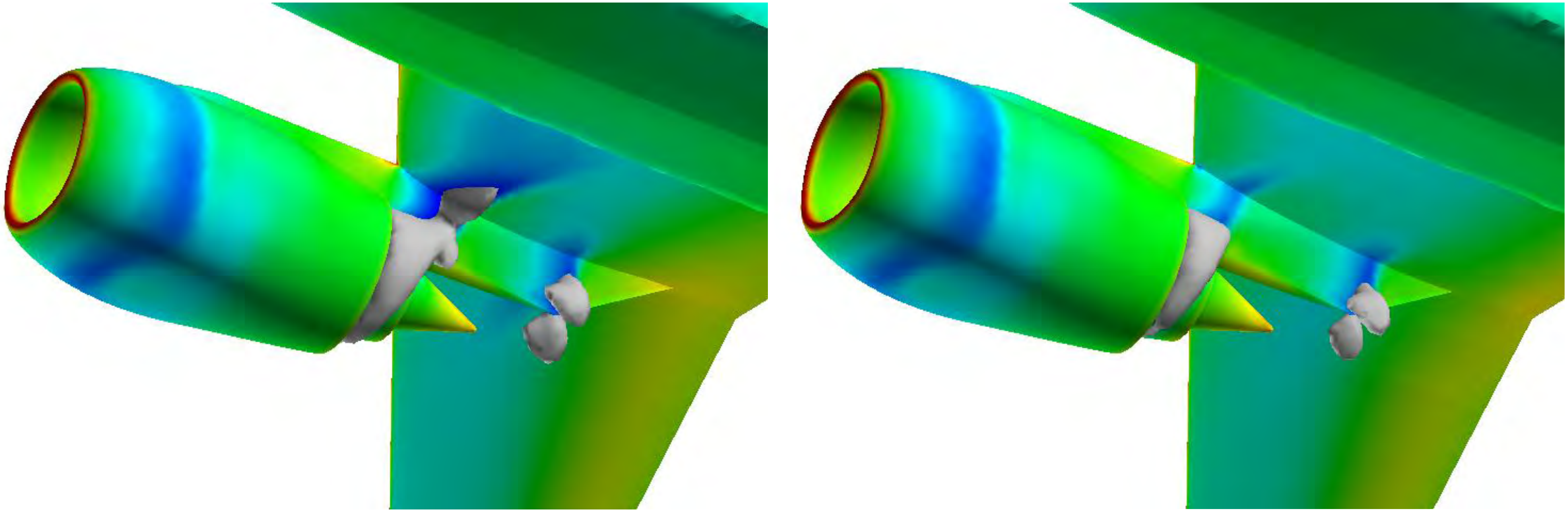


Careful tailoring in Pylon/Nacelle Configuration

- **Optimization by CFD**
- **Free from shock and separation**

Initial

Optimized

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