



Technology and Innovation for the Next Century of Flight

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Innovation in Flight



“...Let no improvement in flying and flying equipment pass us by”

W.E. Boeing - 1929



Changing the Way the World Flies



757/767 – first single-aisle aircraft family with wing on flight deck



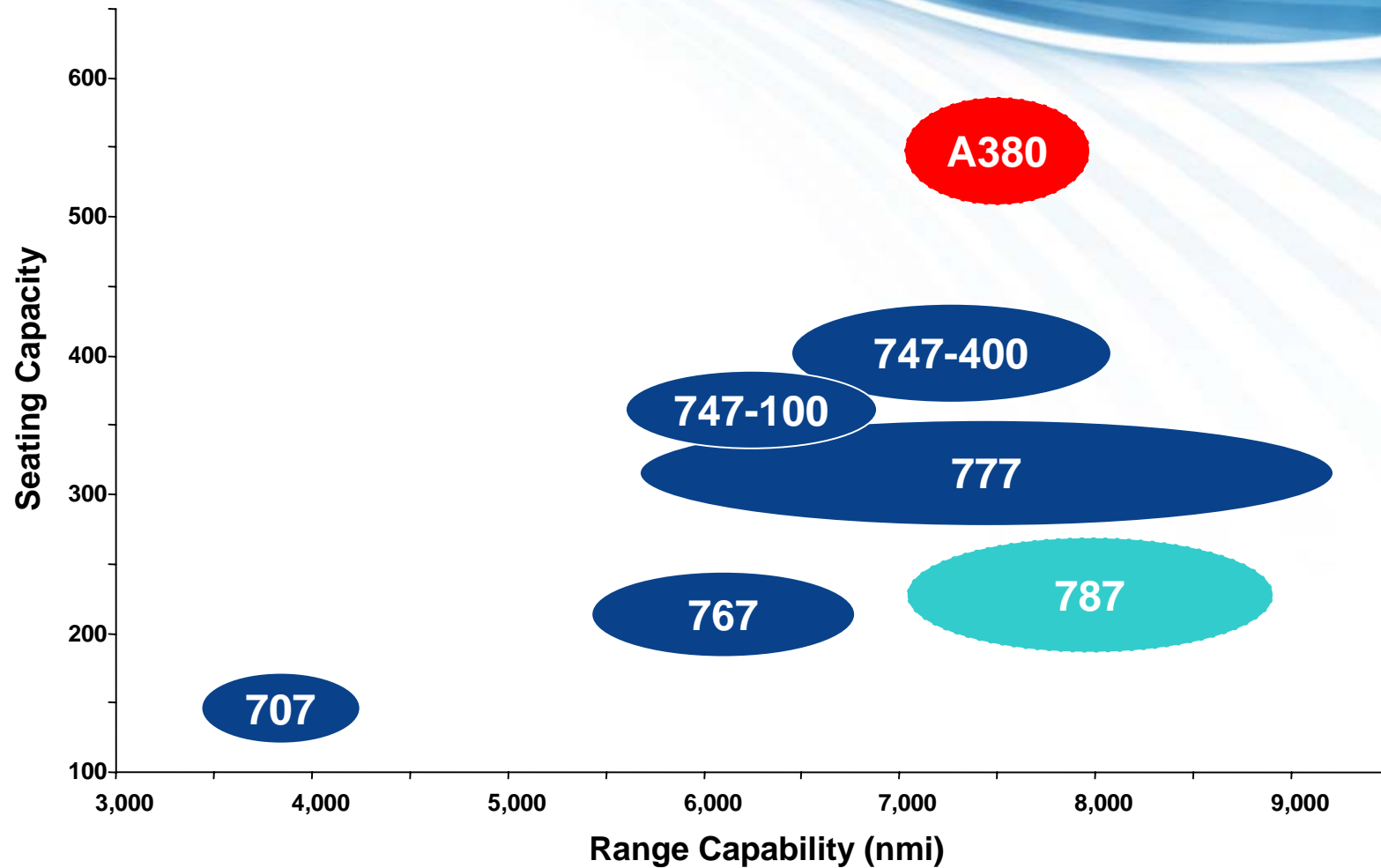
Commercial Aviation – It's All About the Passenger

*Where they want to go,
when they want to go*

- Safe and reliable service
- Non-stop flights with more frequencies
- Low fares
- Comfortable surroundings



Evolution of Long-Range Flight





787 - The Next Great Advance In Flight

- **New levels of airplane**
 - Efficiency
 - Comfort
 - Environmental responsibility
- **A single airplane family serving a wide spectrum of markets**
- **Designed with the investor, operator and passenger in mind**





Innovations that Add Value

Composite Structure

Lower Maintenance
Costs

Breakthrough Cabin

Passenger
Preference

Enhanced Flight Deck

Operational
Reliability

Innovative Systems

Flexible for
the Future

Large Cargo Capacity

More Revenue
Potential

Advanced Wing

Enhanced
Efficiency

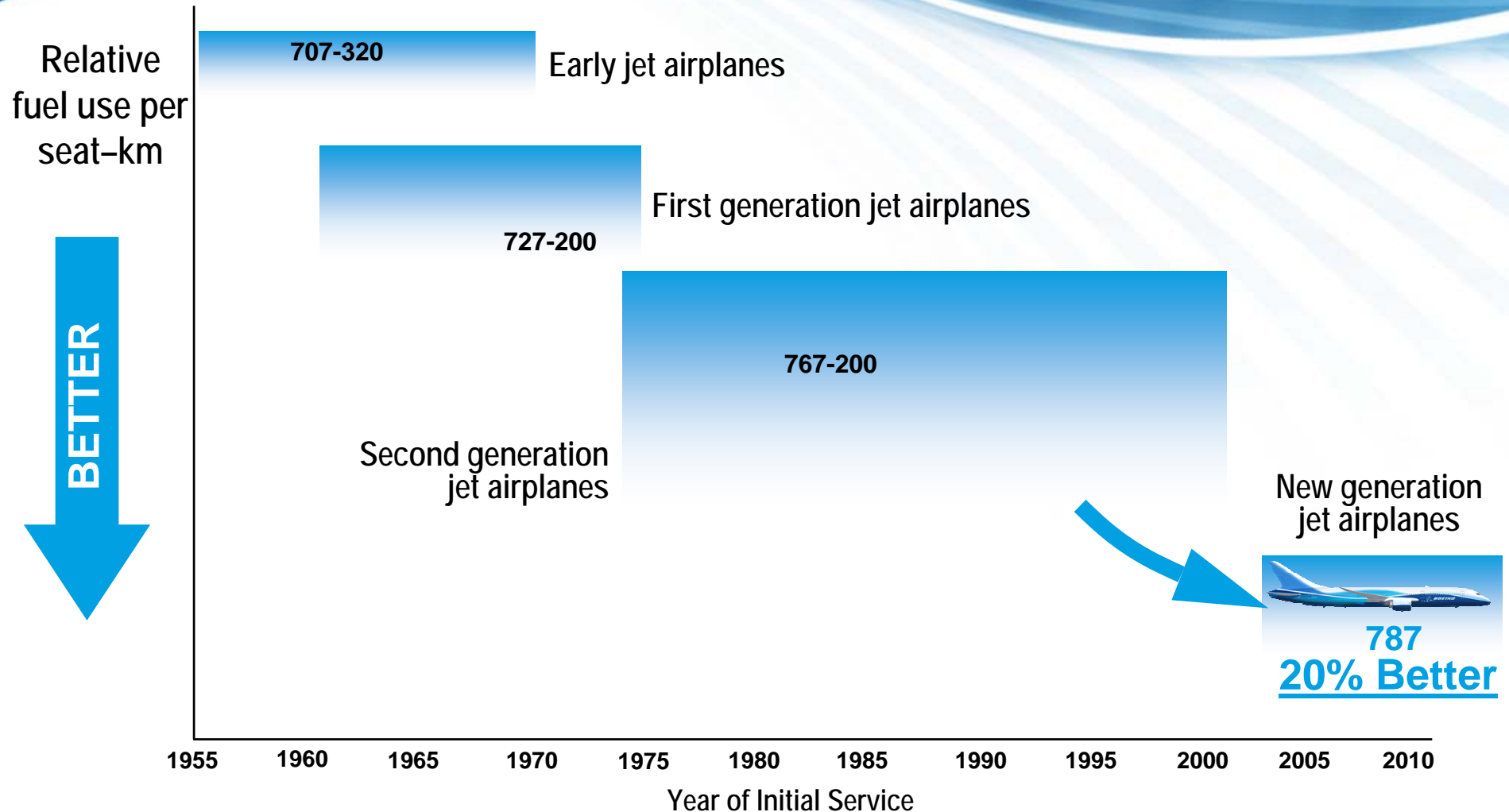
Advanced Engines

Fuel Efficiency
Lower Noise





New Technologies Continue to Provide Breakthroughs in Aircraft Efficiency





New Technologies Make the 787 Possible

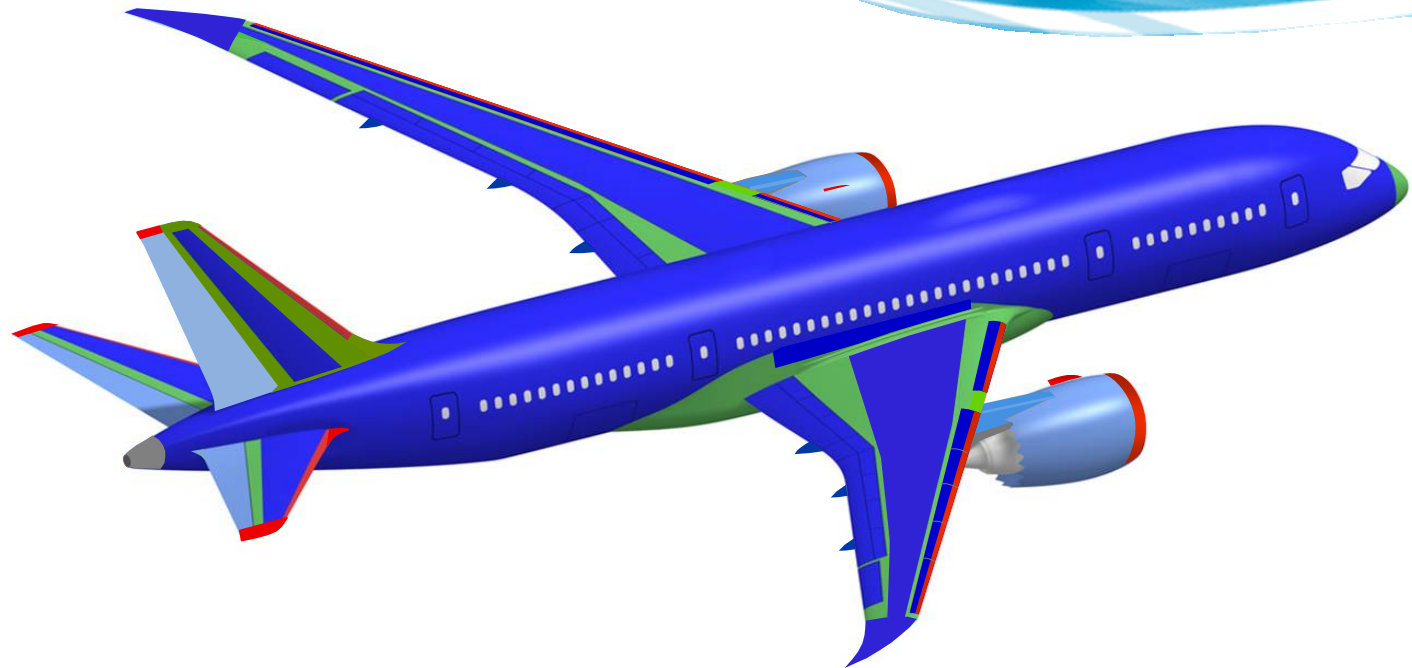
- Configuration
- Propulsion
- Manufacturing
- Flight Deck
- Materials
- Systems










Composites are the Smart Choice

- **Lighter**
- **More durable**
- **Reduced corrosion and fatigue**
- **Reduced scheduled maintenance**
- **Opens new design possibilities**



-  Carbon laminate*
-  Carbon sandwich
-  Fiberglass
-  Aluminum
-  Aluminum/steel/titanium pylons



Composites Simplify, Speed Manufacturing

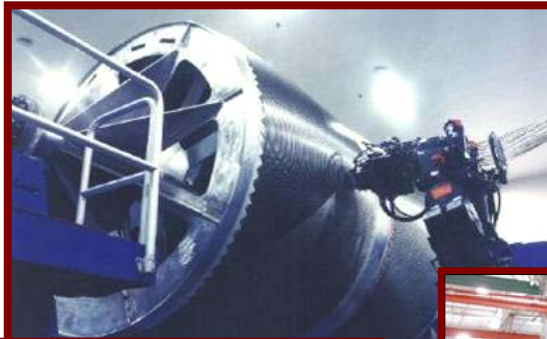
- Larger assemblies
- Significant tooling reduction
- 30-40 percent reduction in manufacturing assembly time
- Repeatable process that creates repeatable first-time quality
- Sizable reduction in hazardous chemicals and waste



18.9 feet/5.7 meter diameter



Extensive Development & Testing of Composite Manufacturing Methods



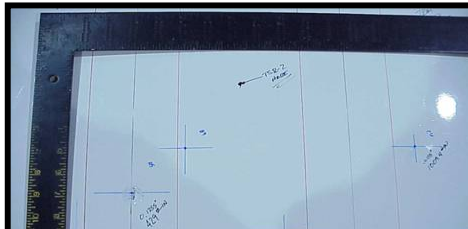


One-Piece Composite Fuselage Construction

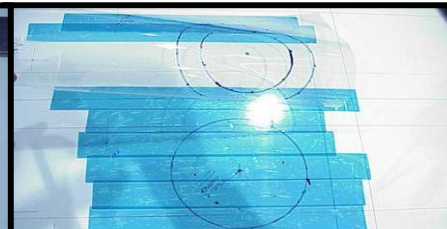




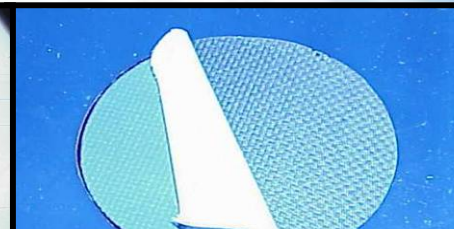
Faster Line Repairs Will Reduce Delays and Cancellations



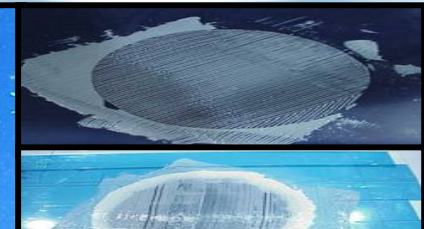
Assess Damage



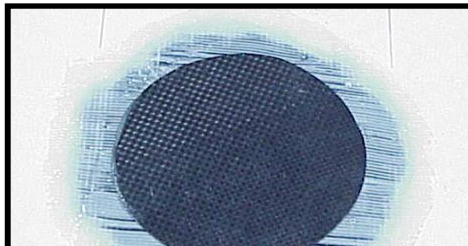
Remove Finish



Cut Patch



Apply Adhesive



Apply Patch



Apply Heat Pad



Vacuum Tool



35 min

Cure



Installed Patch



Surface Covering



Finished Repair

Total Time
0:59



787 Propulsion System Features New Technologies

- **Less fuel, noise, emissions, maintenance**



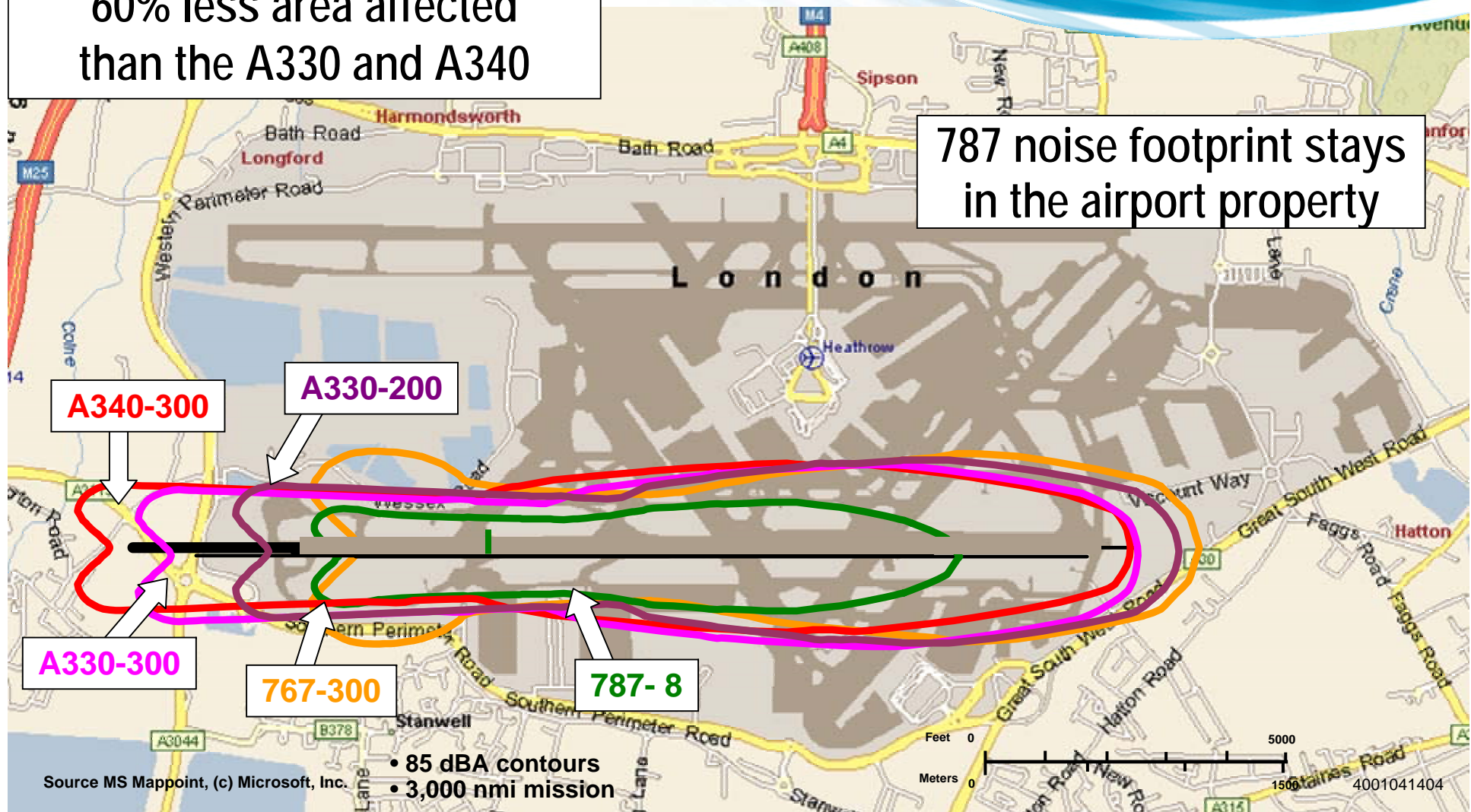
- **Engine and nacelle features:**
 - Higher bypass ratio
 - No-engine-bleed systems architecture
 - Low-noise nacelles with chevrons
 - Laminar flow nacelles
 - Interchangeable (at the wing)



Noise Technologies Benefit Airport Communities

60% less area affected than the A330 and A340

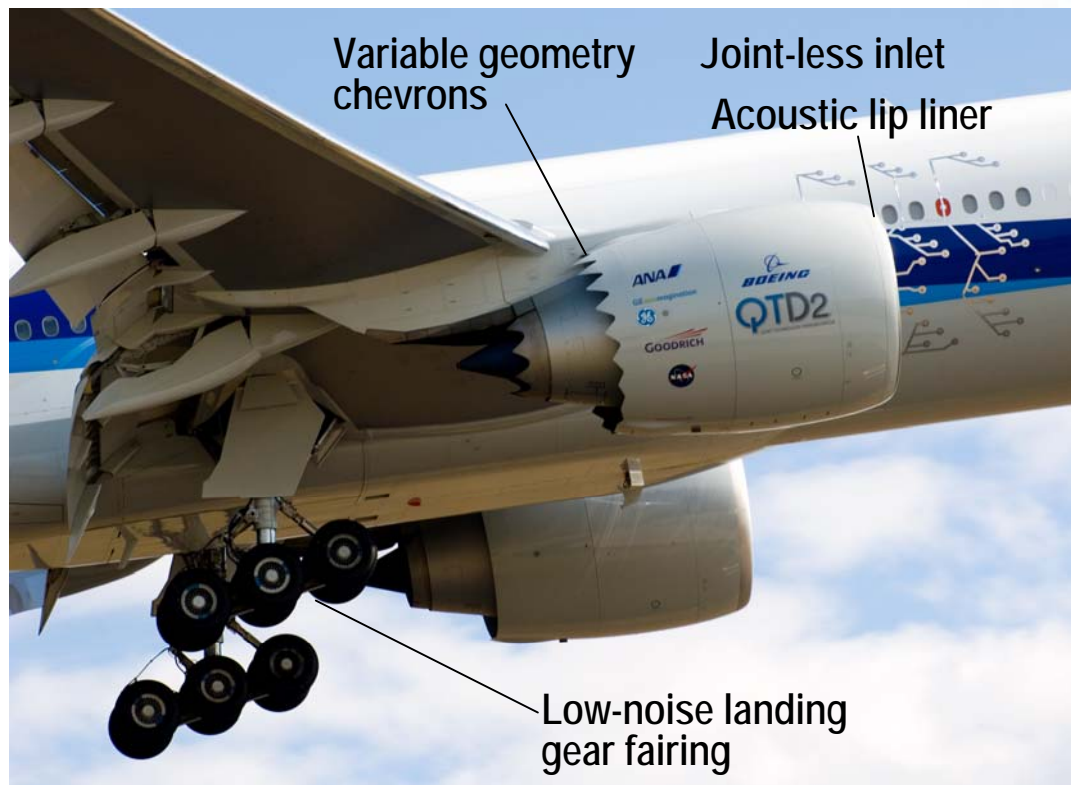
787 noise footprint stays in the airport property





Boeing Continues to Develop Noise Reduction Technologies

QTD2 Flight Test took Place on a 777-300ER in August 2005



Goals of Quiet Technology Demonstrator 2 Program:

- **Develop concepts to make 777 even quieter**
- **Validate noise reduction technologies for 787 and 747 Advanced**
- **Explore noise reduction concepts for the future**



GE Aircraft Engines





Advanced Systems Technologies Provide Better Efficiency and Lower Lifecycle Costs

**Common Core
Open Systems Architecture**
*Easier ownership
(upgrades and transfers)*

**More Electric Systems
Architecture**
*Higher reliability,
better efficiency*

**Advanced
Flight Controls**
*Improved ride quality,
better efficiency*



**Integrated Health
Management**
*Maintenance
predictability*

**e-Enabled
Systems**
Connectivity

Wireless IFE
*Easier ownership,
passenger preference*





A New Sensation for Passengers

Better Lighting

- Improved:

- Cabin altitude
- Humidity
- Air quality
- Temperature
- Sound quality
- Ride quality
- Lighting
- Wireless IFE

More
Head Room

Large
Overhead
Bins

Better Economy
Seating Options

Large
Passenger
Windows

14" (35cm) Wider than Competing Models

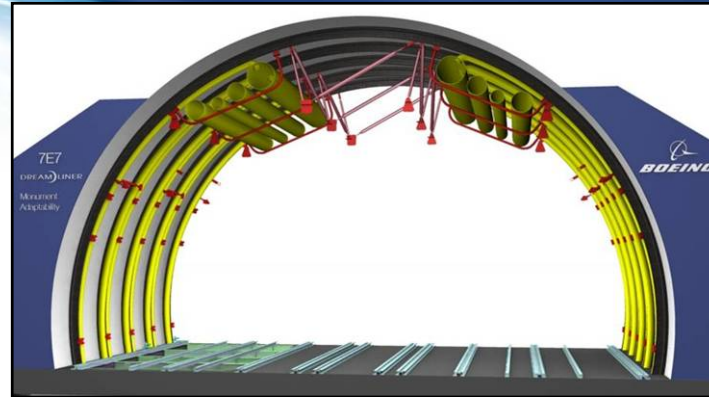
Wider Seats
and Aisles



The 787 Will Feature New Interior Breakthroughs

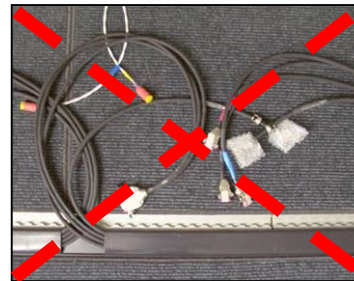
- **Enabling Architecture**

- Adaptable provisions
- Common attachments
- Multi-functional parts



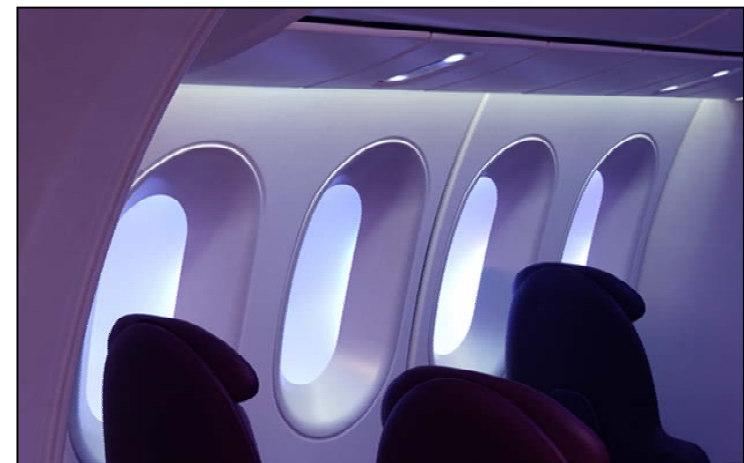
- **Wireless IFE**

- No signal cables
- Seat-to-seat power distribution



- **Innovative Cabin Design**

- Wider seats, wider aisles
- Biggest windows available
- Lower cabin altitude, higher humidity
- Improved sound, air, temperature and ride quality





The Breakthrough Interior Benefits Boeing, Airlines and Passengers

- **For Boeing**
 - Dramatic reduction in build time
 - Less configuration variability
- **For Airlines**
 - Easier to maintain
 - Easier to reconfigure
 - Easier to upgrade
 - Easier to finance
- **For Passengers**
 - More comfort
 - Better flying experience





787 Flight Deck

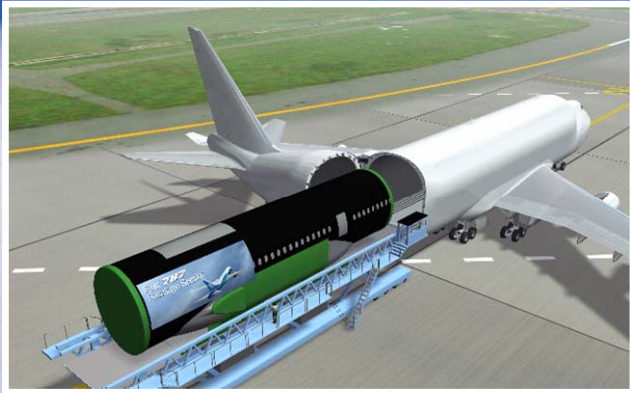
Innovation meets Operational Commonality



- Large displays provide pilots access to more information
- Reduced transition times from other Boeing models
- High degree of standard equipment
- Low cost to maintain and upgrade



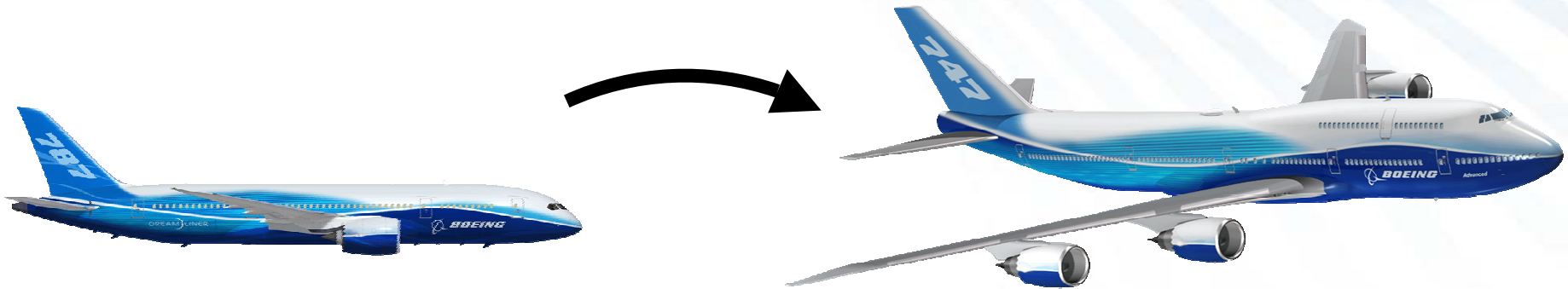
Globalization Drives the Need for New Logistics Solutions





Incorporation of 787 Breakthrough Technologies into Other Products

747 Advanced is an Example



787 Technology

- Advanced-technology engines and materials
- e-Enabled architecture
- Flight deck features

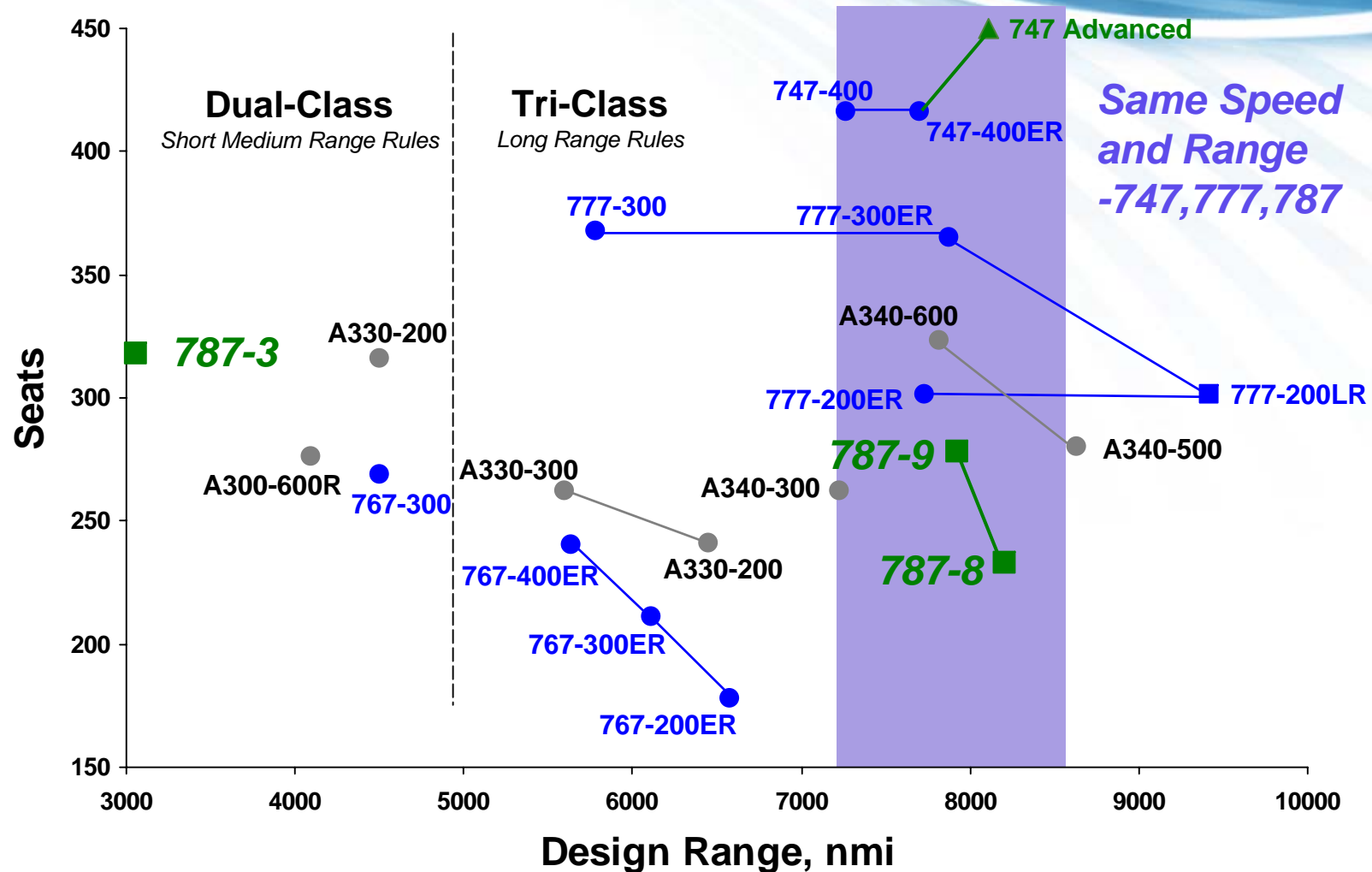
747 Advanced Design

- Increases capacity and range
- Adds aerodynamic performance
- Improves passenger appeal
- Increases operational commonality



The Boeing Twin Aisle Family Plan

Efficiency for Short and Long Haul Markets





Breakthroughs in Manufacturing Technology

Today

- Moving line
- Lean Manufacturing
- Digital Design
- Assembly Advances

Tomorrow

- Advanced simulation and modeling
- Concurrent product development
- Integrated design, build, supply chain





e-Enabled Environment

- The strategic connection and integration of business processes, people, airplanes, information, assets, and knowledge *into a single focused business system*
- Centered on breaking through operational constraints





Connected Service Solutions

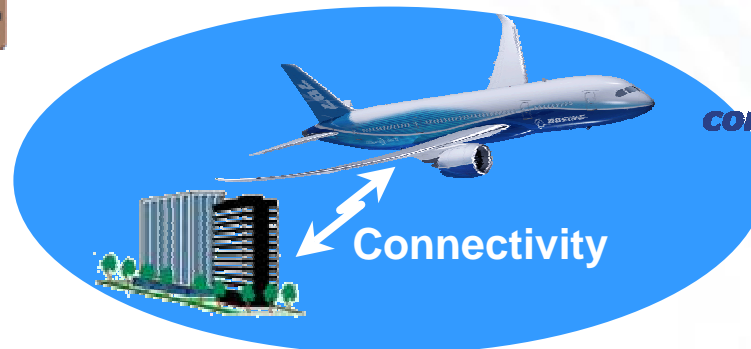
Electronic Flight Bag



Airplane Health Management



Airline Operations Center



connexion
by BoeingSM

Integrated Materials Management



Maintenance, Repair & Overhaul



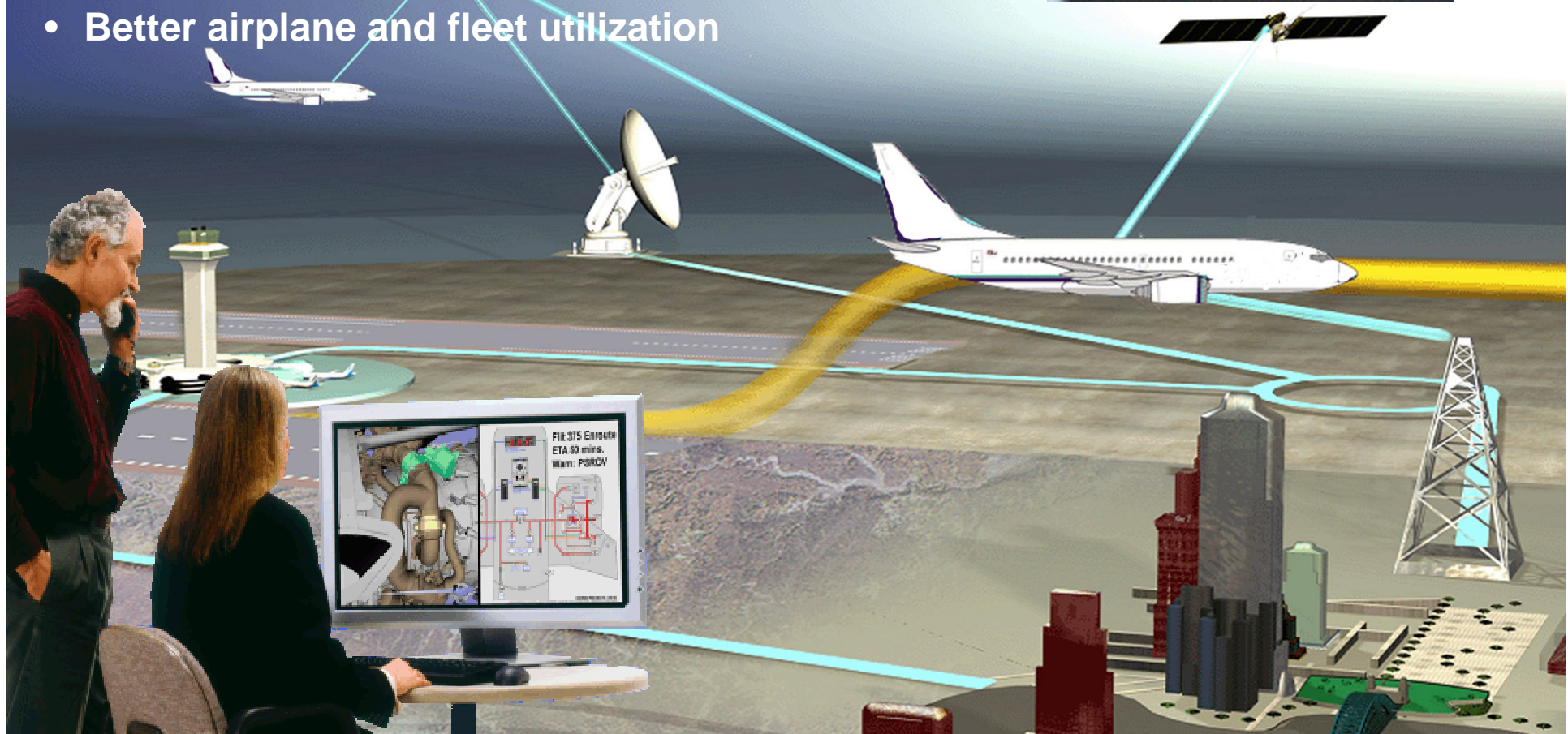
Improving Airline Productivity



The e-Enabled Environment

A Network-Centric Air Transportation System that Adds Real Value

- Reduced operating costs
- Higher efficiency, safety and economy
- Improved passenger experience
- Better airplane and fleet utilization





Product Lifecycle Management Technologies Add Value for Life

- **Design**
 - Rapid optimization (relational design)
 - Single source of data for international team
- **Manufacturing**
 - Same dataset as designers
 - Optimization of flow
- **Delivery**
 - Customized dataset specific to each airplane
- **In-Service**
 - Dataset can be updated for configuration tracking
 - Allows for easier transition of asset

Airplane Lifecycle Ownership

■ Boeing

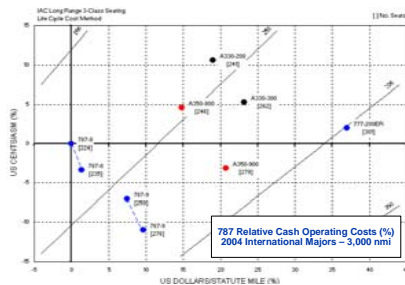
■ Airline No. 1

■ Airline No. 2



Product Strategy

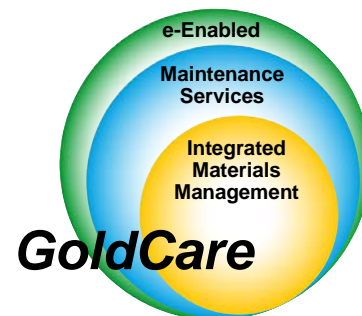
to Significantly Differentiate our Offering



Breakthrough in Value to the Customer



Breakthrough in Cost to Build

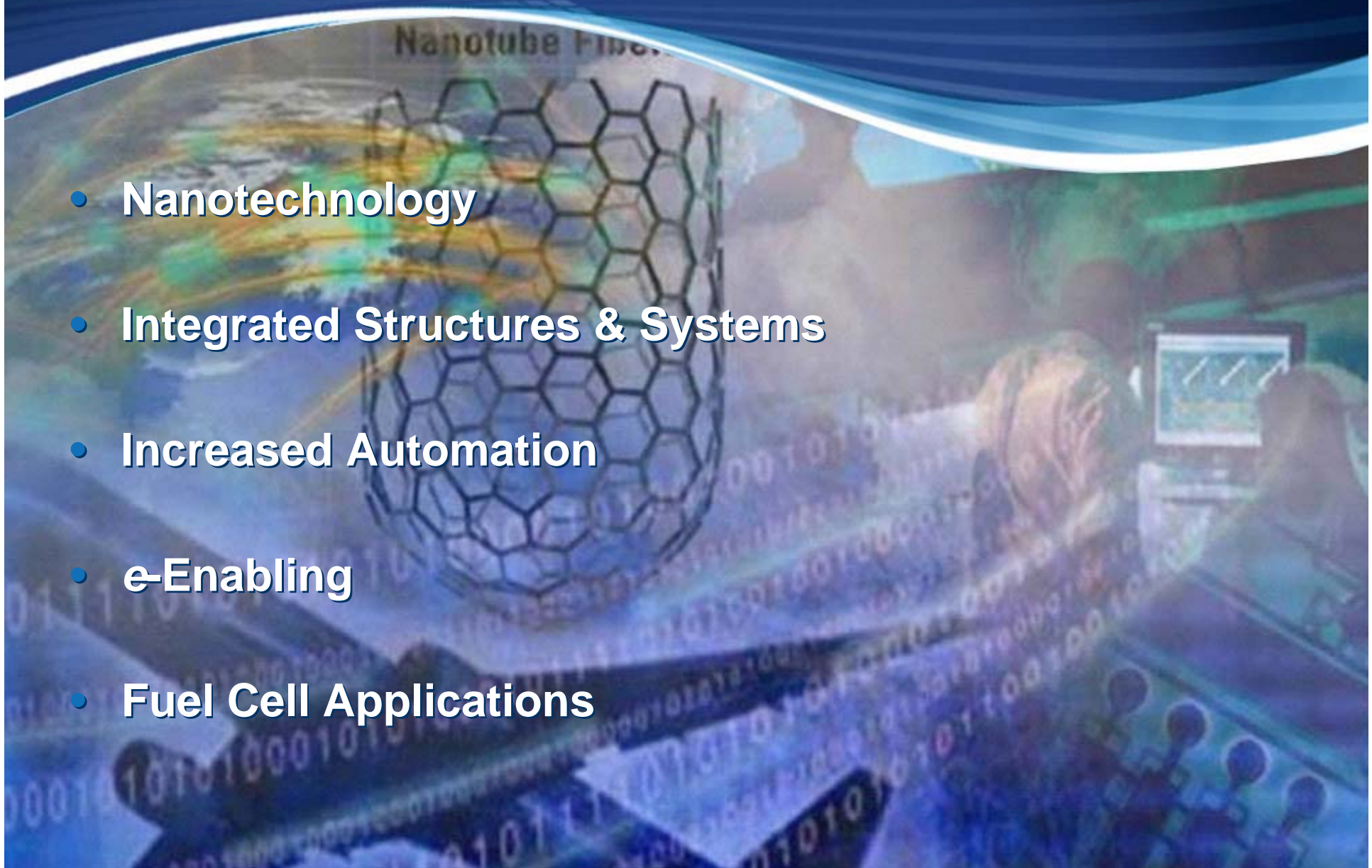


Breakthrough in the Offering



Many Emerging Technologies Could Further Aviation

- **Nanotechnology**
- **Integrated Structures & Systems**
- **Increased Automation**
- **e-Enabling**
- **Fuel Cell Applications**





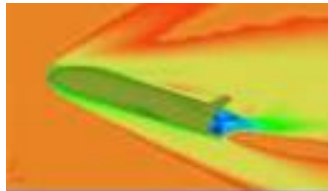
Thank You!

For more information, visit our websites:
www.boeing.com/commercial/
www.newairplane.com





Technology Development for the Future



Technologies



Technology Demonstrators



Processes & Tools



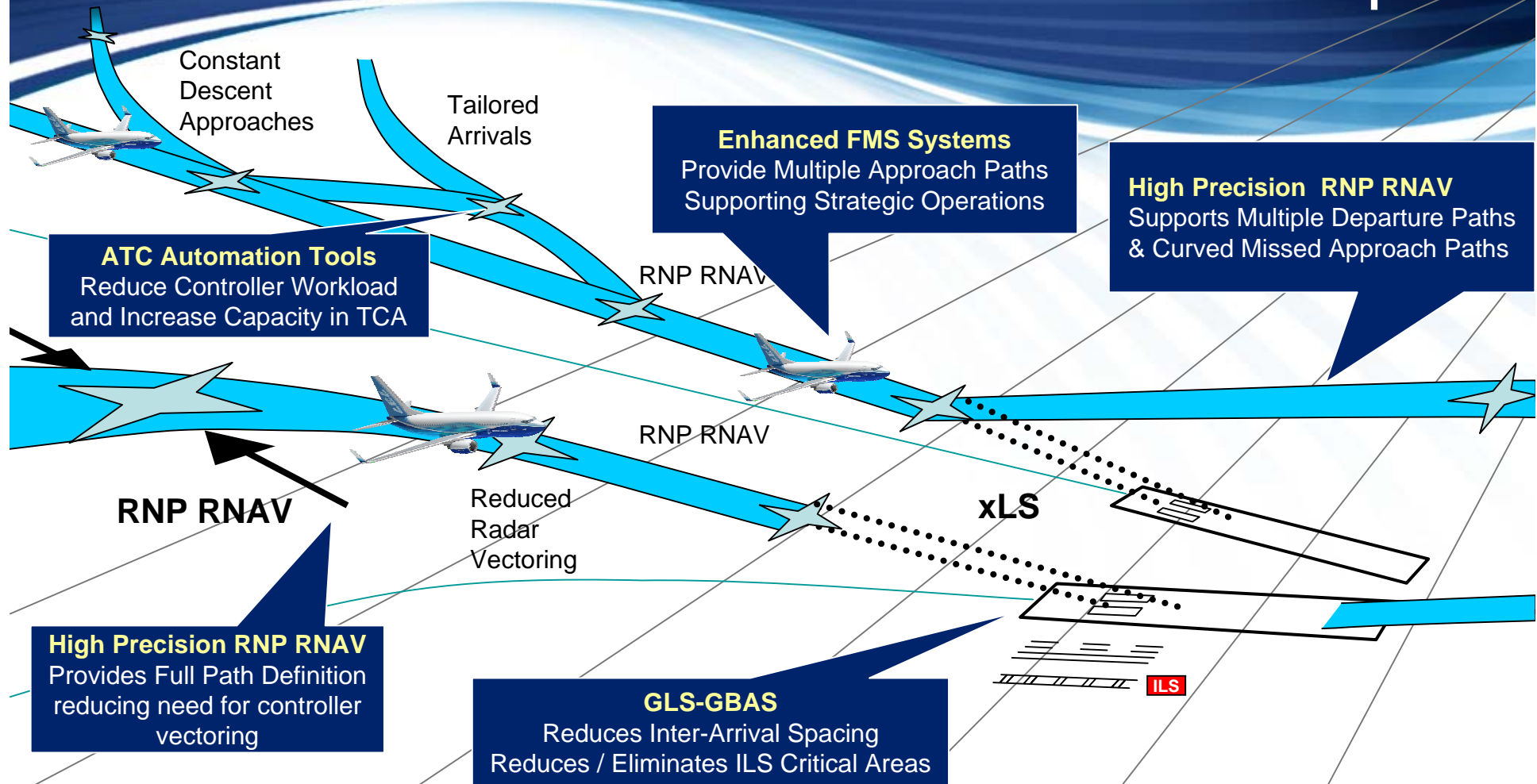
Breakthrough Concepts



Global Talent



The Boeing Vision for Performance Based Airspace

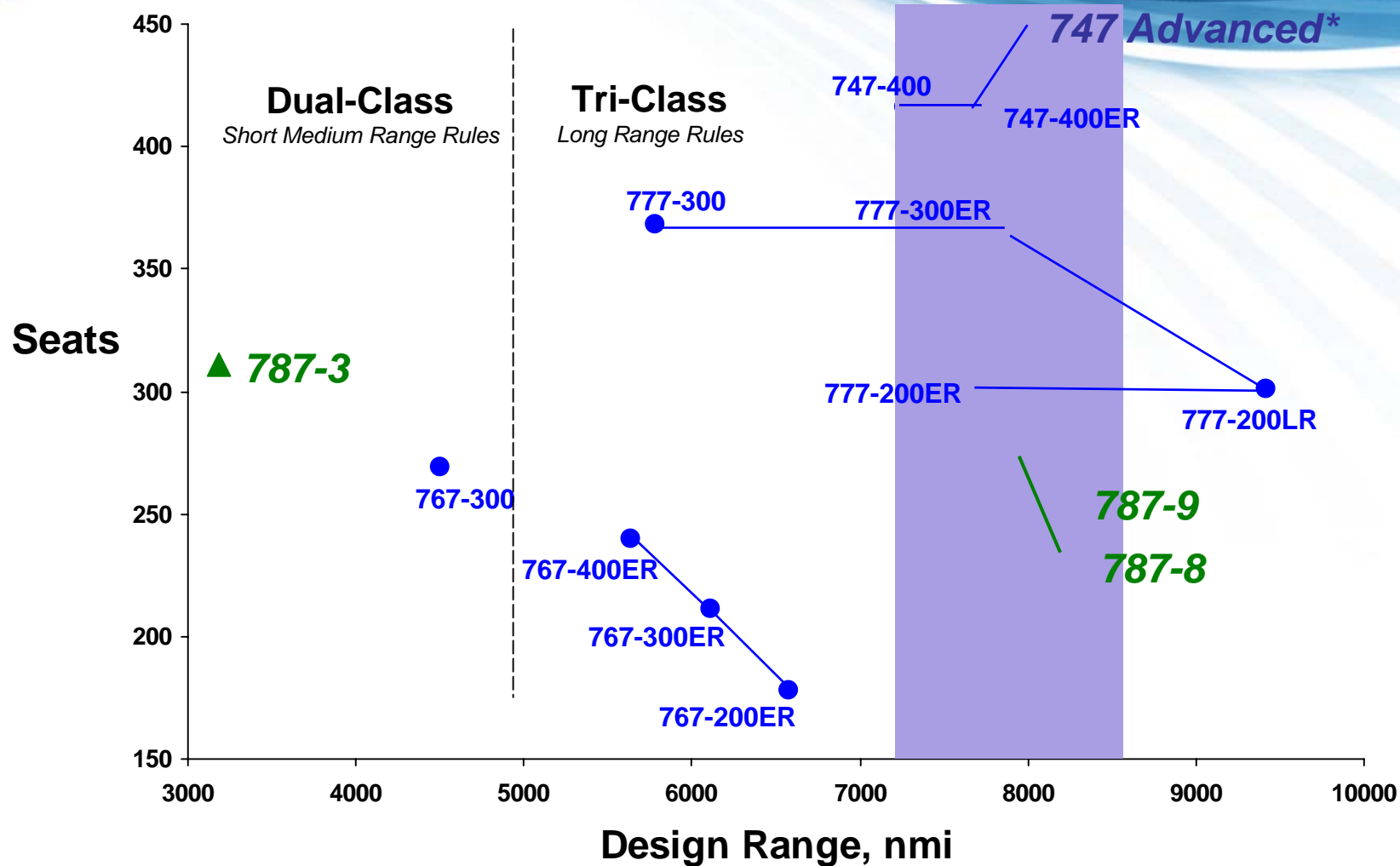


A contiguous plan for enhancing the Air Traffic System capacity, efficiency and safety is required for the continued success of commercial aviation



747 Advanced Compliments the Boeing Long Range Airplanes

Same Range, Same Speed



*Product Development Study



New Design Tools Enable Better Results

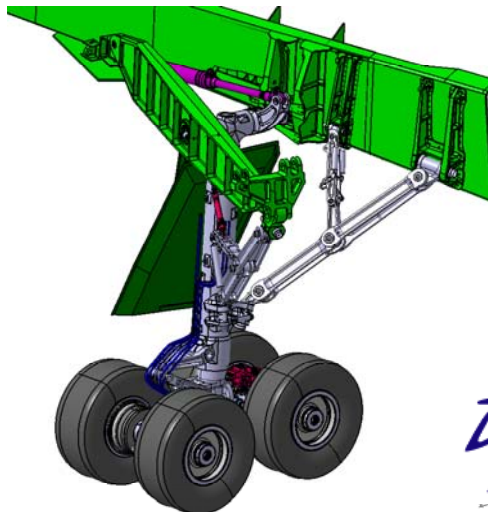


Improved capabilities

- Real-time collaboration between partners
- Advanced human factors modeling
- Increased relational design
- Assembly and maintenance process design

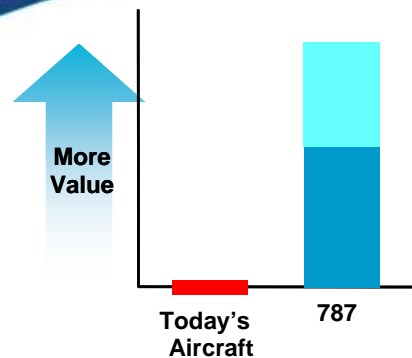
Benefits

- Real-time design changes
- Improved efficiencies
- Fewer errors
- Single source of data for all phases of the program





Technology and Innovation Benefits Airlines, Passengers and the Environment



Breakthrough in Value for Airlines



Breakthrough Flying Experience for Passengers



Breakthrough Environmental Performance