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AVIATION OPERATIONAL MEASURES FOR FUEL AND EMISSIONS REDUCTION WORKSHOP

ENGINE DETERIORATION AND ON-WING PROCEDURES TO RECOVER PERFORMANCE

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Aircraft Panel
Ottawa, 5-6 November 2002

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Presentation Outline

- Engine Deterioration
  - Mechanisms
  - Effect on Performance
- On-Wing Maintenance Actions
  - Process and tools
  - Potential gains
  - Projected savings

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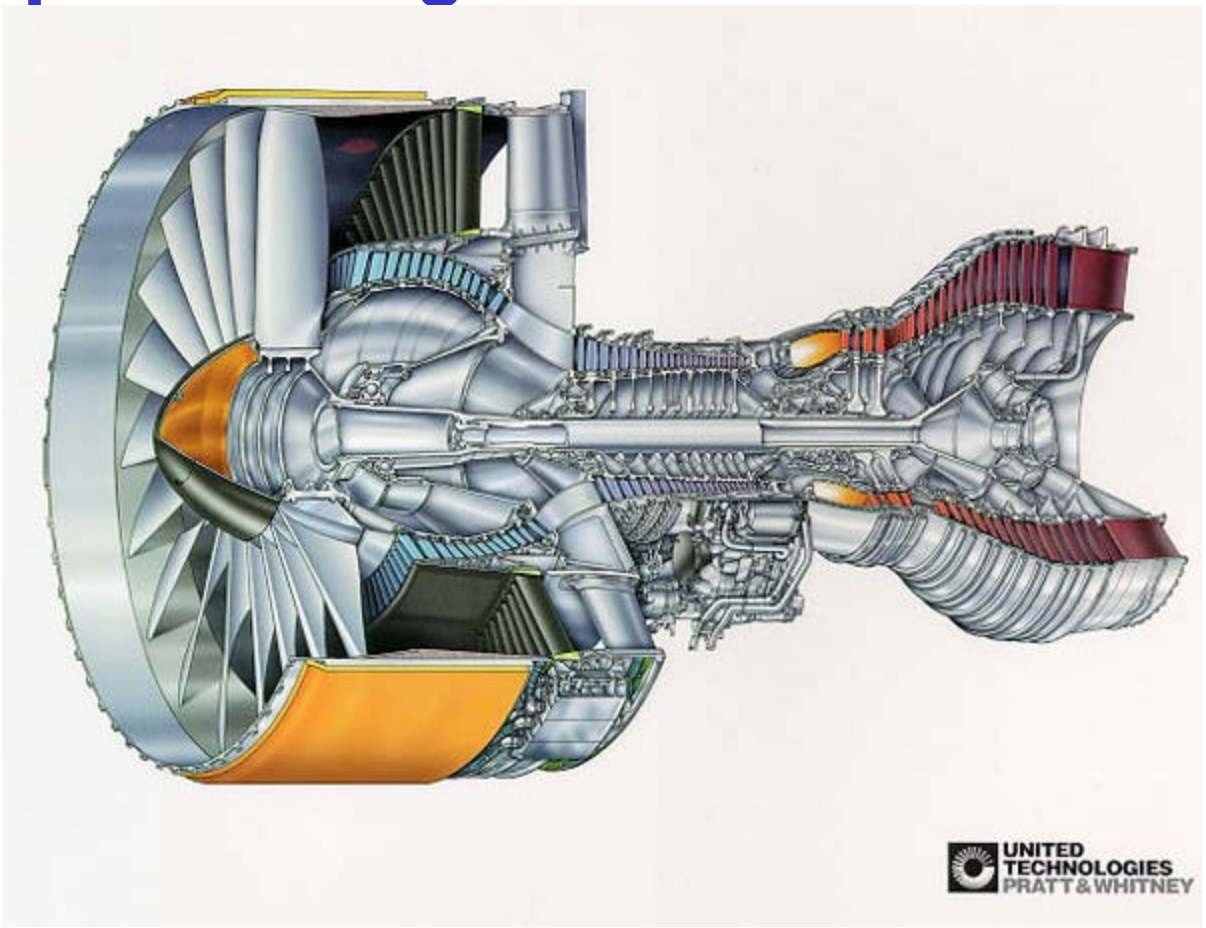
Engine Components Are Affected by Their Operating Environment



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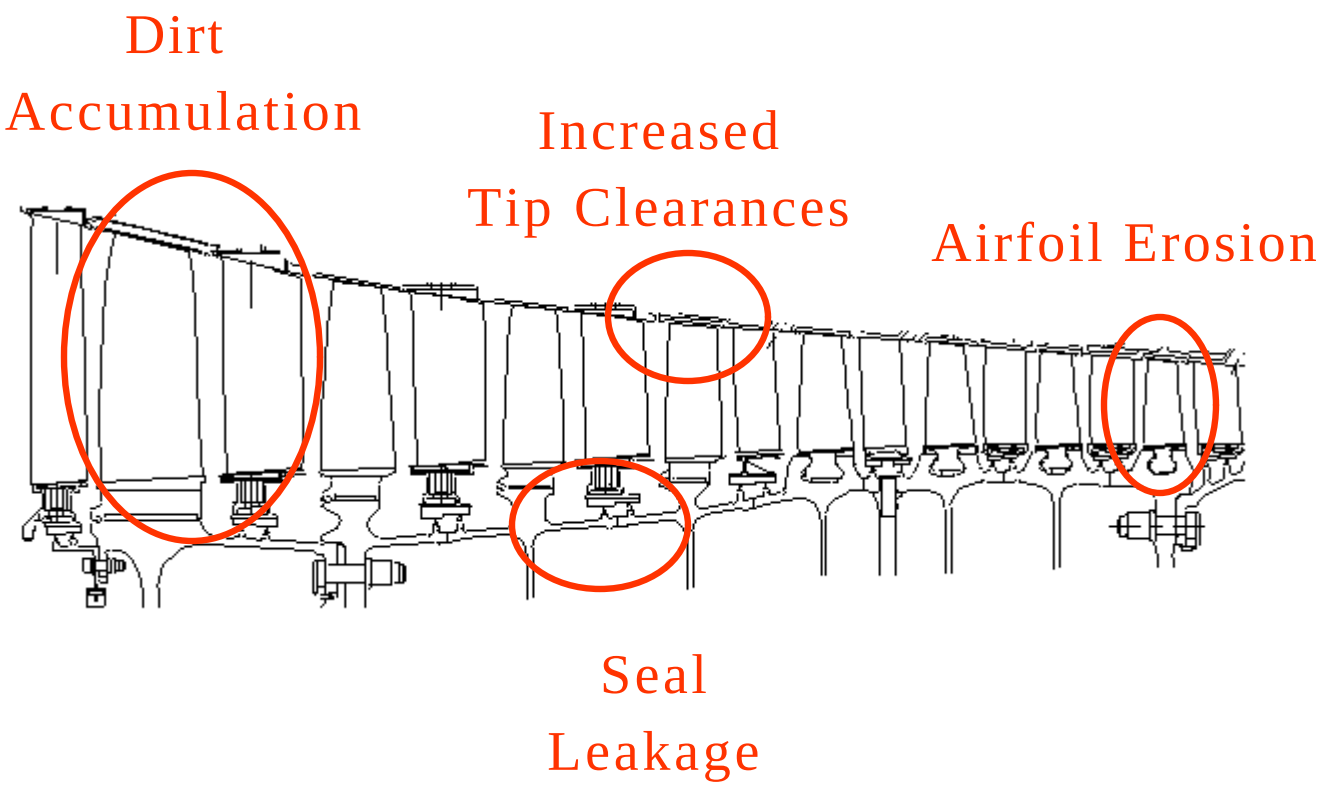
Typical Deterioration Mechanisms



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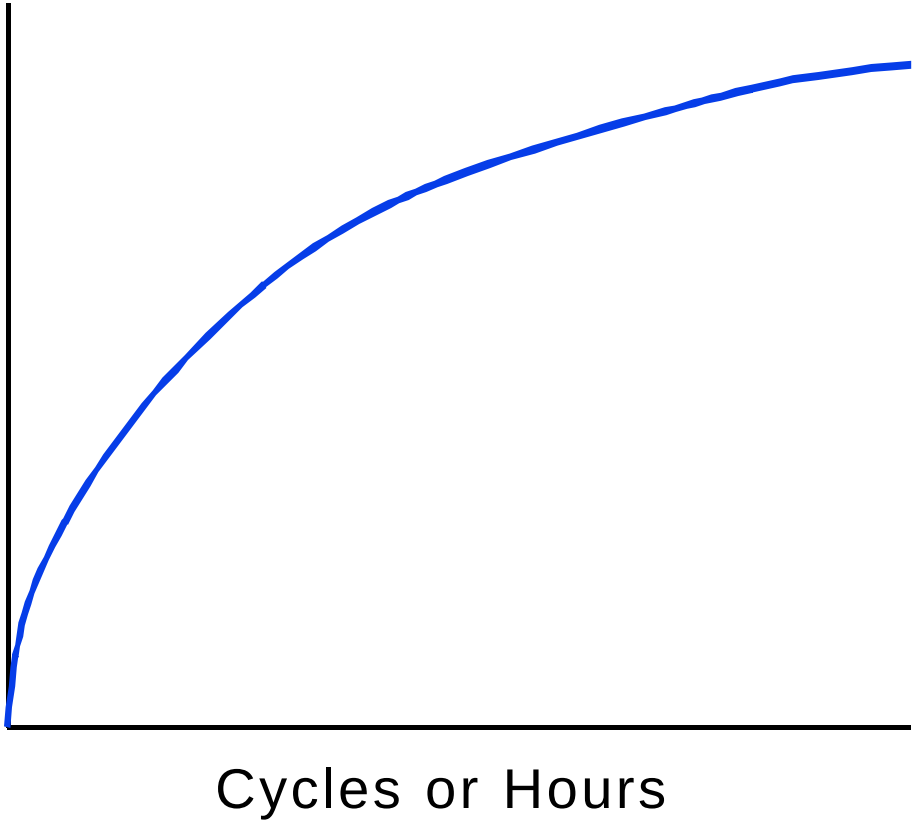
Typical Engine Performance Deterioration (Un-refurbished)



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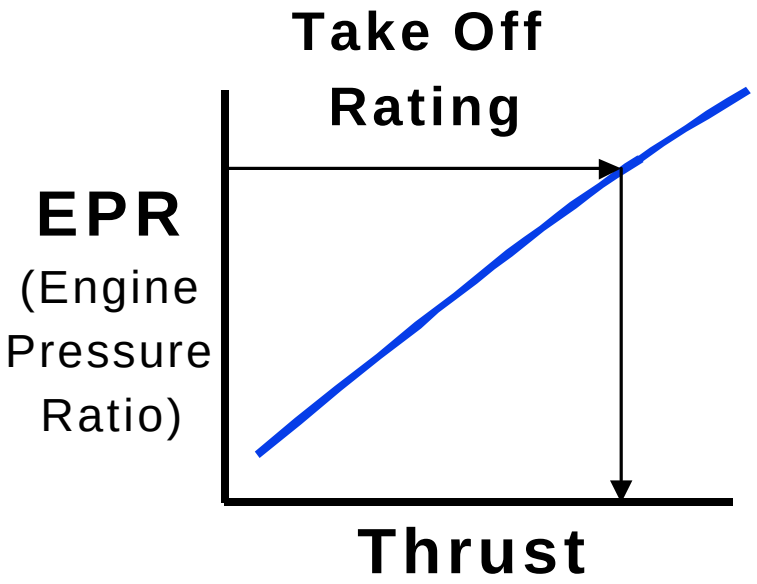
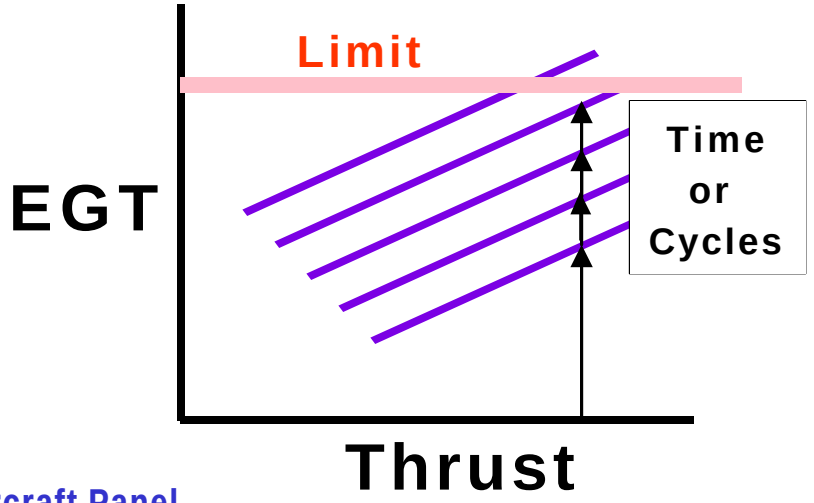
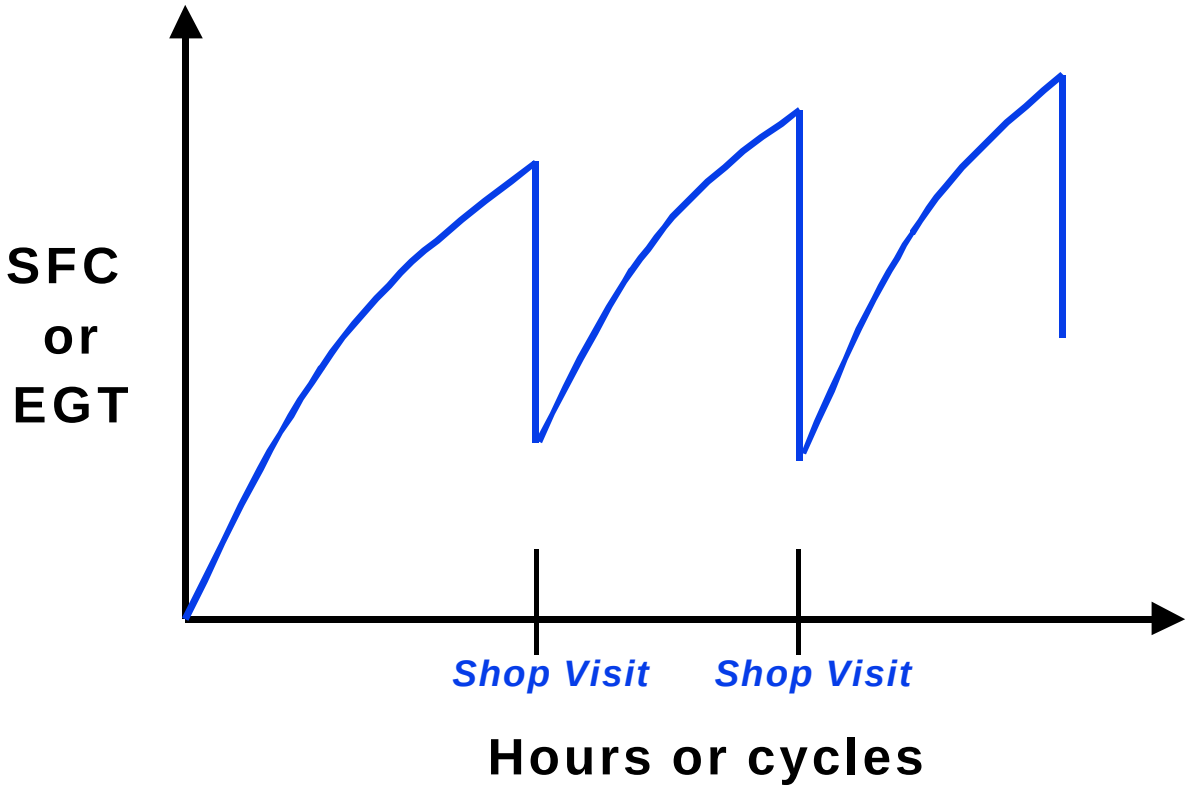
EGT to Achieve Thrust is Measure of Deterioration





Scheduled Refurbishing Recovers SFC and EGT



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Simple Procedures to Recover Performance Between Shop Visits

- On-Wing Engine Washing
  - addresses dirt accumulation
- On-Wing Engine Bleed Rigging
  - addresses leakage caused by bleed system wear

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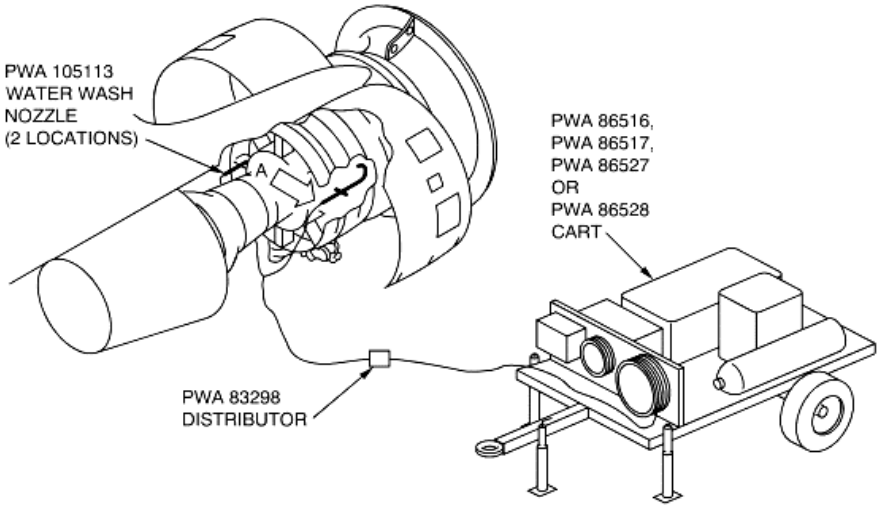
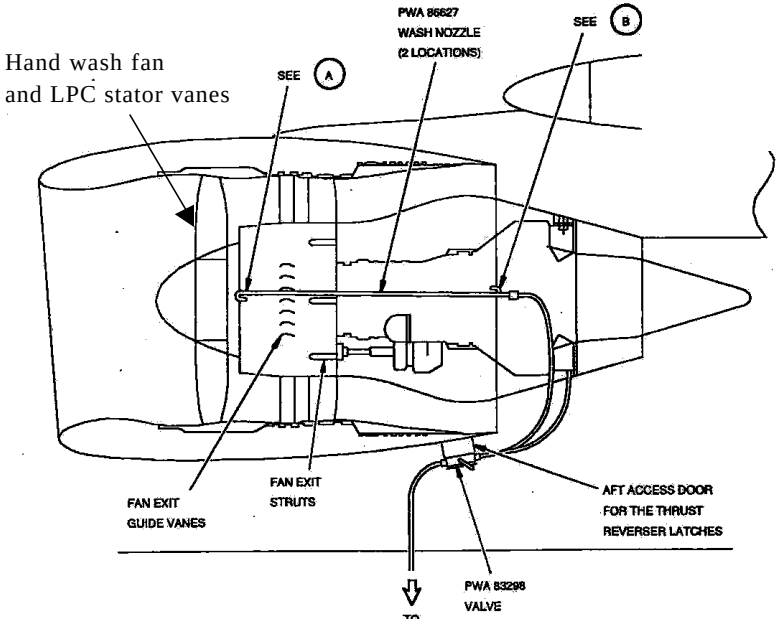
On-Wing Engine Washing

Regular Intervals Ensure Fuel Economy

- Simple procedure
- Special tooling identified
- 3-4 hours, two mechanics





Payoff :

Up to 1.5%

SFC Benefit

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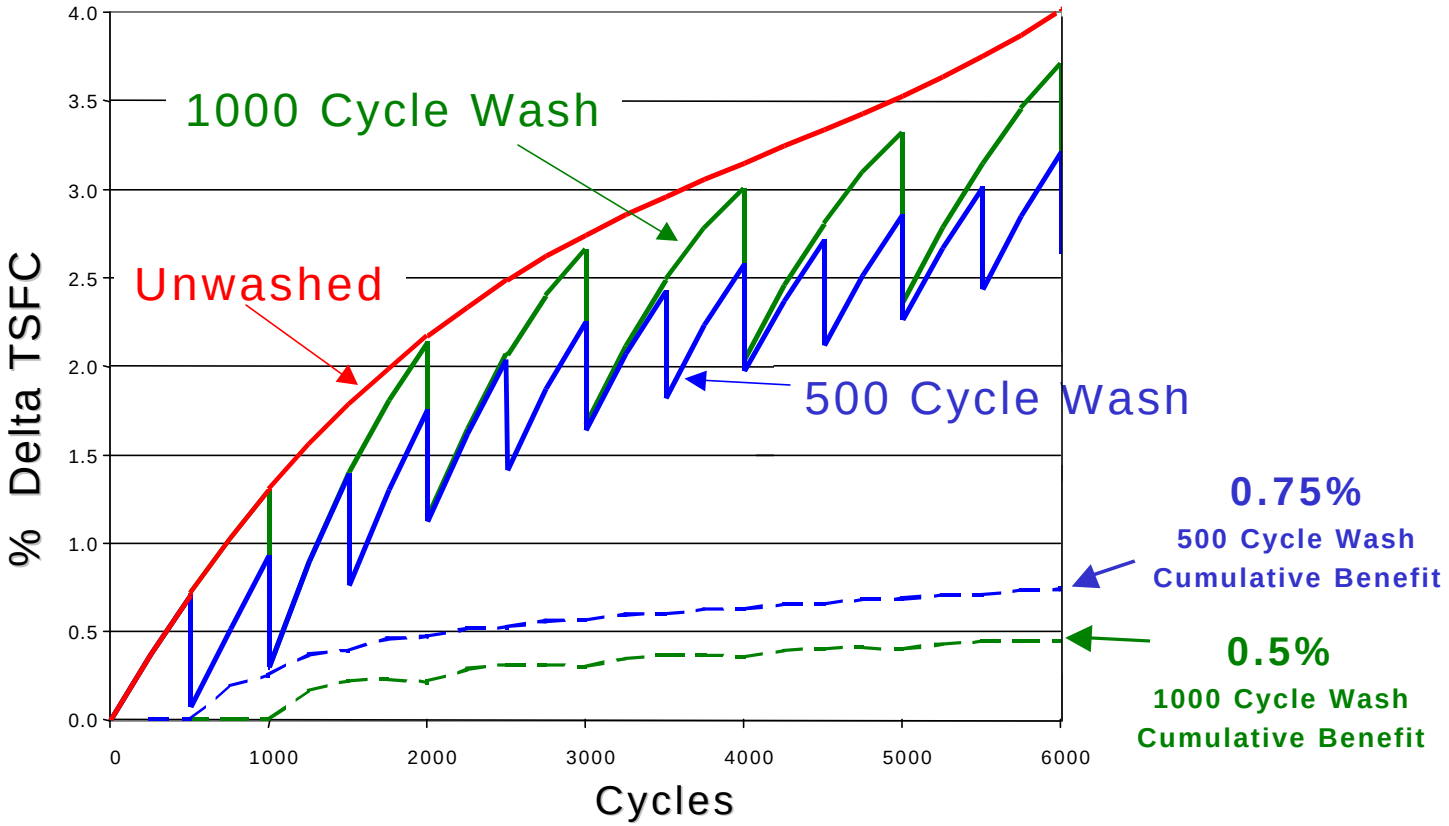
SFC and EGT Recouped Between Shop Visits with Repetitive Engine Wash

Sample Impact of Water Wash Frequency



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On-Wing Water Wash Cost - Benefit

- Costs
  - 6-8 man-hours per wash
  - waste water disposal
  - airplane down time
- Benefits (annual per engine)
  - fuel savings of $20000 to $30000
  - CO_2 reduction of 190 to 290 tonnes
  - maintenance cost savings of $4000 to $6000

Note: 777 type airplane, 6.5 hr cycle, 620 cycles/yr., $1.00/gallon fuel

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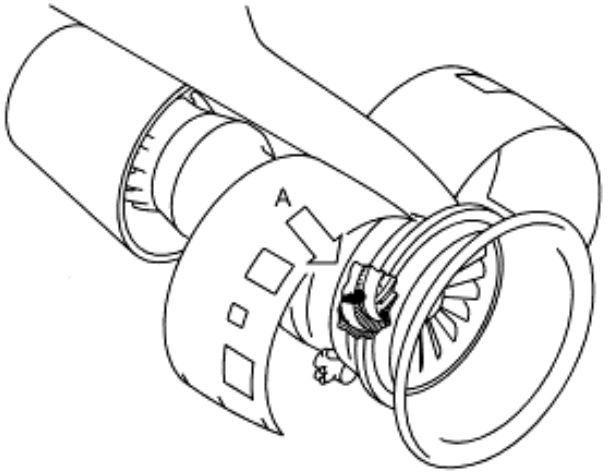
On-Wing Engine Bleed Rigging

Repair of Leaking Bleed Valves Saves Fuel

- Simple Procedure
- Start, Stability, Service Bleeds
- Problem Noted from in-flight performance trends
- **Up to 2.5% SFC Benefit**



On-Wing Engine Maintenance

Simple Procedures Can Save Fuel

- On-Wing water wash saves fuel and recovers EGT, extending time between shop visits
- Attention to bleed system rigging prevents excessive fuel consumption

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Thank you !

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