Engines: Challenges Ahead

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Agenda

Backlog, Trends, Forecast

Technology and Developments

Current Events
Unprecedented Backlog

2019 Backlogs

- Airbus NB
- Boeing NB
- Airbus WB
- Boeing WB

Years of Backlog

- A380
- 747
- A330
- A350
- 767
- 787
- A320
- 777
- 737

Years: 2019, 2021, 2023, 2025, 2027, 2029
Resiliency of Backlog

- Combined Backlog 13,294
  - Boeing 5904
  - Airbus 7390
- Diversified backlog, well distributed across the globe
- No single region accounts for more than 25%
  - NA 18%
  - AP 25%
  - EU 15%
Trends: Productivity Factors
Airplane productivity factors

Industry Load Factor
- % Capacity Utilized

Industry Utilization
- Flight Hours Per Day
Airplane productivity factors

Industry Average Speed


Miles Per Hour

Industry Average Seats per Aircraft


# of Seats

Industry Average Speed


Miles Per Hour

Industry Average Seats per Aircraft


# of Seats
Forecasting
- P&W’s share: 0.4% engine market in 2015
- Targeting back to a quarter of the market by end of decade

*Source: Airline Monitor*
Forecasting: OEMs and titanium

Source: Airline Monitor, Internal TIMET estimates

Includes spare parts for active fleet
Engine Build Forecast

- Next Generation engines the difference on new models:
  - A320 NEO
  - 737 MAX
  - A330 NEO
  - 777X

- Next Gen engines have 2–3x the titanium as legacy engines

Source: Airline Monitor, Internal TIMET estimates
Technology
- Jet fuel prices flat compared to a year ago
- Airlines resuming normal service

Source: tititudorancea.com, IATA
Fuel Economy Improvements Over Time

Source: Airline Monitor
Fuel Economy Comparisons

1970 = 1223 gal/block hr  
2017 = 854  
30.2% improvement

1970 = 1144 gal/block hr  
2017 = 820  
28.3% improvement

1970 = 3582 gal/block hr  
2017 = 1951  
45.5% improvement

Source: Airline Monitor
Future of Flight

**Higher Bypass**
- Larger Diameter

**Additive Manufacturing**
- Disruptive to traditional process
- Attractive for cost savings
- Regulatory hurdles
- Long time horizon

**Electric Airplanes**
- Longer time horizon
- Power and size capabilities yet to be proven
- Range and certification challenges
Current Events
Supply Chain Ramp
Geopolitical Uncertainty