Detecting Pneumatic Leaks on Commercial Aircraft

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Overview

• Aircraft pneumatic systems
  – A quick aircraft system lesson to understand the environment and challenges.
• Additional methods used
• How we are using Ultrasonic Leak detection
• Ultrasonic Leak detection challenges
Pneumatic powered systems

- Pressurization
- Anti-ice heat source for wings, tail etc.
- Air conditioning
- Redundant systems
Where Pneumatic pressure comes from
Pneumatic Bleed System

8TH STAGE BLEED AIR

TO AIR COND SYSTEM

TO AIRFOIL ANTI-ICE SYSTEM

TO AIR COND SYSTEM

8TH STAGE BLEED AIR

13TH STAGE BLEED AIR

PNEUMATIC GROUND CONNECTION

APU

8TH STAGE REPLACED BY 13TH STAGE BLEED AIR

13TH STAGE BLEED AIR

ONE WAY CHECK VALVE

LEGEND

8TH STAGE BLEED AIR

13TH STAGE BLEED AIR

J360038C
• Air conditioning system
Areas that are pressurized

- Pressurized and air conditioned by air conditioning systems
- Pressurized by air exhausted from flight deck.
- Pressurized by intermittent action of forward cargo compartment pressure equalization valve. May be heated by radio rack exhaust air ducted under floor.
- Pressurized by intermittent action of aft cargo compartment equalization valve. Unheated.
- Unpressurized
Problems caused by leaks

• System performance
  – Cooling
  – Pressurization

• Efficiency (fuel burn)
  – Bleed air is “typically” potential thrust

• Flight deck indications
  – If system requirements are not met indication light notifies crew.
    • Pressure sensors
    • Temperature sensors
Search for a better method

• We needed a better method to find leaks before they can impact the system.
• Leakage is normal at some locations.
• Maintenance program is tightly controlled
  – Changes go through technical groups
  – FAA approved
Other Aircraft are similar
Other methods of detection leaks on ground

• By hand
• Foil
• Tell-tell stick
• Developer
• Temp Tabs
Methods tested

• Thermal Imagining
• Hand held temp probe
• Ultrasonic Leak detection
Temp probe

Fluke 80PK-24

Fluke 51
Thermal image of Ducts
Ultrasonic Leak Detection in progress using Tele-bend
How we are using Ultrasonic Leak Detection

• Troubleshooting known/unknown problems.
  – Find smaller leaks.
  – Small leaks may be future problem.
• At an existing maintenance program interval, replace hand method for improved results.
• Ability to scan an area quickly aids troubleshooting.
• Find it. Fix it.
Limitations / Challenges

• Large laminar leaks due not have a large ultrasonic sound signature. Ultrasonic's may miss these if it is the sole means of detection. Common sense and other methods are still needed.
• Technician adoption – some are slow to fully adopt. Prior company usage strictly for O2 leaks created some paradigms.
• Hearing - Some have complained that their hearing deficiencies limit the ability to hear leakage sound.
• Its still a tool! Good training and procedures, and technique is required.
Questions?
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Thank you