Engine Borescope Practices

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The role of engine borescope inspections

20 years ago ..........

- Aircraft owned, spare engines available, fleet utilization less optimized.
- More in-house maintenance - little use of HMP’s and MRO’s.
- Basic borescope equipment, experienced workforce, less fleet/engine types.

Today ...........

- Creative leasing programs, power-by-the-hour, fleets matched to route demands, more ETOPS.
- Cost-effective maintenance programs, minimized down-time, compete for work.
- Video borescopes, more service-limit information and demand for precise information.
Does your operation currently perform any type of engine borescope inspections?

a. Yes - 16
   - Airline - 9
   - MRO - 5
   - Cargo - 2
b. No - 0
c. Yes, but by an outside vendor - 0
d. Other - 0

CFM56 LPT Vane Segment
Older Borescope Resolution
Approximately how many personnel do you employ that perform borescope inspections?

a. 1-25 - 7
   - Airline - 2
   - MRO - 5
b. 26-75 - 1
   - Cargo - 1
c. 76-150 - 3
   - Airline - 2
   - Cargo - 1
d. Over 150 - 5
   - Airline - 5

RB211 LPT Vane Segment
Who performs your engine borescope inspections?

a. In-house designated personnel - 9
   - Airline - 4
   - Cargo - 1
   - MRO - 4
b. Outside contractor or vendor - 0
c. Both of the above - 7
   - Airline - 5
   - Cargo - 1
   - MRO - 1
d. Other - 0
What types of engine borescope inspections are performed at or for your operation?

a. Periodic (time/cycle controlled) condition monitoring - 16
   ▪ 1 MRO - periodic only
b. FOD, birdstrike - 15
c. Reported overtemp - 15
d. Evaluation for lease return, receiving acceptance - 15
In what type of maintenance environment does your operation conduct borescope inspections?

a. Line maintenance - 11
   - Airline - 8
   - Cargo - 2
   - MRO - 1

b. Aircraft base/overhaul maintenance - 13
   - Airline - 8
   - Cargo - 2
   - MRO - 3

c. Repair/overhaul shop - 10
   - Airline - 5
   - Cargo - 2
   - MRO - 3

d. Other
Does your operation have a company written practice or standard procedure for performing borescope inspections?

a. Yes - 14
   - Airline - 8
   - Cargo - 2
   - MRO - 4

b. No - 2
   - Airline - 1
   - MRO - 1

CFM56 Compressor Blade
Does your written practice or standard procedure require any training or qualification for those personnel performing borescope inspections?

a. Documented training only - 2
   ▪ MRO - 2

b. Documented training and qualification - 13
   ▪ Airline - 8
   ▪ Cargo - 2
   ▪ MRO - 3

c. No - 1
   ▪ Airline - 1

d. Other

RB211 6th Stage TE & Shroud Stereo Tip - No Measurement
Which of the following borescope inspection training best describes your operation?

a. Factory/OEM or in-house training only - 3
   - Airline - 2
   - Cargo - 1

b. Combination of initial classroom, practical, OJT training - 7
   - Airline - 4
   - MRO - 3

c. OJT training only - 2
   - Airline - 1
   - MRO - 1

d. Other - Both a. & b. - 4
   - Airline - 2
   - Cargo - 1
   - MRO - 1

CFM56 Combustor Stereo Measurement
Does your borescope inspection training program require some type of recurrent training/qualification?

a. If yes, how often:
   - 1 Year – 1 (Airline)
   - 2 Years – 3 (2 Airlines, 1 MRO)
   - 3 Years – 3 (1 Airline, 2 Cargo)

b. No - 8
   - Airline – 4
   - MRO – 4

c. Not applicable - 1
   - Airline - 1

d. Other

CFM56 Combustor
Who is qualified to perform borescope inspections within your operation?

a. Mechanics - 0
b. Inspectors - 5
c. Designated personnel - 4
d. Other - 7
   - NDT personnel - 1
   - Mechanics & Inspectors - 1
   - Inspectors & Designated personnel - 5

CFM56 Compressor Blade LE
What type(s) of borescope inspection equipment is used within your operation?

a. Rigid fiber-optics with separate light source - 6
b. Flexible fiber-optics with a separate light source - 5
c. Video borescope without measuring capabilities - 8
d. Video borescope with measuring capabilities - 15
For borescope inspections with results beyond limits requiring engine removal; does your operation have a procedure for reviewing/confirming results?

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Count</th>
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<tbody>
<tr>
<td>a.</td>
<td>No – The person who performed the borescope makes the final determination</td>
<td>2</td>
</tr>
<tr>
<td>b.</td>
<td>Yes – results are reviewed/confirmed by a supervisor or manager</td>
<td>3</td>
</tr>
<tr>
<td>c.</td>
<td>Yes – results are reviewed/confirmed by engineering</td>
<td>14</td>
</tr>
<tr>
<td>d.</td>
<td>Yes – results are reviewed/confirmed by a designated committee</td>
<td>0</td>
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</table>
The role of engine borescope inspections

Why borescope?
- Gain information at normal intervals for condition monitoring.
- Provide information to help determine serviceability after abnormal operations.
- Establish repair work scope, maintenance program adjustments, operation practices.

What are the expectations?
- Inspectors must know the engine components, correct access, maintenance documents.
- Inspectors must practice proper borescope equipment care, handling and usage.
- Inspectors must be able to accurately document and communicate results.
Thank You!

Questions?