
BOEING
BOEING
Technology and Innovation
for the Next Century of Flight

# Innovation in Flight


***"…Let no improvement in flying and flying equipment pass us by"*** W.E. Boeing - 1929

# Changing the Way the World Flies





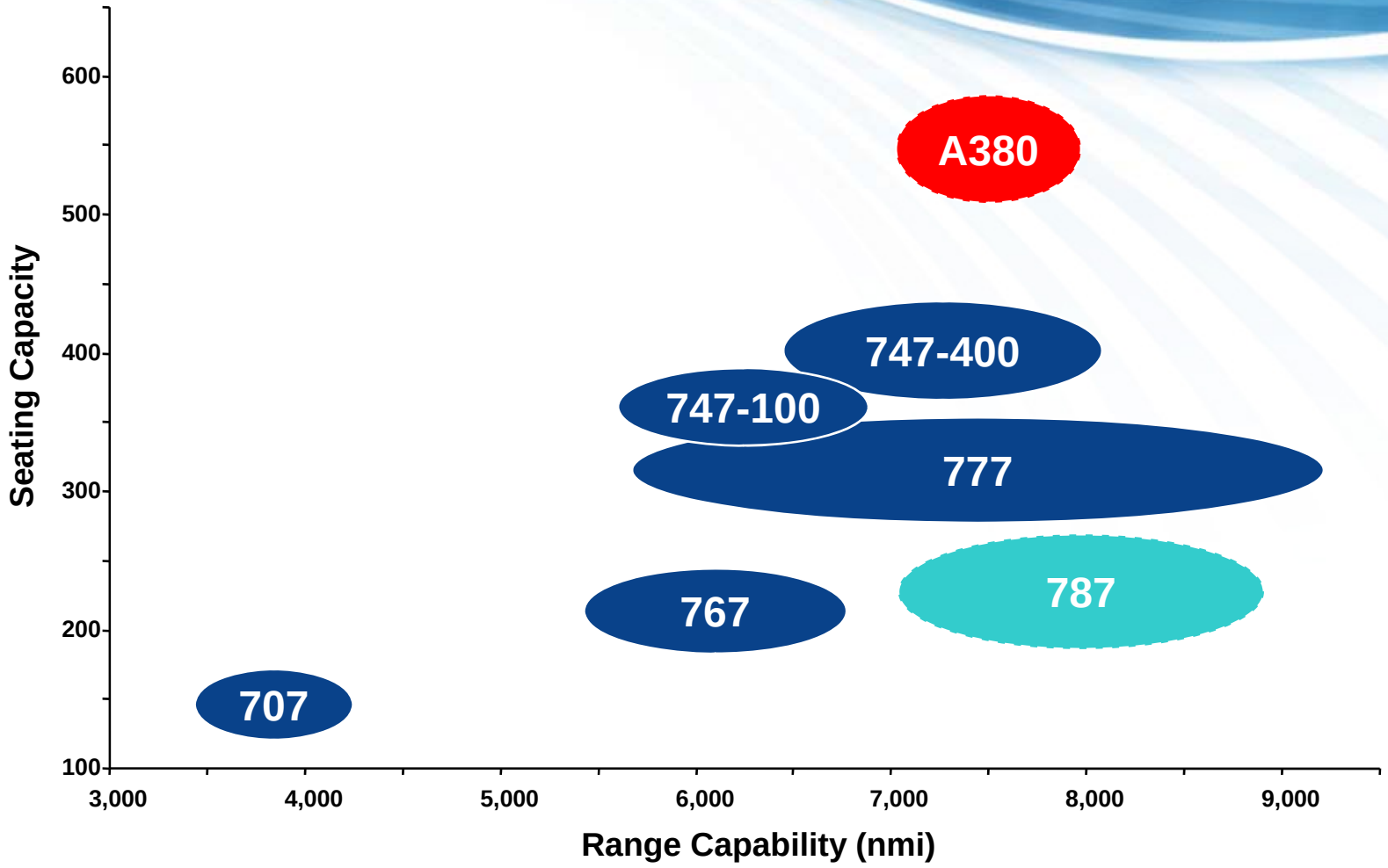
**757/767 – first single-aisle twin with common flight deck**

# 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

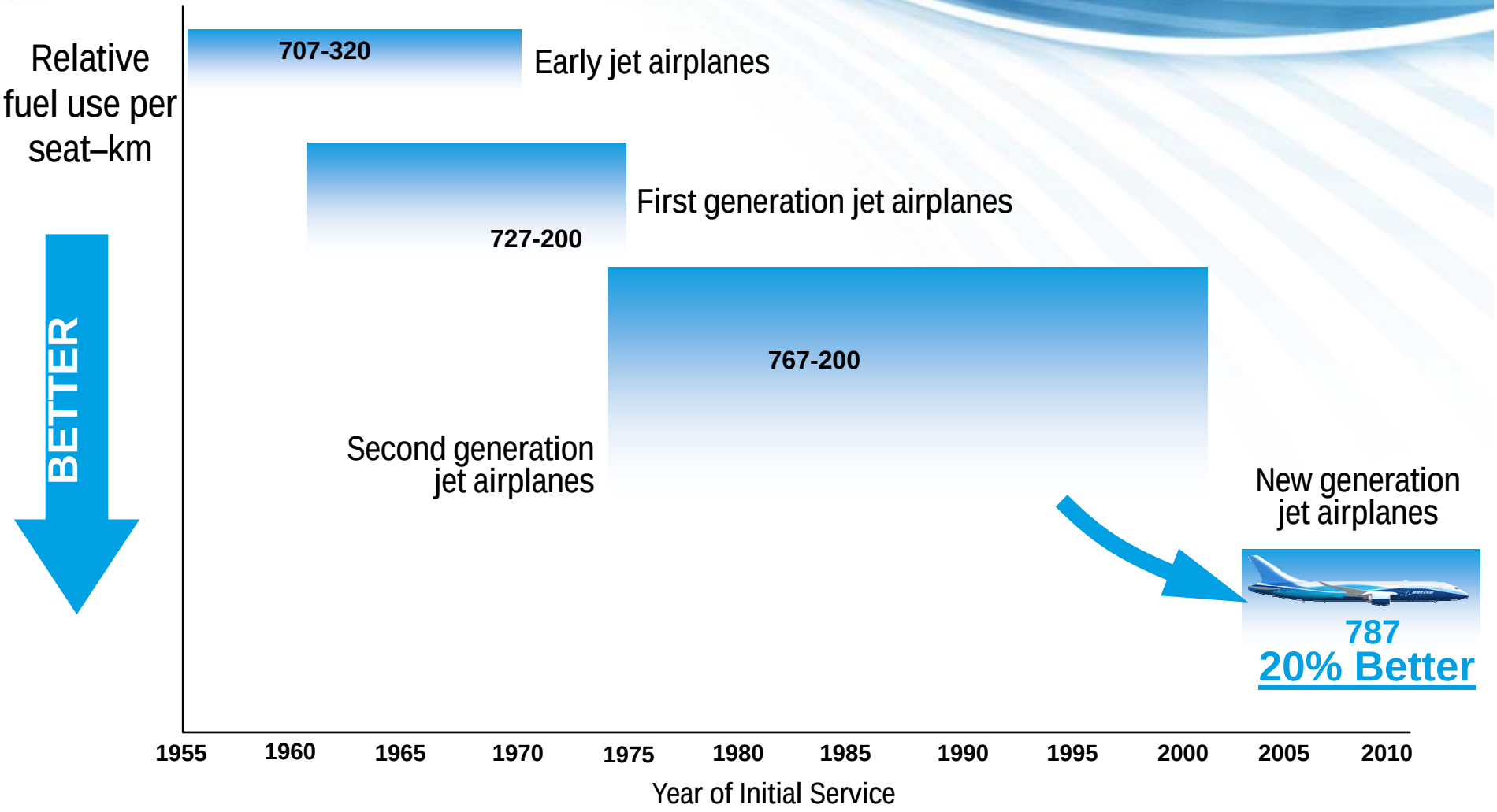
**Innovative Systems**
Flexible for the Future


**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

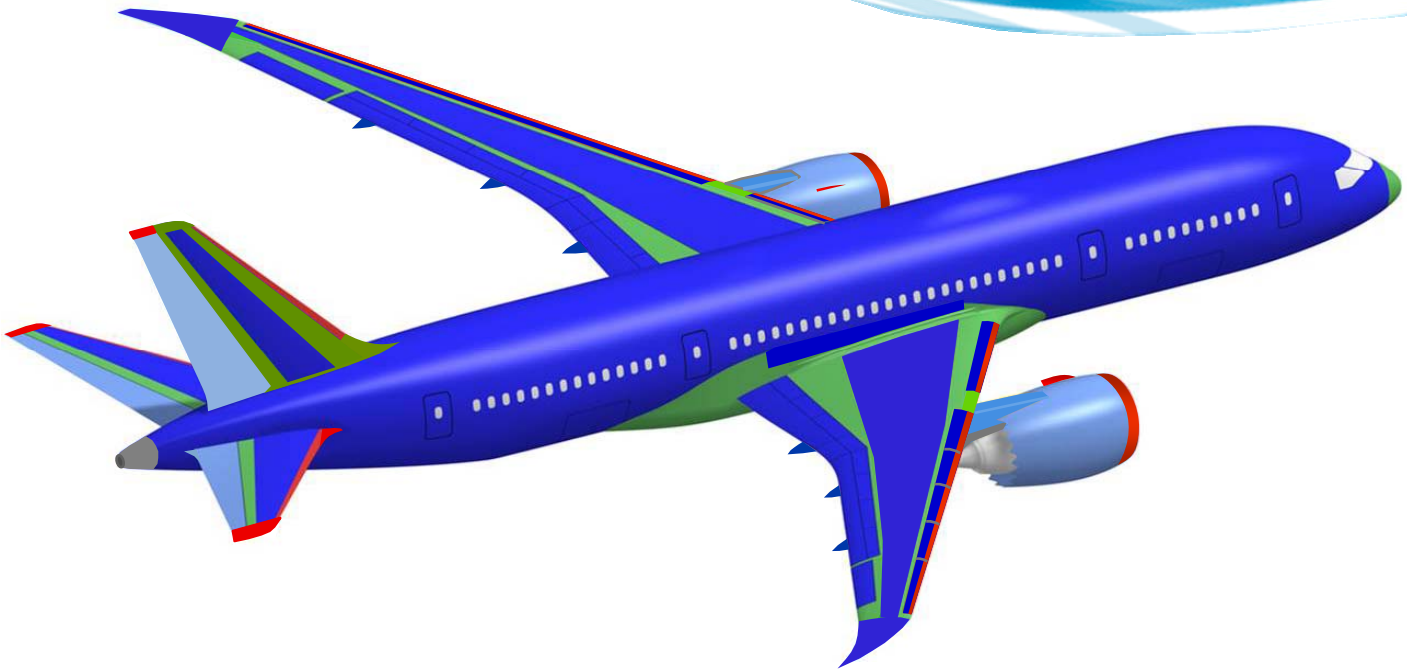


# New Technologies Make the 787 Possible

- 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

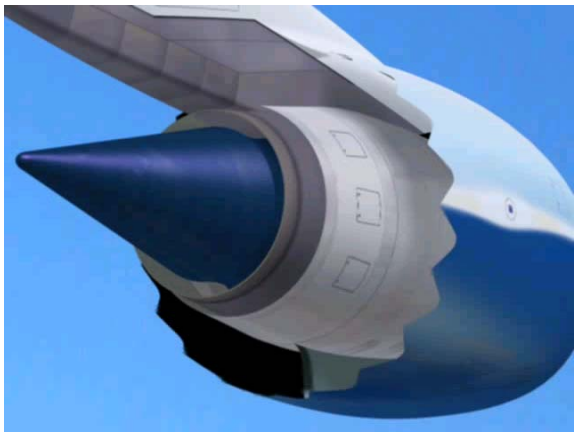
# Faster Line Repairs Will Reduce Delays and Cancellations


Total Time

0:59

# 787 Propulsion System Features New Technologies

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

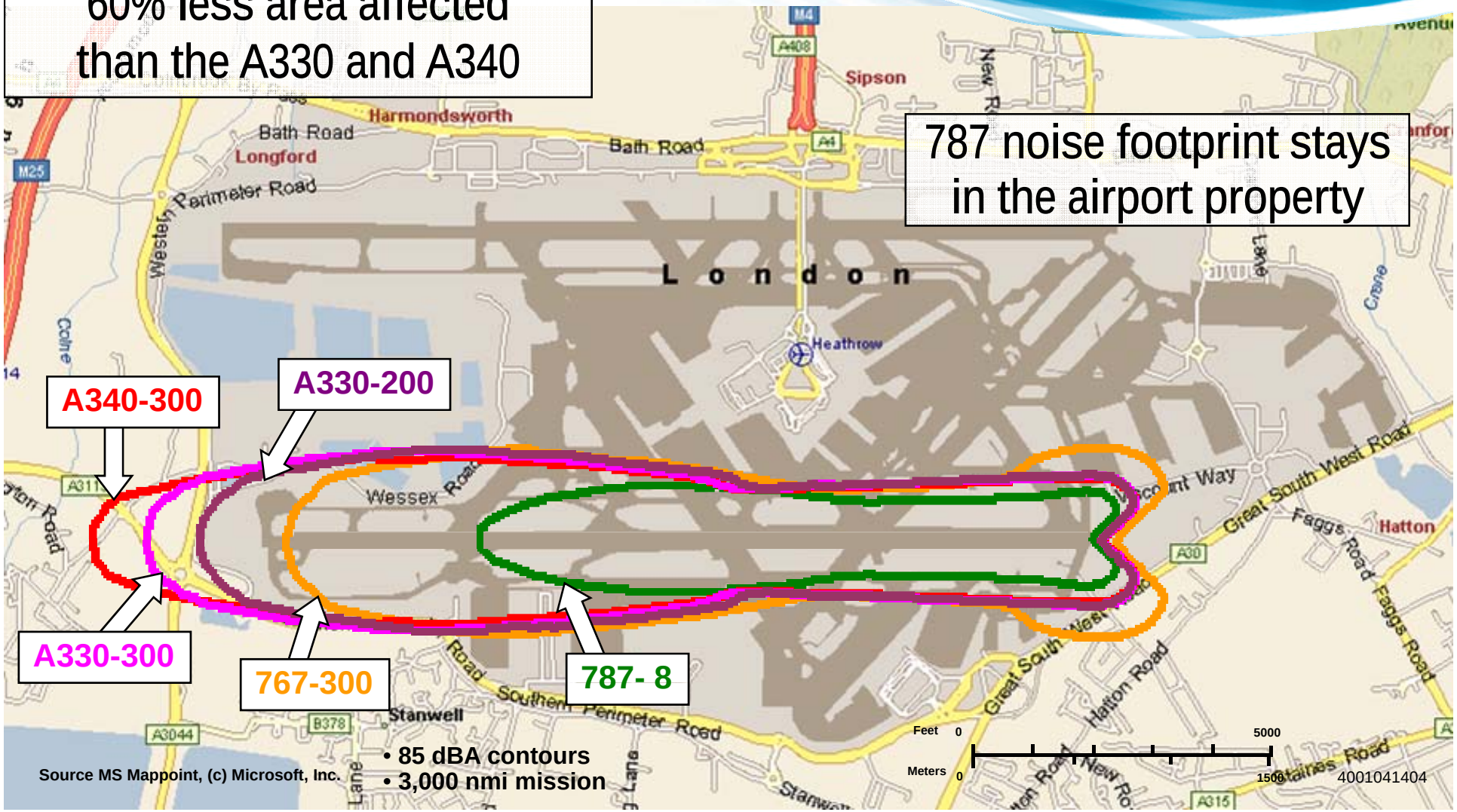


- **Engine and nacelle features:**
  - **Higher bypass ratio**
  - **No-engine-bleed systems architecture**
  - **Low-noise nacelles with chevrons**
  - **Laminar flow nacelles**
  - **Interchangeable (at the wing)**

# Noise Technologies Benefit Airport Communities

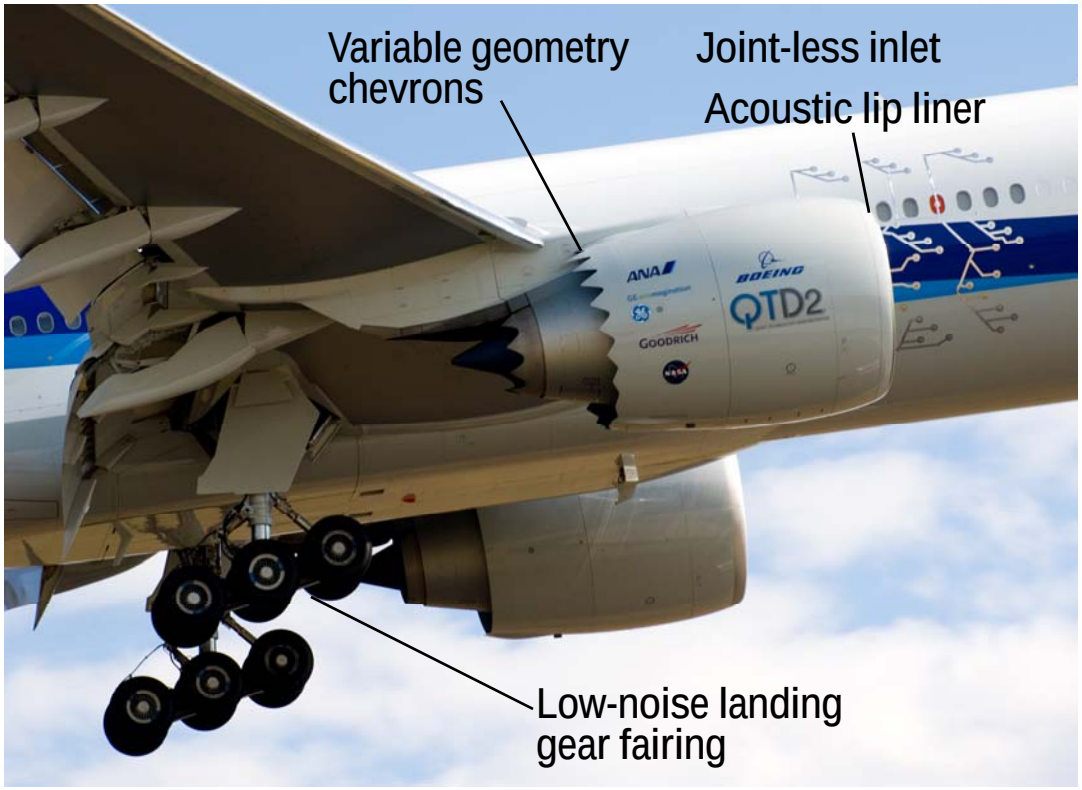
60% less area affected than the A330 and A340

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**

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GE Aircraft Engines

NASA

GOODRICH

# 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***

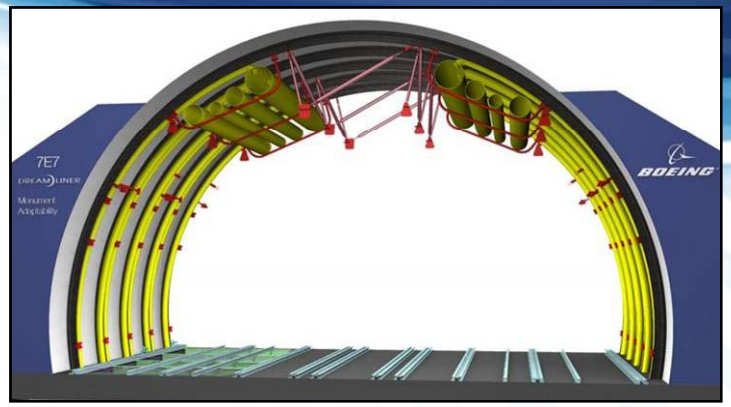
**Wireless IFE**
***Easier ownership, passenger preference***

# A New Sensation for Passengers

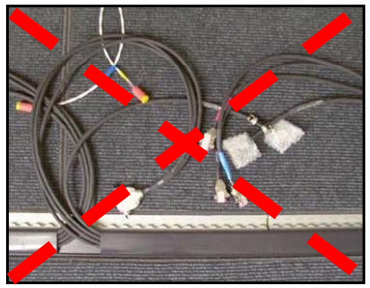

- Improved:
  - Cabin altitude
  - Humidity
  - Air quality
  - Temperature
  - Sound quality
  - Ride quality
  - Lighting
  - Wireless IFE

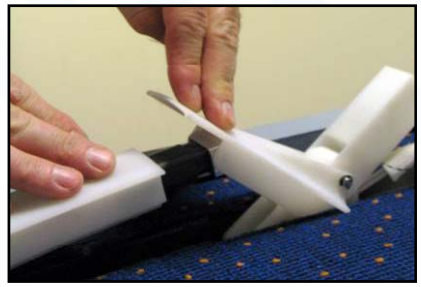
# The 787 Will Feature New Interior Breakthroughs

- **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

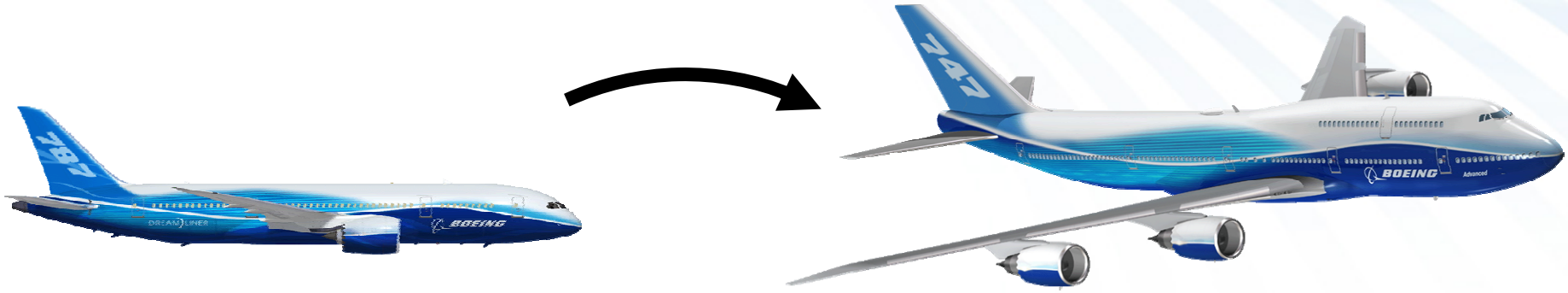
## *Innovation meets Operational Commonality*


- **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

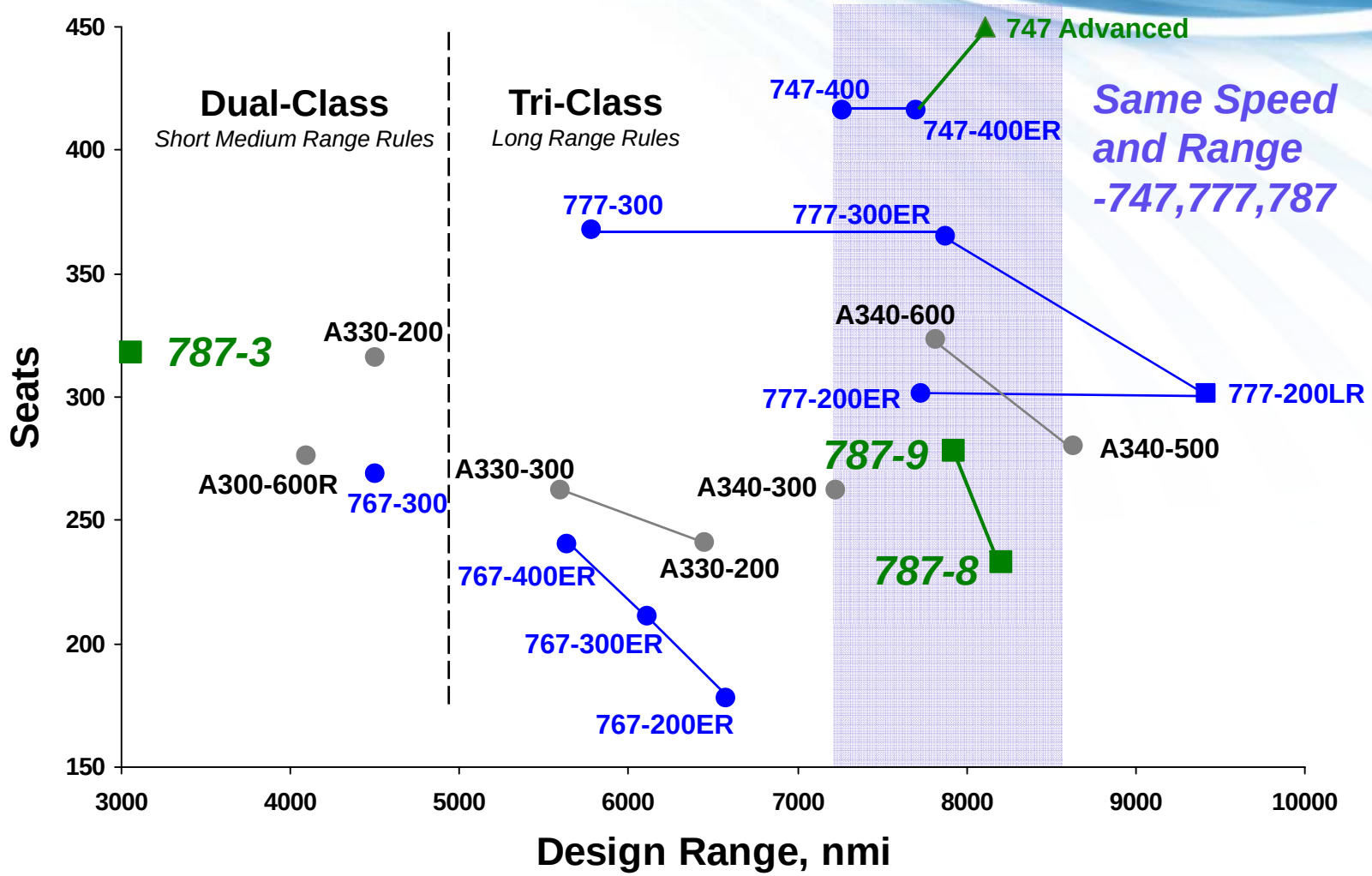
### 747 Advanced Design

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

*Product Development Study

# 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

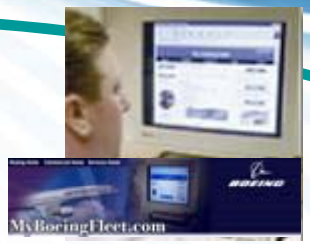
## Tomorrow

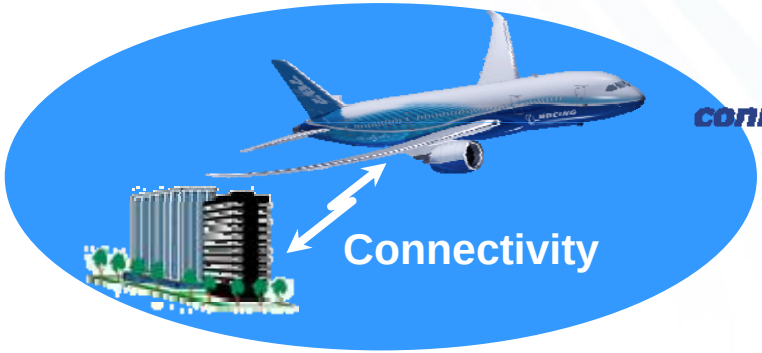
- Advanced simulation and modeling
- Concurrent product development
- Integrated design, build, supply chain

# Connected Service Solutions

***Electronic Flight Bag***

***Airplane Health Management***




***Airline Operations Center***

***Integrated Materials Management***

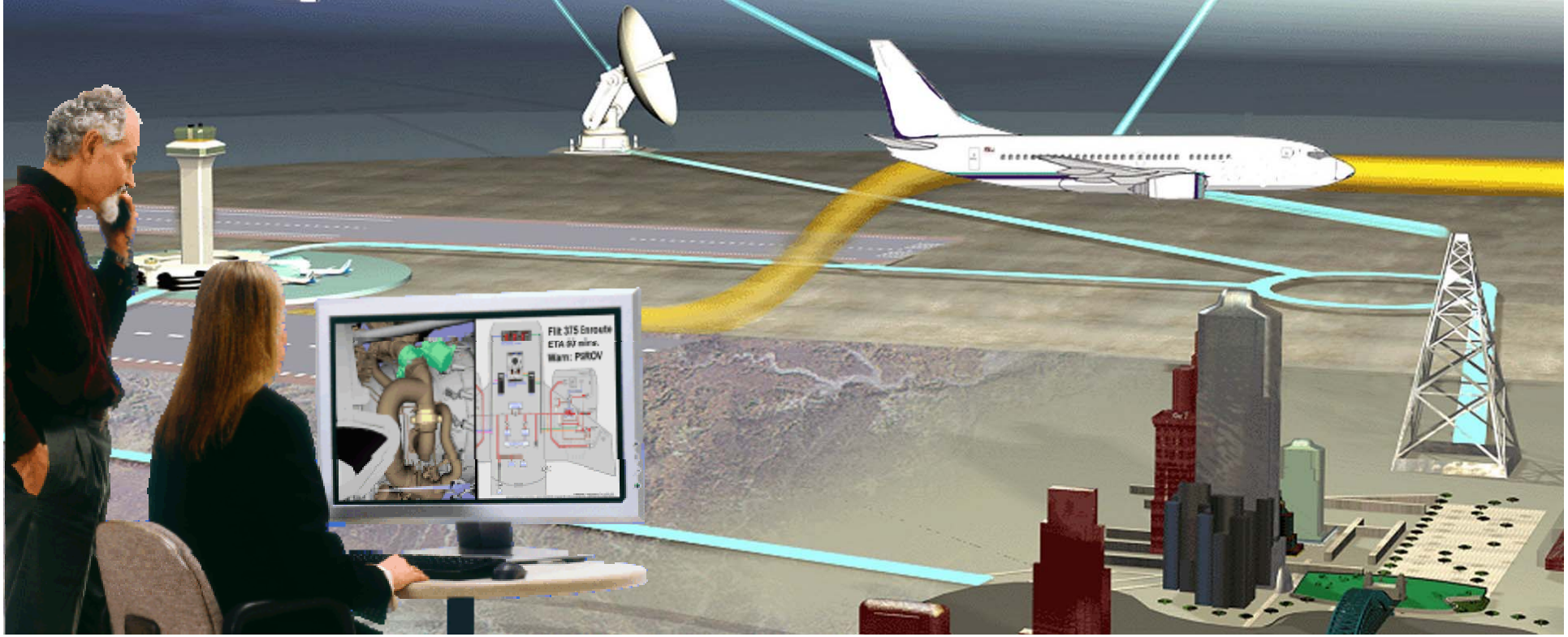
***Maintenance, Repair & Overhaul***

***Improving Airline Productivity***

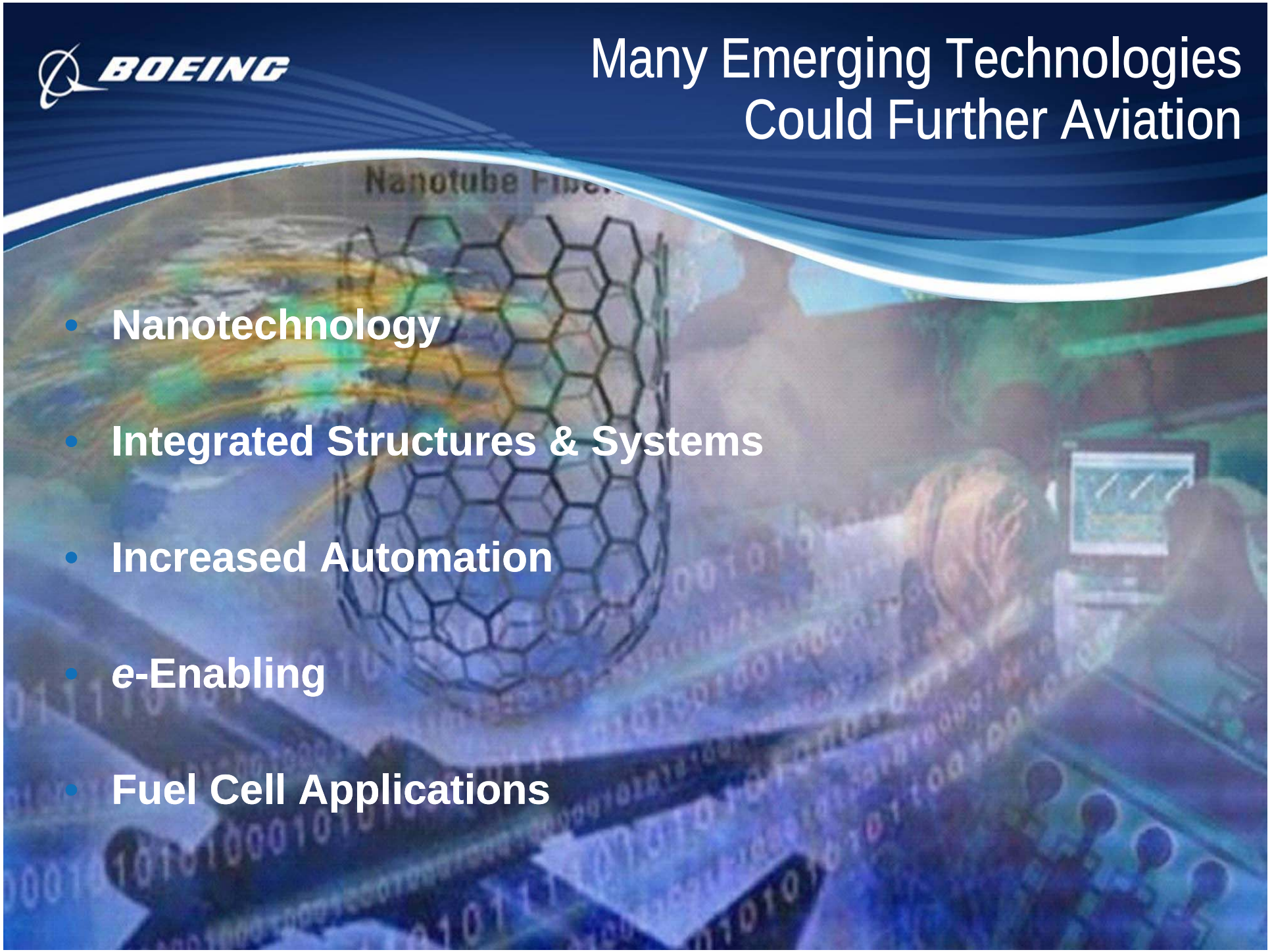
# The e-Enabled Environment

*A Network-Centric Air Transportation System that Adds Real Value*

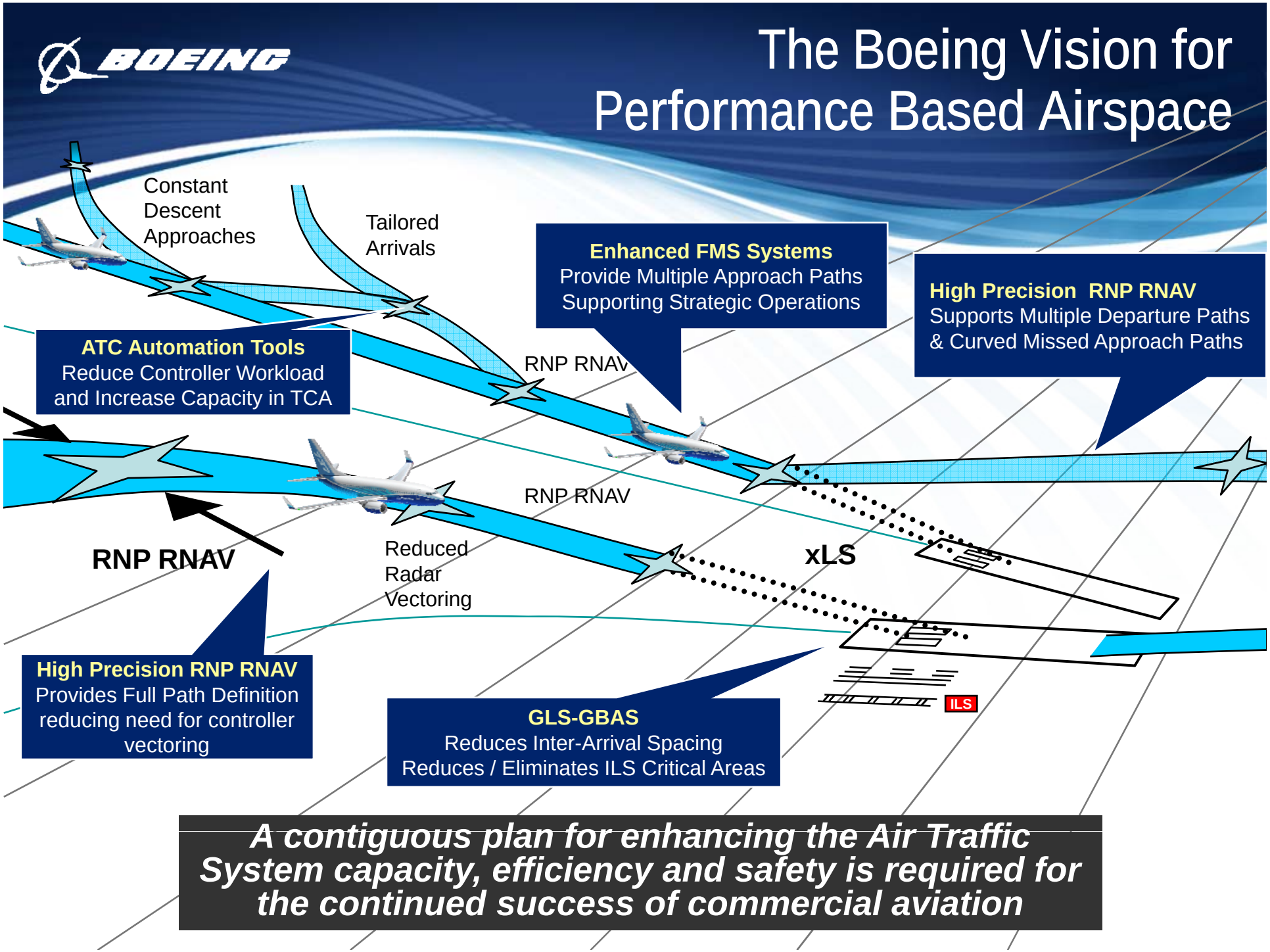
- **Reduced operating costs**
- **Higher efficiency, safety and economy**
- **Improved passenger experience**
- **Better airplane and fleet utilization**



# Many Emerging Technologies Could Further Aviation




- **Nanotechnology**
- **Integrated Structures & Systems**
- **Increased Automation**
- ***e*-Enabling**
- **Fuel Cell Applications**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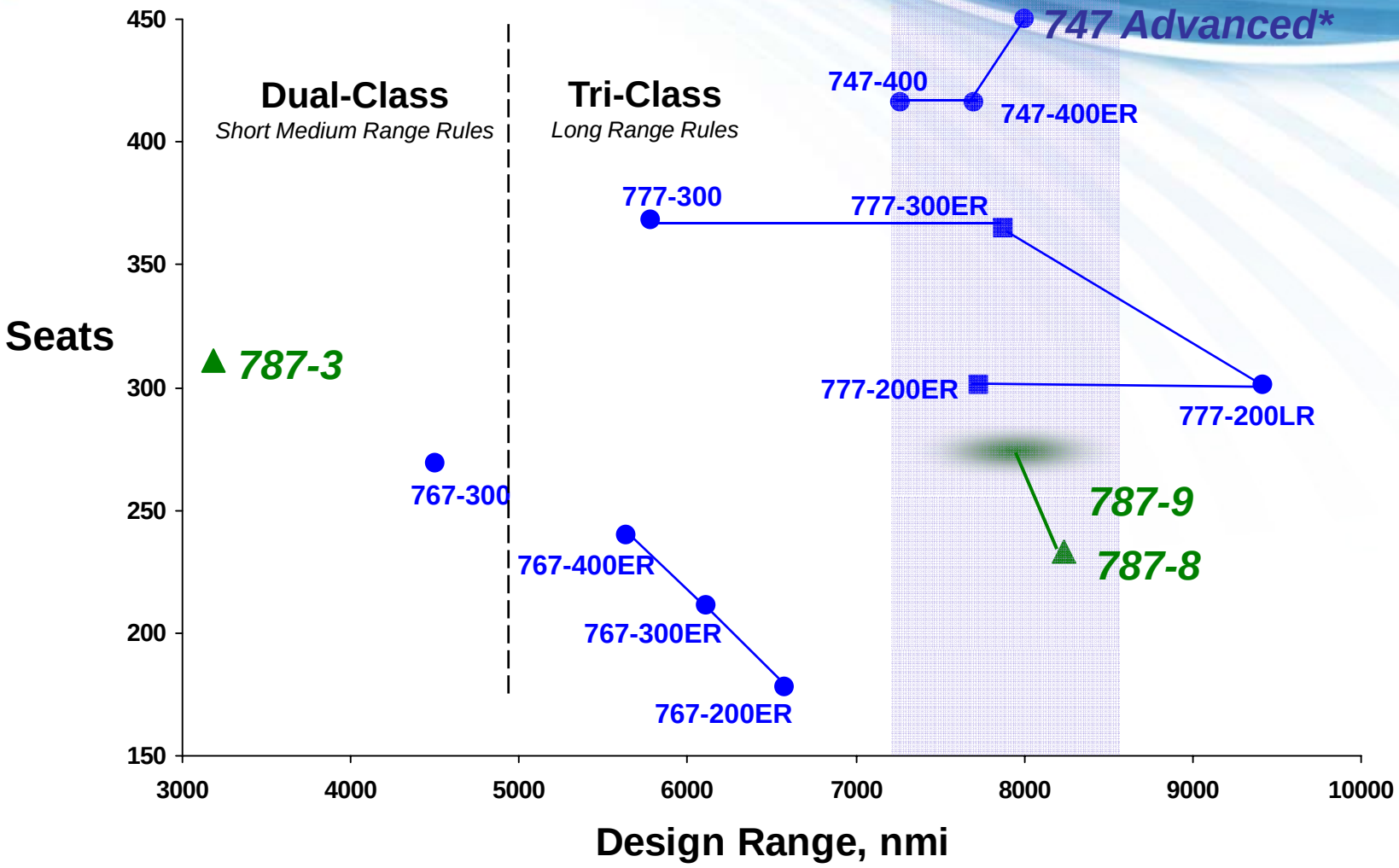
The Boeing Vision for Performance Based Airspace
Constant Descent Approaches
Tailored Arrivals
Enhanced FMS Systems
Provide Multiple Approach Paths Supporting Strategic Operations
High Precision RNP RNAV
Supports Multiple Departure Paths & Curved Missed Approach Paths
ATC Automation Tools
Reduce Controller Workload and Increase Capacity in TCA
RNP RNAV
RNP RNAV
RNP RNAV
Reduced Radar Vectoring
xLS
ILS
High Precision RNP RNAV
Provides Full Path Definition reducing need for controller vectoring
GLS-GBAS
Reduces Inter-Arrival Spacing
Reduces / Eliminates ILS Critical Areas
A contiguous plan for enhancing the Air Traffic System capacity, efficiency and safety is required for the continued success of commercial aviation

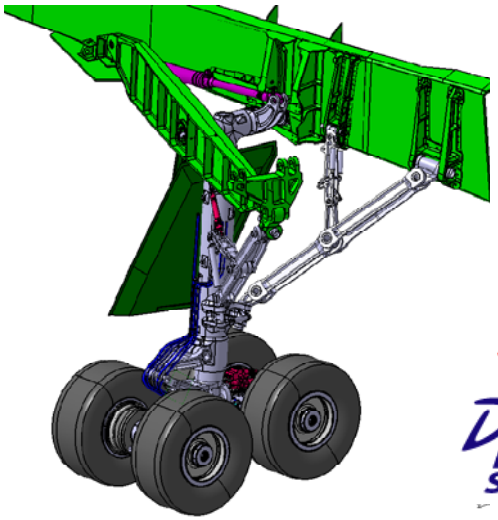
# 747Advanced Compliments the Boeing Long Range Airplanes

*Same Range, Same Speed*




*Product Development Study

# New Design Tools Enable Better Results



## Improved capabilities

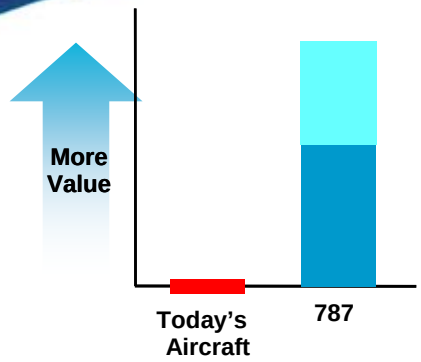
- Real-time collaboration between partners
- Advanced human factors modeling
- Increased relational design
- Assembly and maintenance process design

## Benefits

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

DASSAULT SYSTEMES ENOVIA CATIA DELMIA

# Technology and Innovation Benefits Airlines, Passengers and the Environment




**Breakthrough in Value for Airlines**

**Breakthrough Flying Experience for Passengers**

**Breakthrough Environmental Performance**