Engine Deterioration and Maintenance Actions

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GE imagination at work
Measures for fuel and emissions reduction – engines

- Performance Deterioration
- Maintenance Actions
- Fuel efficient design trends
Engine performance
Cruise fuel mileage deteriorates over engine on wing life

• Dirt accumulation
• Mechanical wear & erosion

Cruise fuel mileage deterioration

Years in service
EGT margin (EGTM) to measure engine performance deterioration

- EGT to achieve thrust
- EGTM deterioration
What impacts deterioration?

- Flight legs/cycle
- Environmental factors
- Derate
- Overhaul
  - Workscope planning
  - Material Quality
- On Wing Maintenance
Maintenance Actions

- Diagnostic trending
- Core wash
GE provides diagnostic support for 60% of its operating engines.
In-flight diagnostic trending to recover fuel efficiency on wing

- Performance shift detected
- Operating limits not approached
- Maintenance action recovered 1.3% fuel flow on wing
Keeping the gas path clean improves fuel economy and on wing life

Engine core wash

EGTM recovery 5-15°C

Flight cycles

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In-flight diagnostic data show regular core wash delivers fuel economy

Cruise Fuel Flow

Deterioration

Cycles

No core

Aircraft fuel savings

~1.3% ~ $200k*

Regular core wash

*$2/gallon
GE Customer & Product Support assist to optimize fuel efficiency

AMM Core wash updates

- Reduced dry out run
- Idle wash – no dry out
  - no effluent

CF6

- VSV/VBV driver
- Procedural simplification

Program optimization

- Diagnostic solutions
- CRZ FF/TOW benefit
- Environmental impact
- Select procedure
- Determine frequency
Fuel efficient design trends
New generation engines offer big fuel efficiency gains and lower emissions.
Fuel efficient, balanced design

Configuration
- 80% increase in BPR
- 30% increase in OPR
- Counter rotating spools

Hardware
- Swept fan aerodynamics
- 3D aero HPC airfoils
- Advanced alloys, coatings