Commercialization of Radio Frequency Identification within Aerospace and Defense

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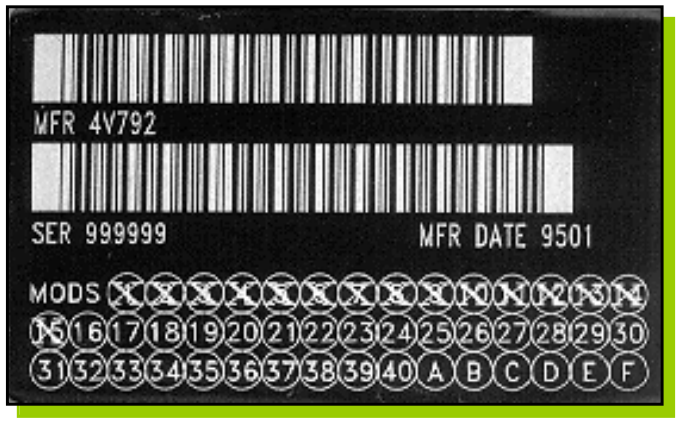
Sample Bar Coded Nameplate



Radio Frequency Identification (RFID)

- RFID is an automated identification and data collection technology that uses radio frequency waves to transfer data between a reader (interrogator) and items that have tags (transponders) affixed
- Similar to bar code
  - RFID tag stores data ~ bar code label
  - RFID reader ~ bar code reader
  - Radio waves ~ light waves
- RFID advantages compared for commercial aviation
  - No line of sight required
  - Dynamic read/write capability
  - Simultaneous reading and identification of multiple tags
  - Tolerant of harsh environments

Benefits of Automated Identification

Customer and Supplier Benefits

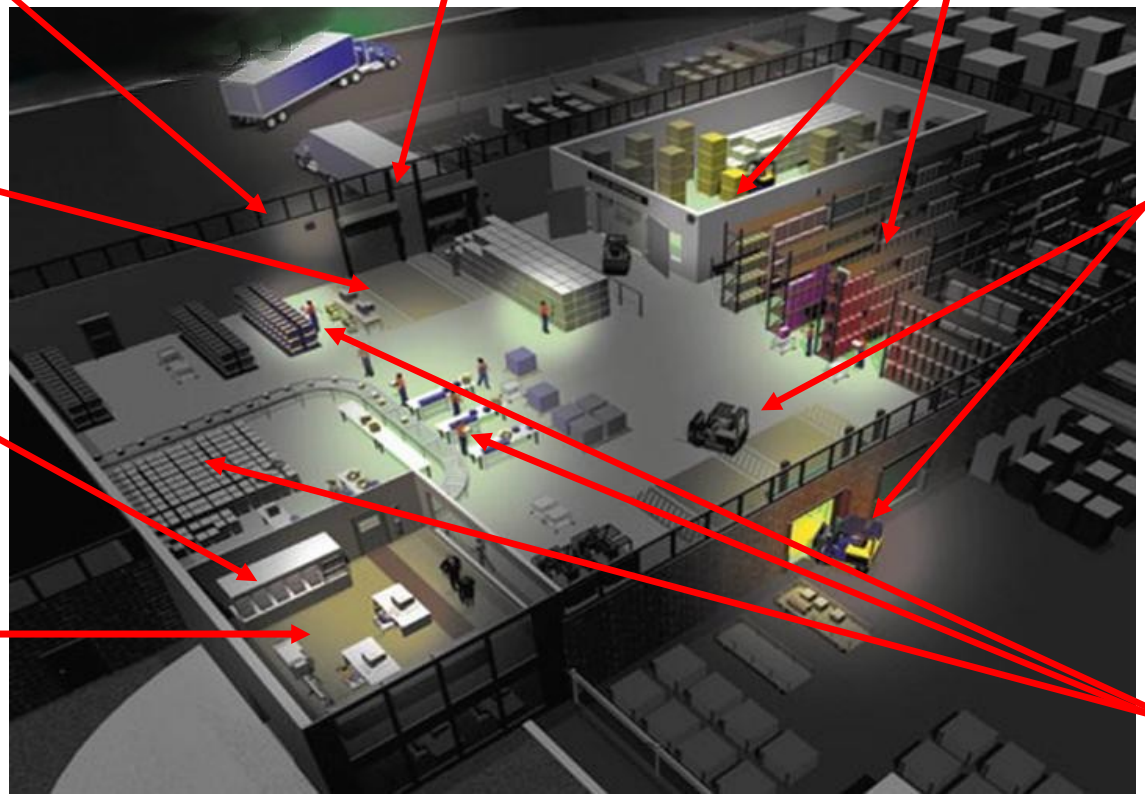
- reduces inventory control and provisioning costs
- accurate configuration control and repair history
- reduces warranty claim processing costs
- regulatory agency compliance monitoring
- part installation and removal time tracking
- accurate and efficient spare parts pooling
- identification of rogue parts
- accurate flight hours tracking by part

Boeing and Airbus Benefits

- reduces parts receiving costs
- eliminates data entry errors
- provides accurate "as delivered" configuration
- improves parts traceability
- reduces risk of unapproved parts
- timely in-service problem resolution
- accurate and efficient spare parts pooling
- improves customer satisfaction

By working together on these non-competitive standards initiatives, both Boeing and Airbus benefit by avoiding conflicting requirements with mutual suppliers and customers and delivering products and services which create best value.

RFID Use cases in the Factory



- Benefits also include reduced unit costs, cycle time and defects

Federal Aviation Regulations (FAR)

- Radio and electronic equipment, controls, and wiring must be installed so that operation of any one unit or system of units will not adversely affect the simultaneous operation of any other radio or electronic unit, or system of units...
- The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable, and…

Boeing Position on Passive RFID

Because passive RFID devices:

- Have no on-tag power source and no active transmitter, and
- Perform a ground operated, non-essential function, and
- Are not potential sources of interference or susceptibility and
- Are FCC-certified for unlicensed use.

The FAA and EASA have agreed that passive RFID devices comply with applicable regulations and do not impact form, fit, or function of installed systems and equipment.

Boeing RFID Certification Approach

- Agreement reached on simplified certification strategy based on cross FAR application, applicable to all aircraft types (airplanes, rotorcraft, general aviation, etc.).
- FAA has published Passive RFID Policy Memorandum, dated May 13, 2005.

Considerations for Deploying RFID on the 787

- Line replaceable
- Repairable
- Recommended as a spare
- Frequency of removal
- Spares price
- Dispatch criticality
- Life-limited or time-controlled part
- Emergency equipment

RFID Proof of Concept with FedEx

- RFID tag installation completed October 3, 2003 during freighter conversion by Aeronavali (Venice, Italy).
- Test aircraft, MD-10 (N370FE), returned to revenue service on November 12, 2003.
- Infineon 13.56 MHz passive tags were tested – scope was 40 installations covering all major aircraft zones.
- Duration of RFID test was 90 days in-service.
- FedEx Engineering Authorization 8-1130-67451 indicated minor alteration does not alter form, fit or function of components.

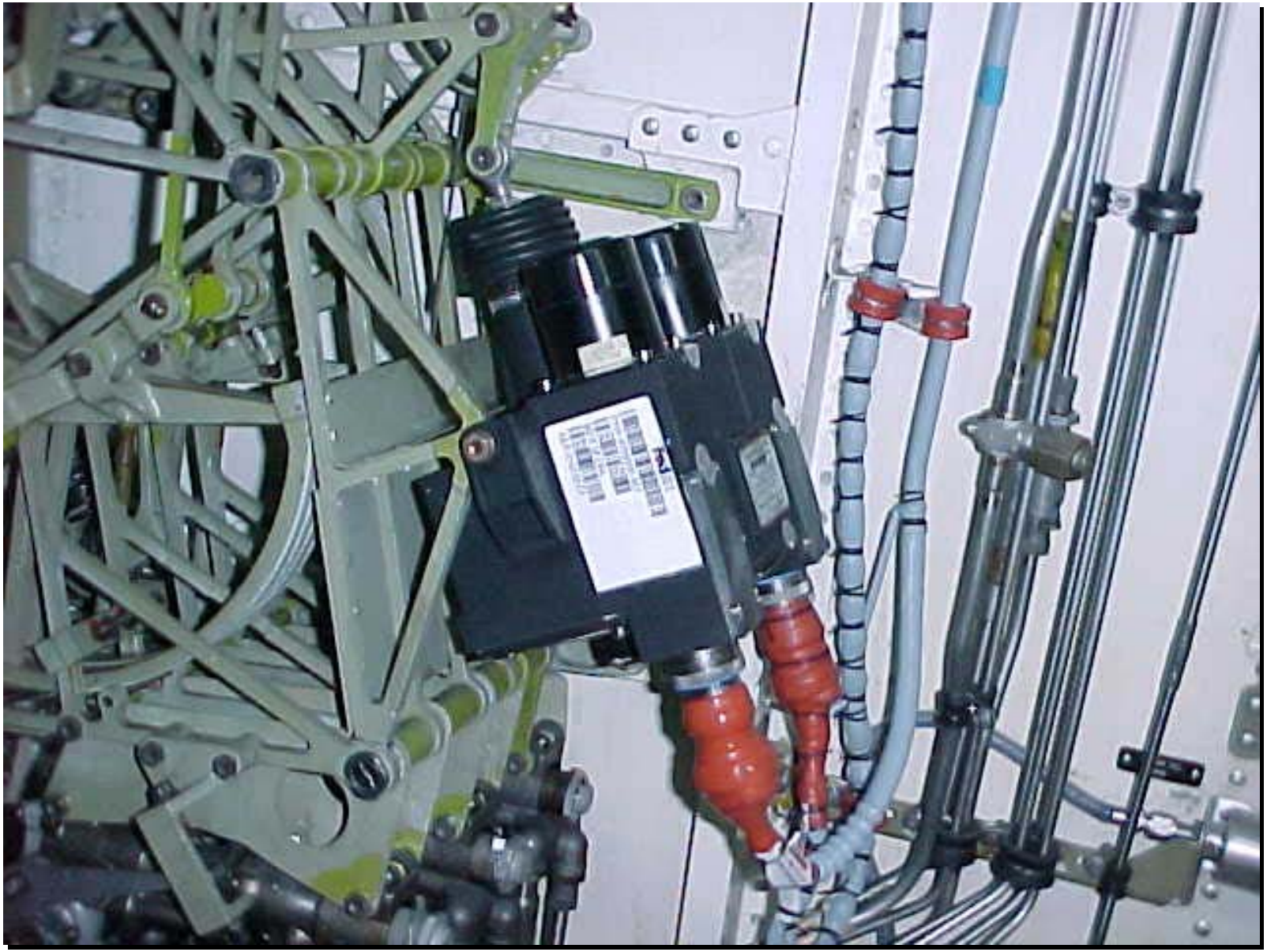
RFID Enabled Smart Label

FedEx MD-10 N370FE

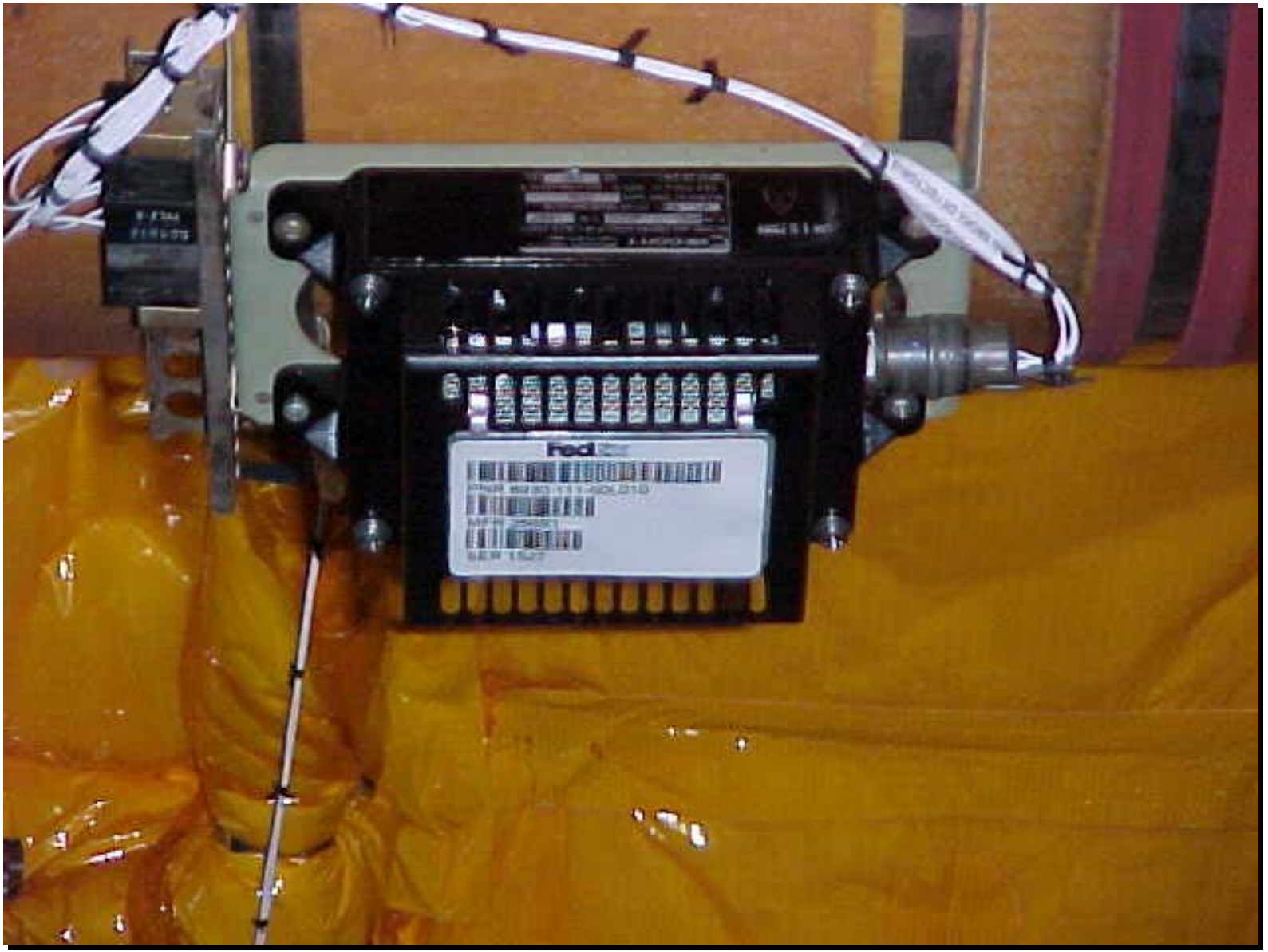
Annunciator Control Unit

Air Data Inertial Reference Unit

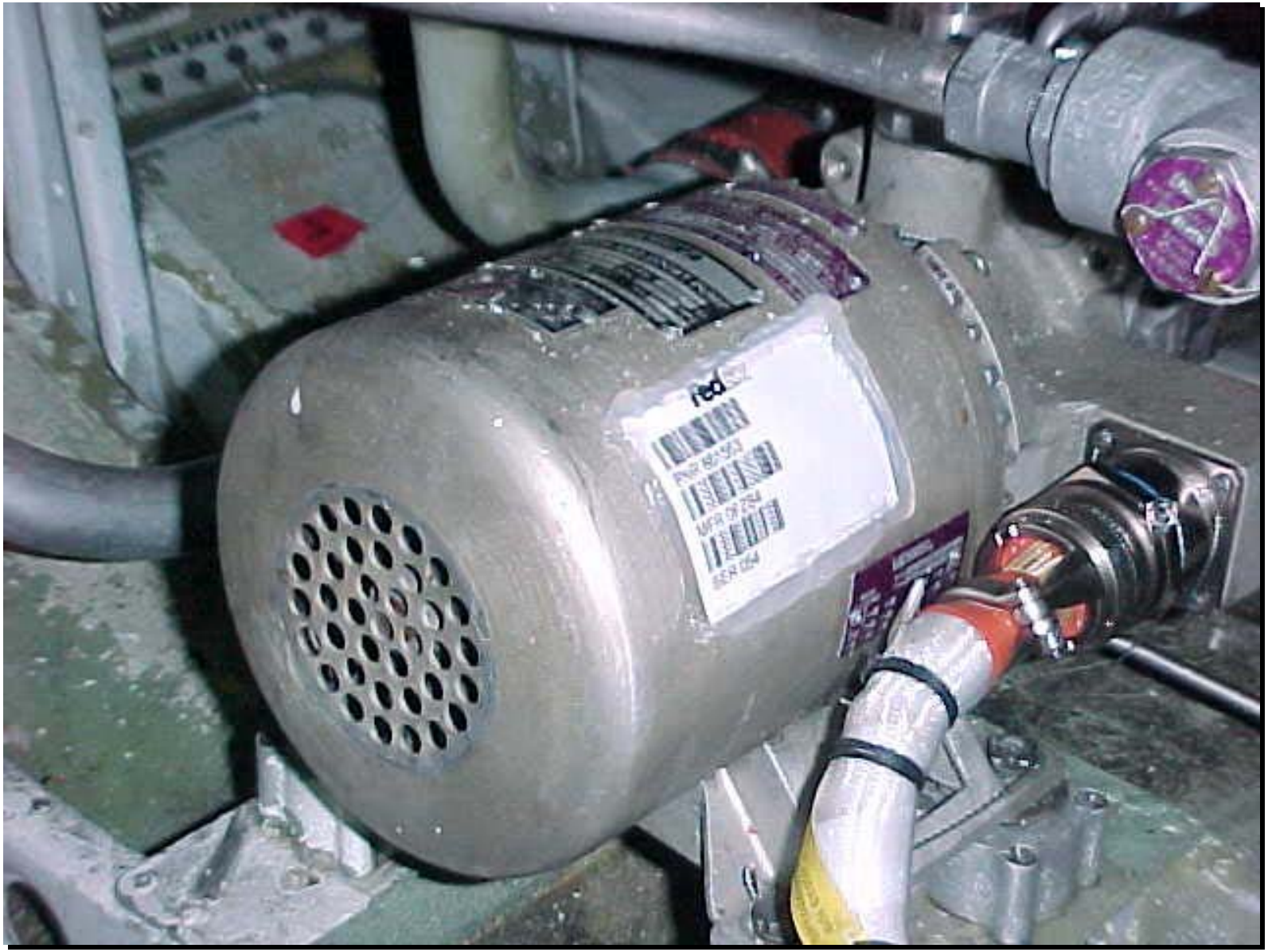
Flap Limit Duplex Actuator Unit



Smoke Detector



Auxiliary Hydraulic Pump



Hand Held Portable Data Terminal

915 MHz Evaluation

- A similar 90-day in-service evaluation with 915 MHz smart labels on the same 40 components on the same airframe (N370FE) is now complete. Findings are similar to 13.56 MHz evaluation.
- FedEx, Boeing and the FAA have approved this additional evaluation using a revised FedEx Engineering Authorization.
- Installation of the smart labels took place in Memphis, TN on October 6, 2004. Final report-out meeting with FedEx, Intermec and POSData in Everett on February 15, 2005

The 787 Is a Complete, Flexible, Efficient Family

787-8

210-250 passengers (three-class)

8,000 – 8,500 nmi | 14,800 – 15,700 km

787-3

290-330 passengers (two-class)

3,000 – 3,500 nmi | 5,500 – 6,500 km

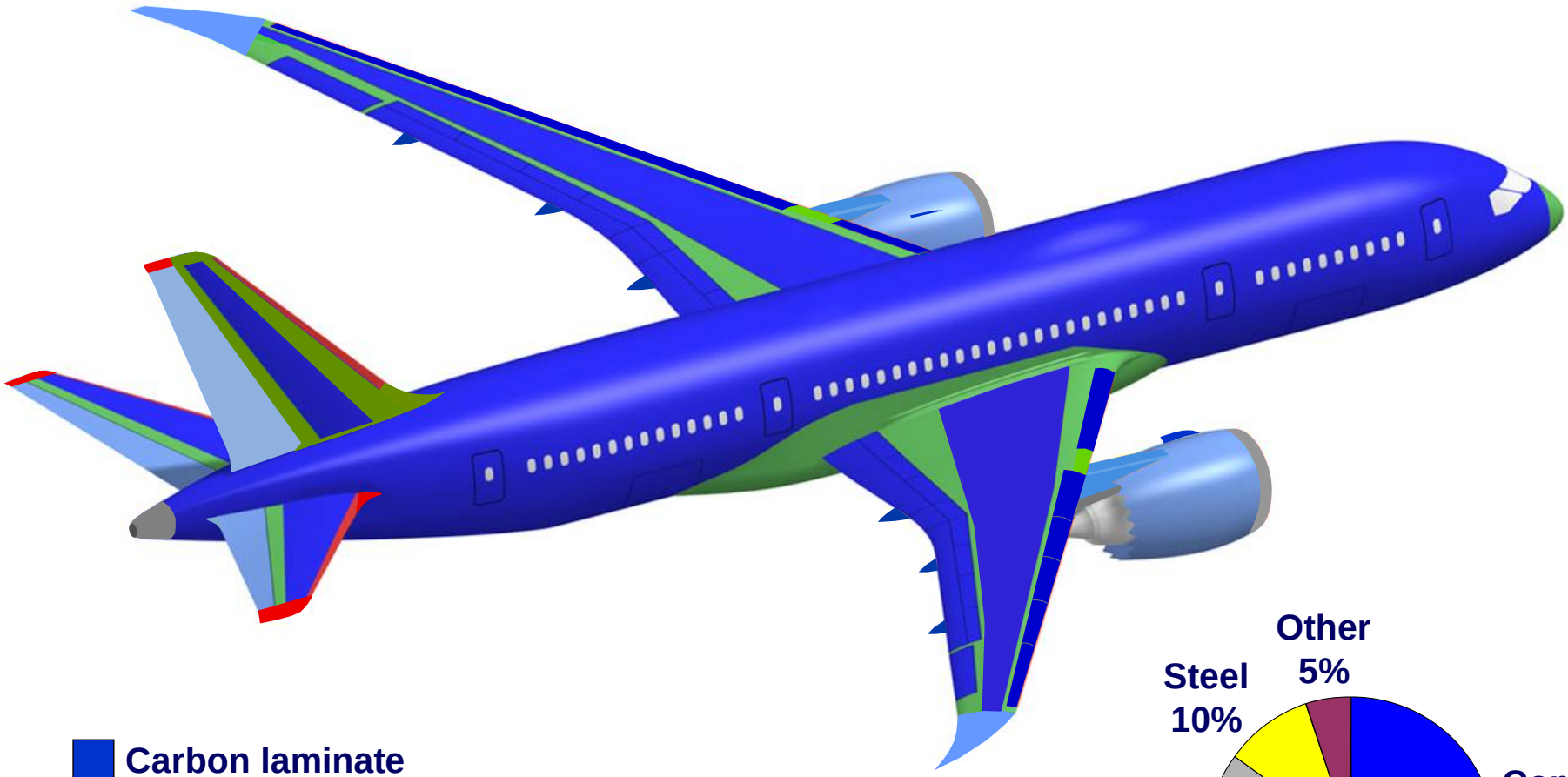
787-9

250-290 passengers (three-class)

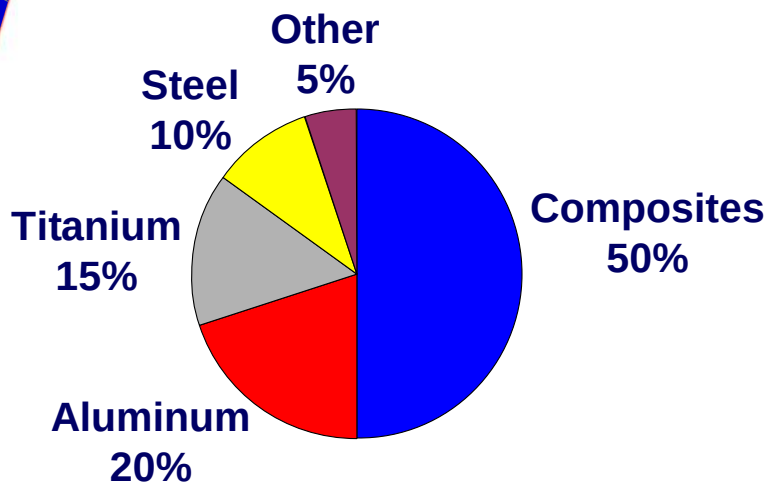
8,600 – 8,800 nmi | 15,700 - 16,300 km

Composites Serve as Primary Structural Material

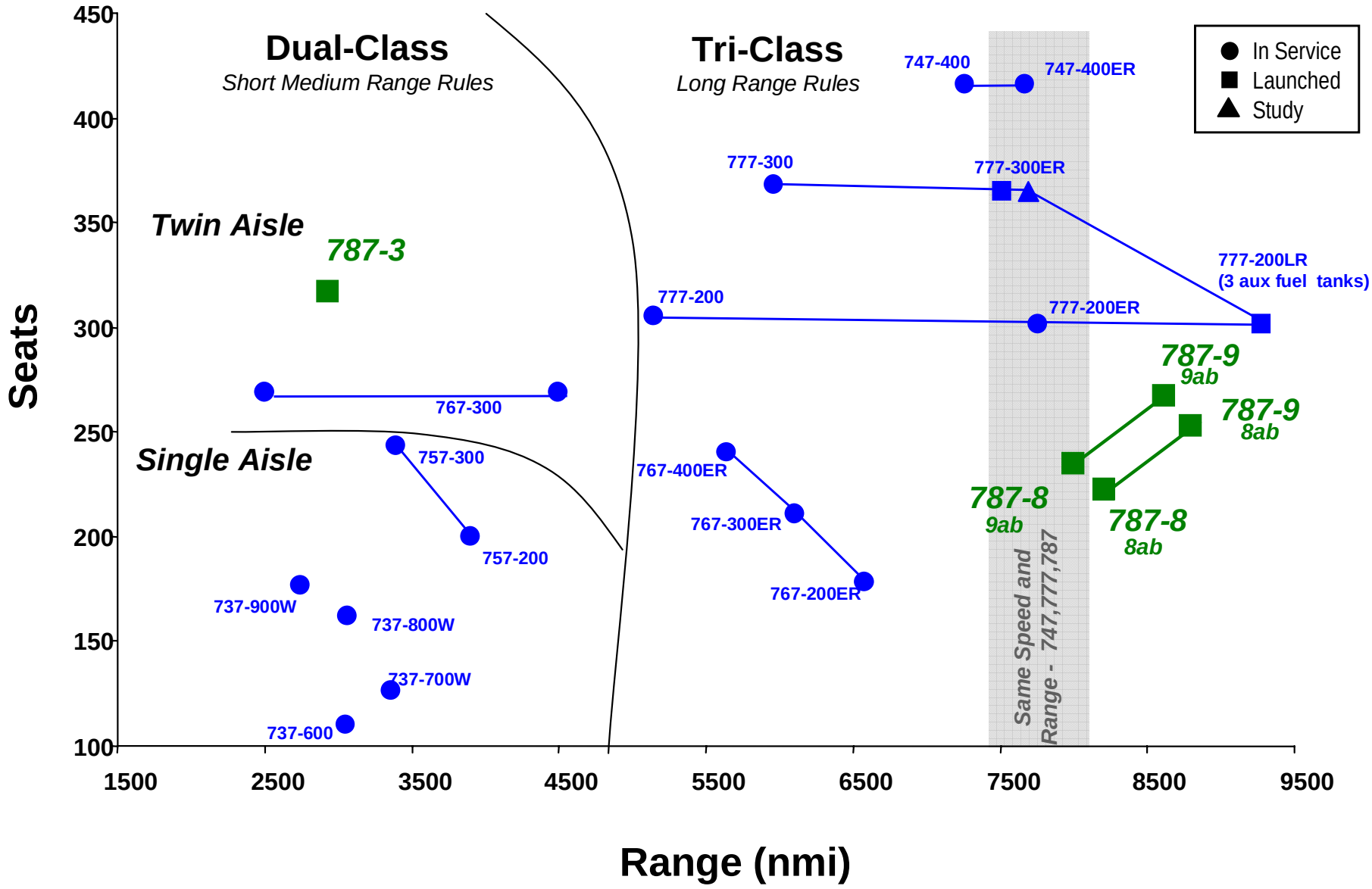
787 DREAMLINER



- Carbon laminate
- Carbon sandwich
- Other composites
- Aluminum
- Titanium



Mission Capabilities Defined, Optimized for Efficiency



Point-to-Point Enabled

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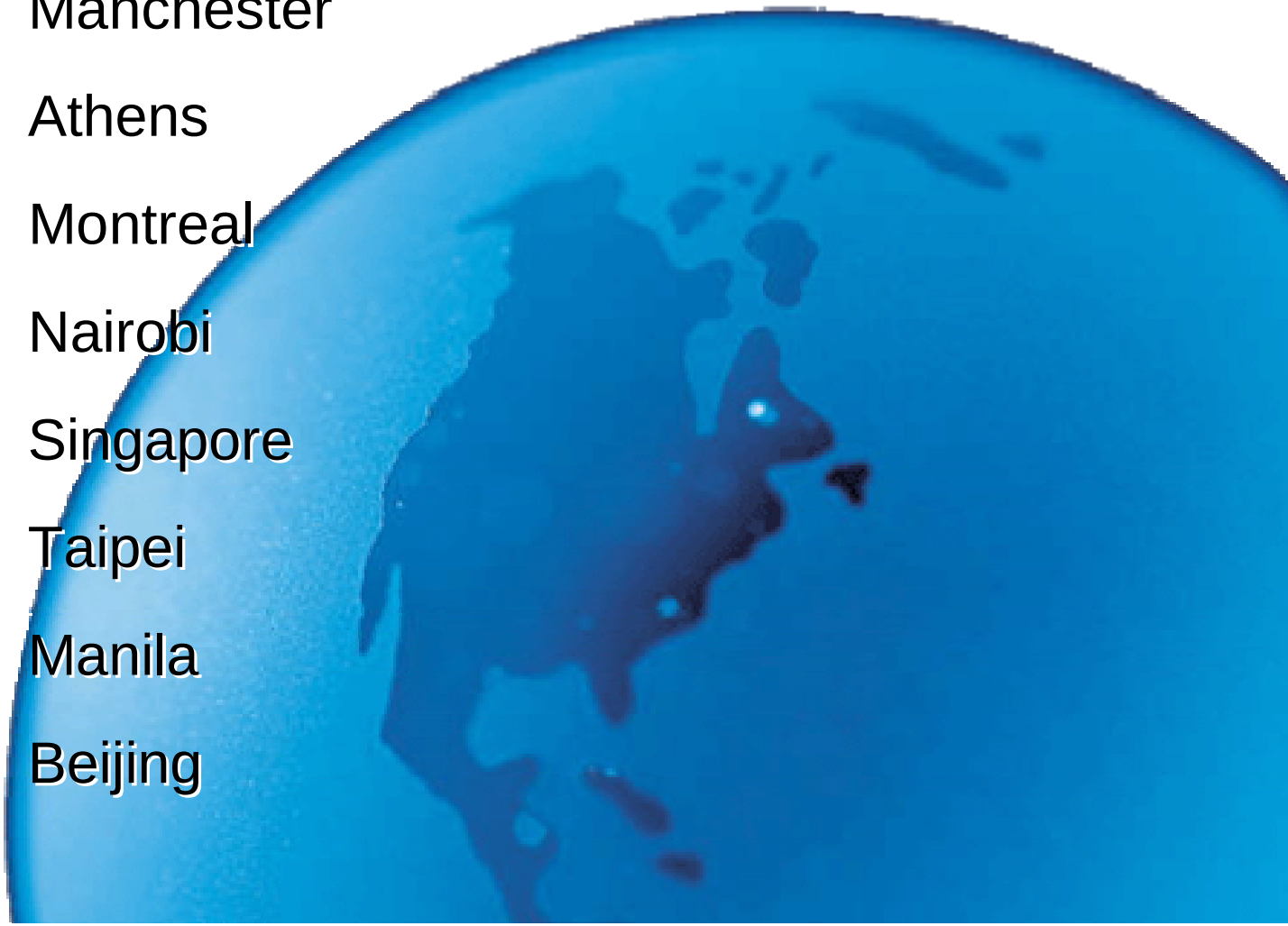
- Vancouver - Sao Paulo
- Seattle - Shanghai
- San Francisco- Manchester
- Boston - Athens
- Tel Aviv - Montreal
- Munich - Nairobi
- Geneva - Singapore
- Dubai - Taipei
- Madrid - Manila
- Auckland - Beijing



Creating a Better Flying Experience

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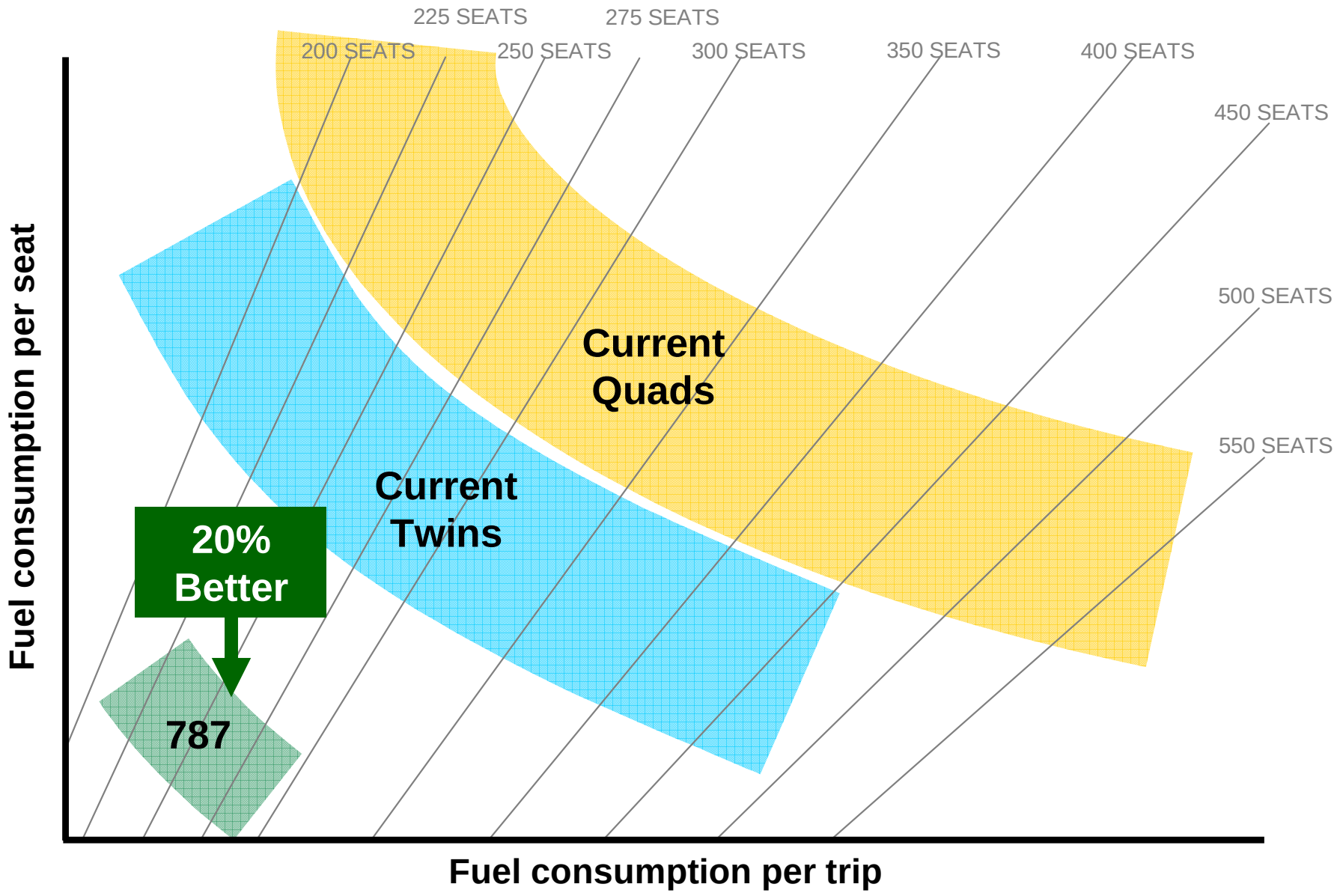
Opening a New Era in Fuel Efficiency



Progressing on Schedule

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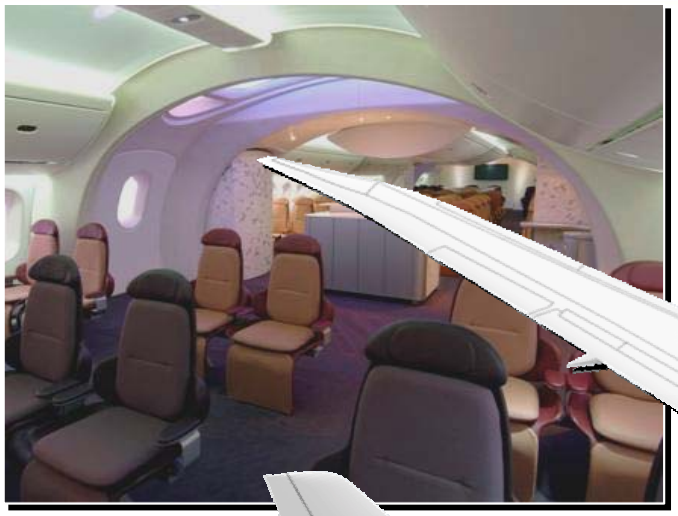
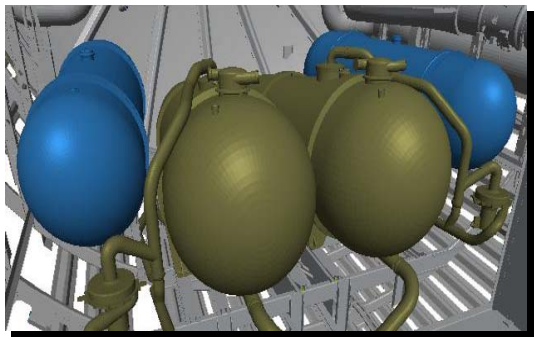
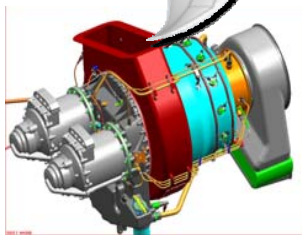
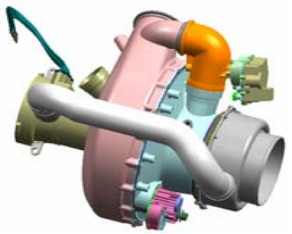
2002	2003	2004	2005	2006	2007	2008	2009	2010
Airplane Announcement	Authority to Offer	Program Launch	Firm Configuration	Start of Major Assembly	787-8 First Flight	787-8 Enters Service		787-3 Enters Service, 787-9 Enters Service

787 Applications









Intended Operational Uses

- Point-of-use information system
  - Reference maintenance and operational history immediately
- Safety, quality, efficiency
  - Required certifications, inspections and qualifications
- Not an authoritative source of data
  - Not for proprietary data
  - An inoperable tag does not render the component unserviceable

Intended Operational Uses

- Two-way communication between operator and OEM
  - Mechanic observations
- Logistics
  - Servicing
  - Component removals
- Reliability
  - No fault found history
  - Service Bulletin incorporation

Examples of ATA Data Elements

- Part number
- Serial number
- Manufacturer
- Fabricator
- Date of manufacture
- Country of origin
- Modification level
- Warranty expiration date
- Weight
- Part description/nomenclature
- Lot number
- Hazardous material code
- Electrostatic sensitive device indication
- Shelf life expiration date
- Software part number
- Airworthiness certificate tracking number

Released Aerospace Standard AS5678

- Passive, reader talk first protocol
- 860 - 960 MHz frequency range
  Read/write secure memory
- Complies with ATA SPEC 2000 Chapter 9
- Environmental tests per DO 160E requirements
- Metal mount, surface insensitive packaging
- 20 year service life
- Complies with FAA policy dated May 13, 2005
- Air interface in accordance with EPCglobal
  (ISO 18000-6C)

Accomplishments to Date

- RFID in-service evaluations with FedEx completed
- Global Aviation RFID Forums (six events completed)
- FAA Policy authorizing passive RFID usage issued May 13, 2005
- UHF smart label requirements defined for on-airplane use
- Airplane Level Study 781 completed (weight, cost, etc.)
- United States Patent Number 7,064,668 issued
- Began EPC Global standards activities

Planned Next Steps

- Global Aviation RFID Forums in 2007
- Component supplier technical requirements forums
- 787 launch customer education workshops
- RFID smart label development with Intelleflex
- Finalize certification plan for RFID on 787

Thank you for your attention

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