



# 787 | Extended Operations (ETOPS)

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# Welcome

- Extended Operations History
- Extended Operations Benefits
- Extended Operations Requirements
- 787 Extended Operations Service History

# Explaining ETOPS – Extended Operations

- ETOPS is the permission granted by regulators for an airplane to fly at extended distances from an airport suitable for landing.
- ETOPS approval requires manufacturers demonstrate compliance with ETOPS regulations for the airplane.
- Operators must also receive authority to fly ETOPS based on their ETOPS programs and operational capability.



**ETOPS Enables More Direct and Efficient Routing**

# ETOPS History Shows Evolution of Rules

- 1953 – The “60-Minute Rule” prohibits two-engine airplanes from routes more than 60 minutes from an adequate airport.
- 1985 – ETOPS exemptions allowed with proven performance. Twinjets allowed up to 120 minutes from a suitable airport.
- 1988 – 180-minute ETOPS exemptions allowed.
- 1995 – ETOPS possible from first day of operations.



**Over 25 Years of History and Safe Flights with ETOPS**

# Recent ETOPS Developments

- 2000 – 207-minute ETOPS policy enacted for North Pacific based on operational need, preservation of safety and 777 ETOPS capability.
- 2007 – FAA established the first real *rules* for ETOPS. No longer confined to 180-minutes, ETOPS limits are now based on the proven capabilities of the airplane.
- 2007 – FAA also established requirements for three- and four-engine airplanes when flown more than 180 minutes from a suitable airport.

**ETOPS Expanded Based on Proven Safety and Reliability**

# Allowing Optimal Use of Twinjet Advantages

- Twinjet efficiency advantage is multiplied when paired with ETOPS:
  - ❖ Industry leading safety record.
  - ❖ More fuel efficient.
  - ❖ More point-to-point city-pair operations.
  - ❖ Fewer emissions.
  - ❖ Superior reliability.
  - ❖ Lower maintenance cost.
- Twinjets and ETOPS have substantially reduced the overall environmental footprint of aviation

# Current Boeing ETOPS Approvals

- 737 Classic – 120 minutes
- 737NG – 180 minutes
- 757 – 180 minutes
- 767 – 180 minutes
- 777 – up to 330 minutes
- 787 – 180 minutes



# Design Requirements for ETOPS Airplanes

- ETOPS design requirements are intended to preclude the need to divert, and to protect the safety of a long diversion if it becomes necessary.
- “Preclude” and “protect” approach enhances airplane design:
  - ❖ Increased reliability and redundancy.
  - ❖ Increased auxiliary power unit (APU) capability.
  - ❖ Better fuel availability to any engine.
- ETOPS design intent is verified by analysis, lab tests, engine tests and airplane flight tests.



# 787 ETOPS Engine Test Requirements Met

- Engines “flew” 3,000 simulated flight cycles while on the ground:
  - ❖ Simulated aircraft system loads.
  - ❖ Intentionally imbalanced to validate durability.
  - ❖ Thrust reverser system used.
  - ❖ Multiple 330-minute maximum continuous thrust diversion cycle
  - ❖ Full post-test tear-down and inspection.



# 787 ETOPS Flight Test Requirements Met

- During its flight test program, the 787 demonstrated that it met regulatory requirements for ETOPS including:
  - ❖ Multiple safe flights of 345-minutes with only a single-engine operating.
  - ❖ Multiple safe flights of 345-minutes with numerous systems intentionally failed.
  - ❖ Maximum duration flight.



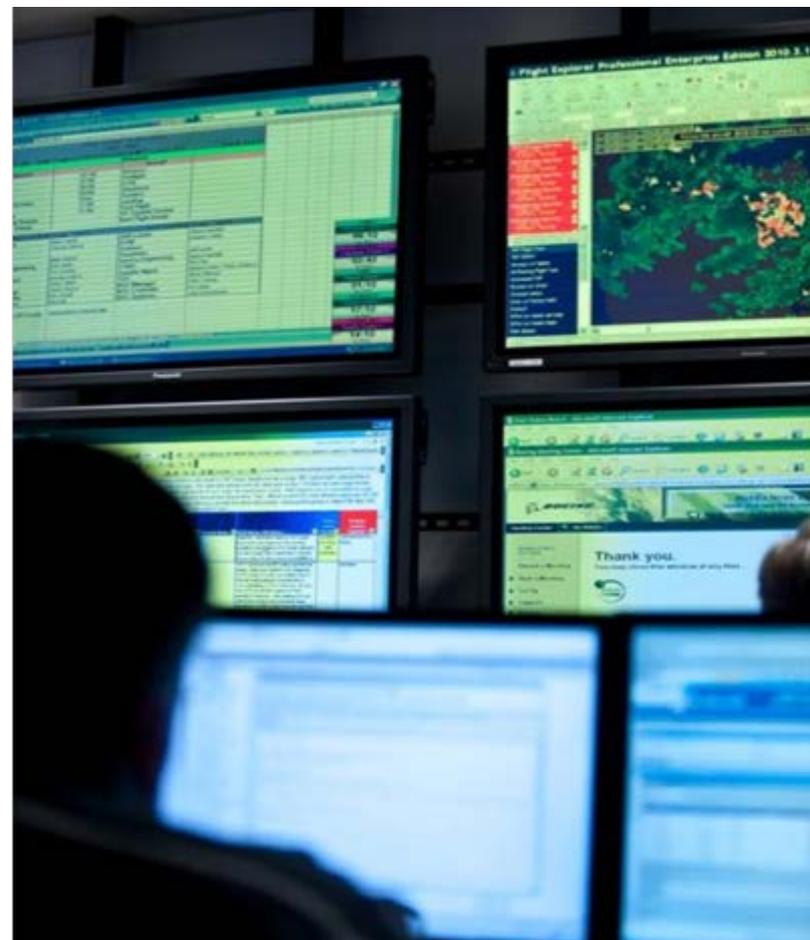
# 787 Fleet Performance Monitored

- ETOPS approval requires on-going tracking and reporting of engine problems.
- Additional reporting of certain types of events is required in initial operations, including:
  - ❖ Electrical failures.
  - ❖ Fuel loss or unavailability.
  - ❖ Cabin pressure failures.
  - ❖ Turn backs and diversions.
- Resolution of such events in the initial period must be approved by the FAA.
- After the initial period, ongoing reporting continues as problems are discovered and resolved, assuring continuous improvement of safety and reliability.

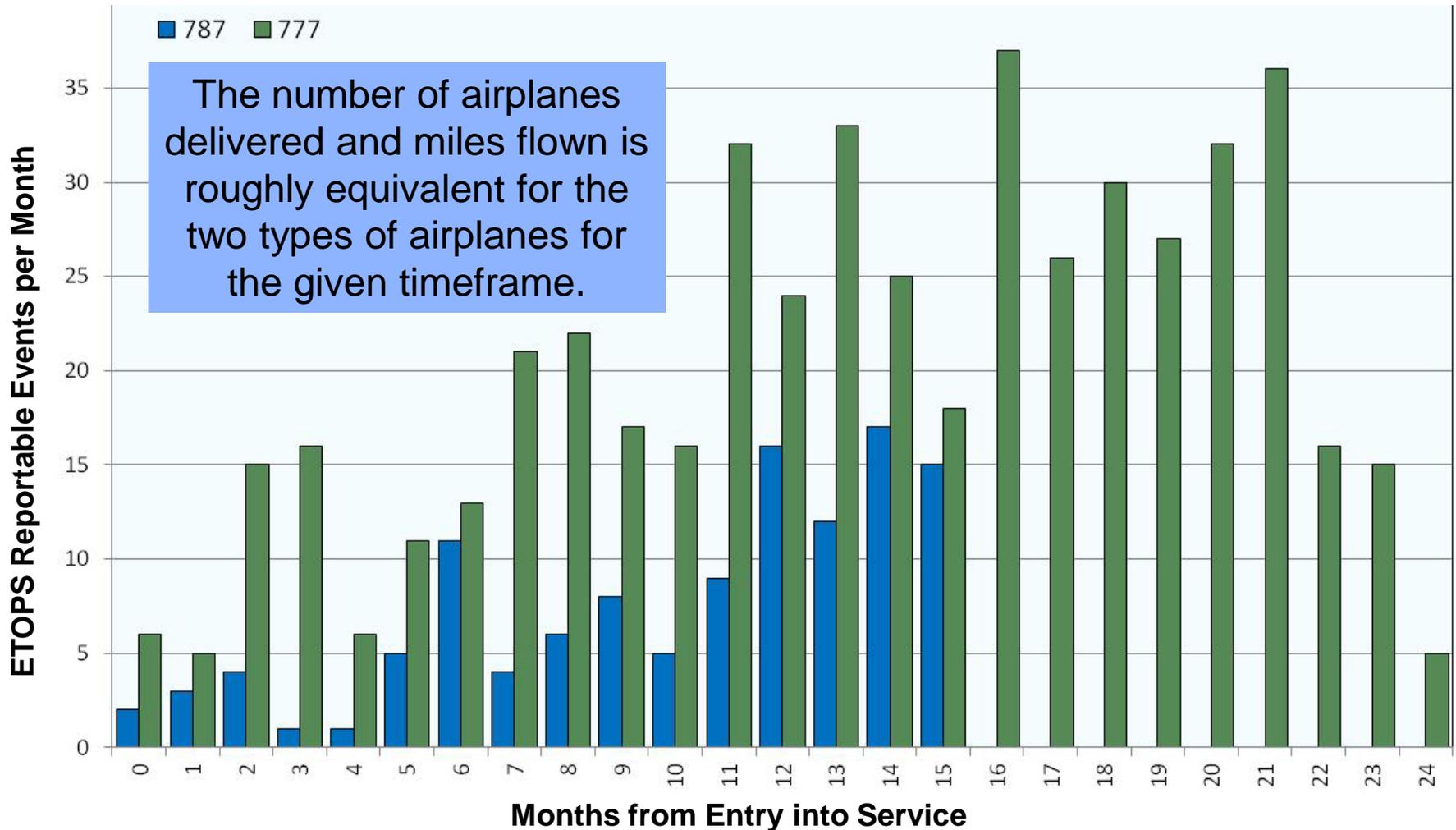


# 787 Events Understood Sooner

- Dedicated 787 Operations Control Center monitors fleet 24 hours a day, 7 days a week.
- Automatically receives performance data from 787s in flight, in real time.
- Provides feedback opportunities on fleet performance not currently available on any other airplane model.



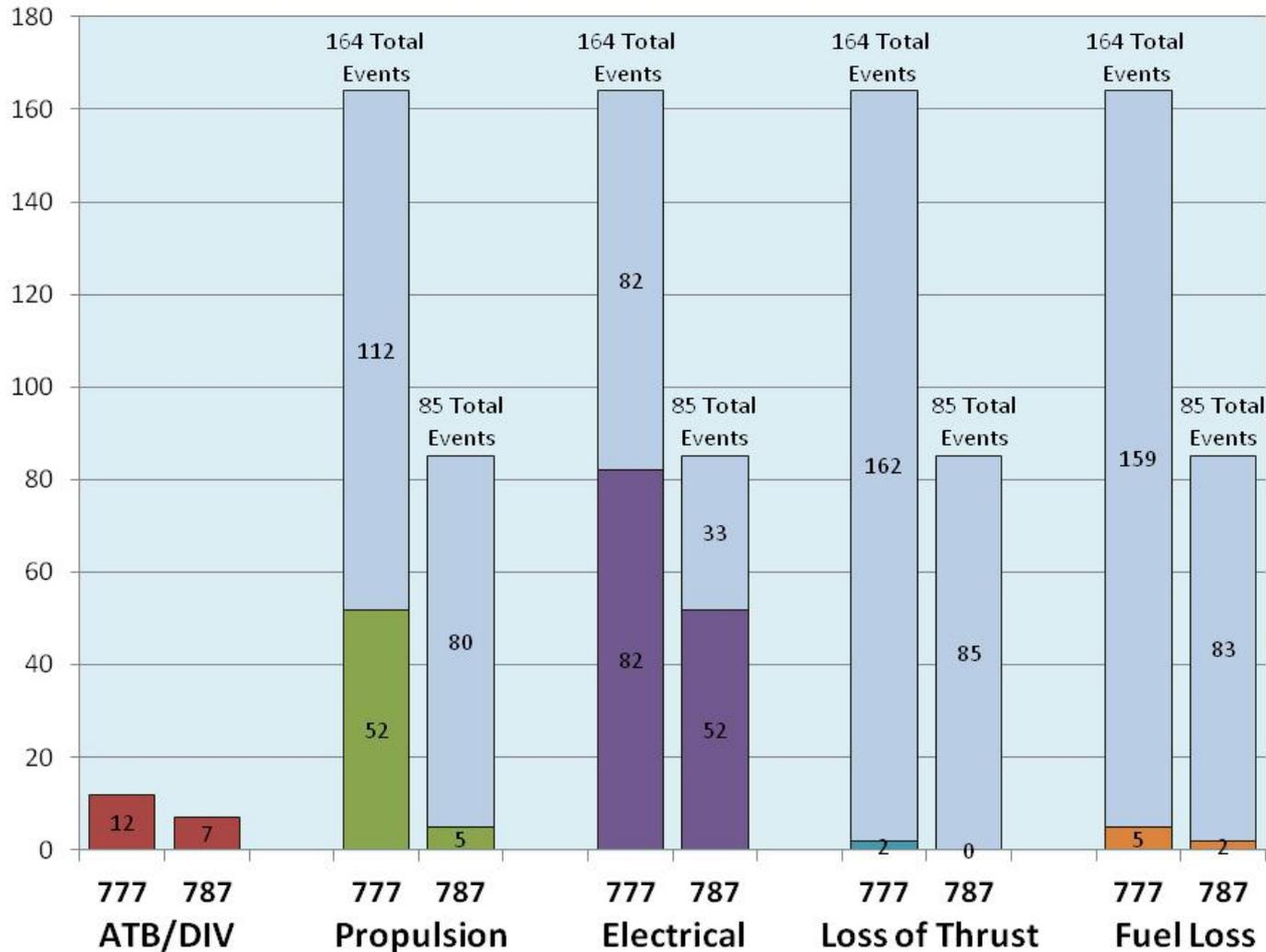
# 787 Compares Favorably to 777



**Significantly Fewer Reportable Events**

# 787 Has Fewer Reportable Events than 777

## First 15 Months of Revenue Service



**787 Has Fewer Events in Every Category**

# 787 Continues Safe ETOPS Legacy

- All ETOPS regulatory requirements are being met.
- Performance is on par with industry best (777).
- More intense in-service fleet monitoring than any other program.



