Through Bushing Inspection System

Fatigue cracking at fastener holes is a common problem in military and commercial aircraft. When cracking in a fastener hole is found repairs often entail oversizing the hole to remove the crack and installing a repair bushing to return the hole to its nominal diameter. Unfortunately, in multi-layer structure, subsequent reinspection of the repaired hole often requires removal of the bushing to enable conventional high-frequency bolt hole eddy current inspection of the substrate. This approach results in significant downtime and labor costs particularly when employed on multi-layered structures and potentially damaging to the integrity of the aircraft structure.

IMTT's Bushing Inspection System provides a unique and innovative approach to detecting these under bushing cracks …

NO BUSHING REMOVAL REQUIRED
HIGH SENSITIVITY
SUPERIOR EFFICIENCY & RELIABILITY

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High Sensitivity RFEC Bushing Probes for Manual Scan

- Through 0.032” – 0.125” thick Inconel-718 bushing; 0.050” crack on Al lug
- Through 0.080” thick Al-Ni-Bronze bushing; 0.100” crack on Steel lug
- Through 0.080” thick Al-Ni-Bronze bushing; 0.150” crack on Al lug

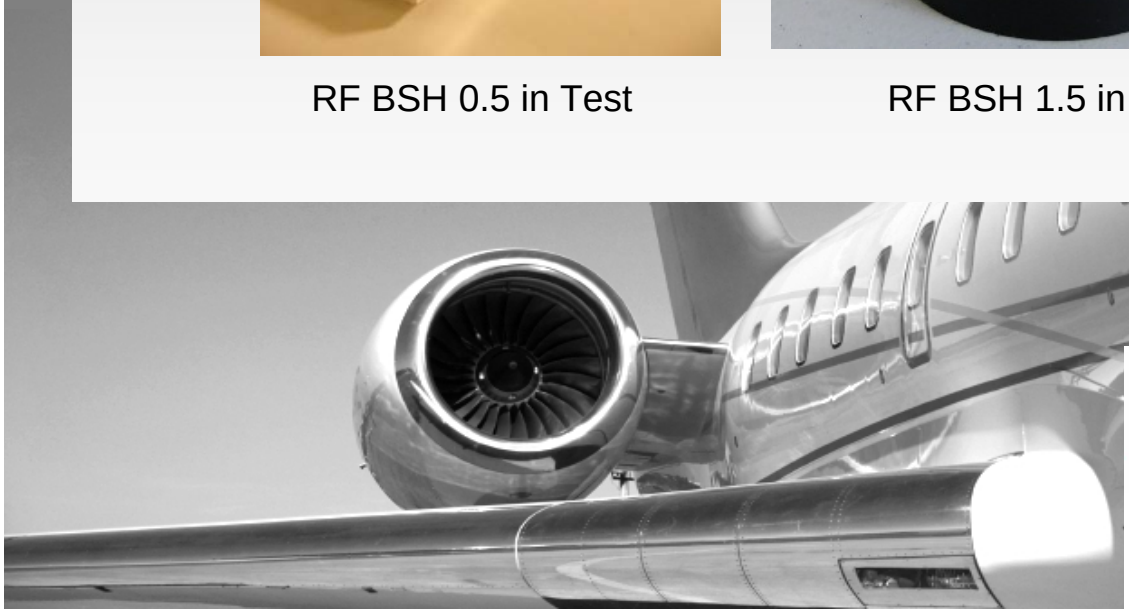
RF BSH 0.5

RF BSH 0.75

RF BSH 1.5

RF BSH 0.5 in Test

RF BSH 1.5 in Test



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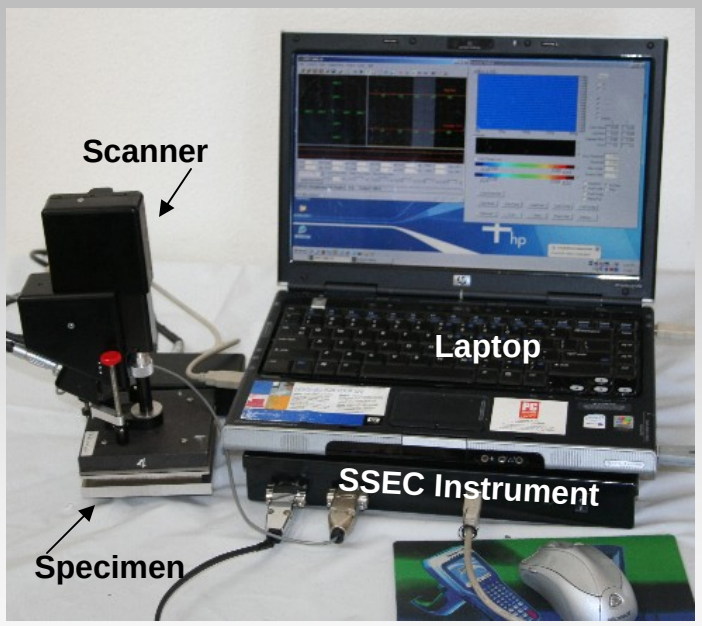
Automated Bushing Scanners

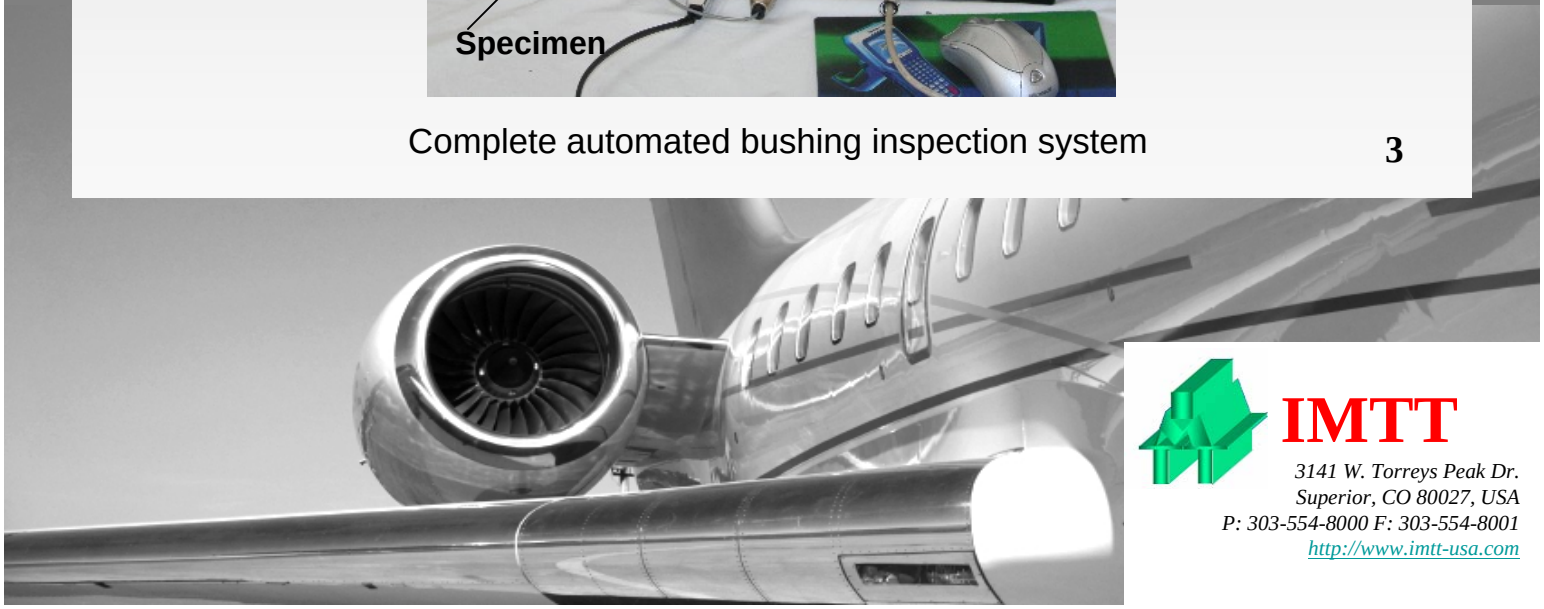
- Completely automated inspection procedure
- Sophisticated algorithm removing background noise
- Automated crack identification

Scanner for ID size of 0.35”-0.60”

Scanner for ID size of 0.50”-2.0”



Complete automated bushing inspection system



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Typical Results for Automated Busing Inspection System BSH 0.5
Aircraft Wing Attach Fitting Cracking

Example #1: Detection of crack on real aircraft sample
aluminum lug under the Inconel 718 bushing (ID = 0.50”; T = 0.063”)

Aircraft wing attach fitting sample

Hole #3 - 0.075” x 0.090” crack

Hole #4 - 0.060” x 0.020” crack

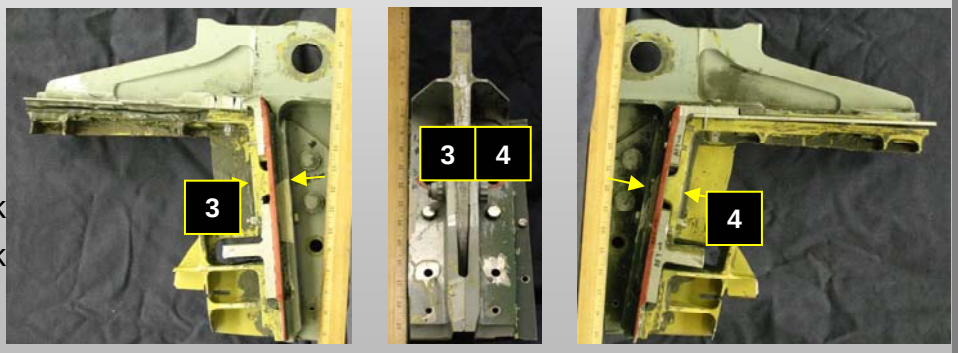
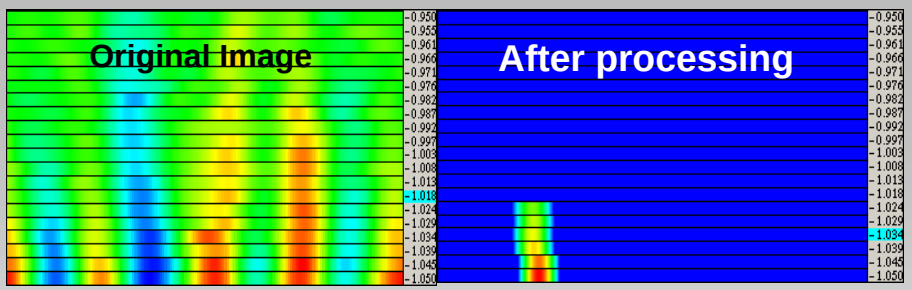
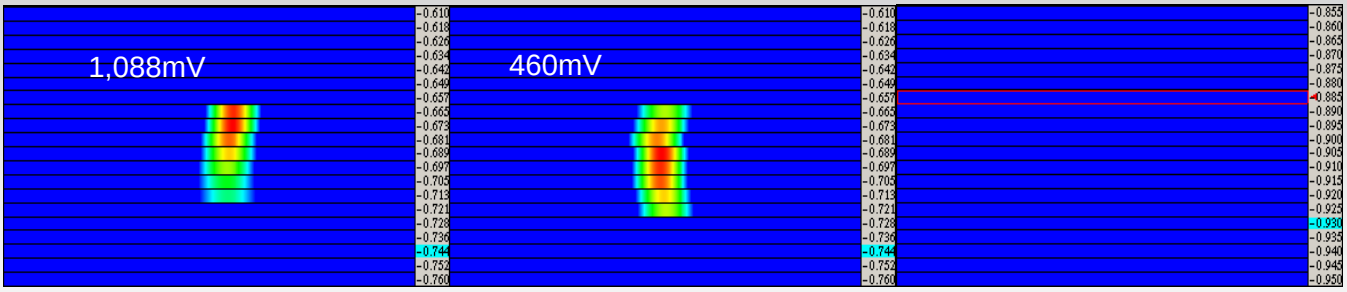


Image & crack identification



Results



Hole #3	Hole #4	Real crack standard
0.075” x 0.090” crack	0.060” x 0.020” crack	No crack

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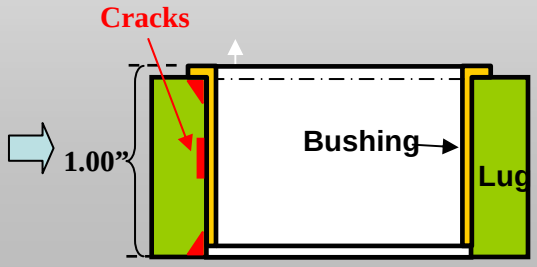
Typical Results with Automated Bushing Inspection System
Boeing 767 Landing Gear Cross-bolt Hole Cracking

Detection of EDM notch on a steel lug under the Al-Ni-Bronze bushing
(ID = 1.50”; T = 0.08”)

Specimen simulating Boeing 767 landing gear Cross-Bolt Hole

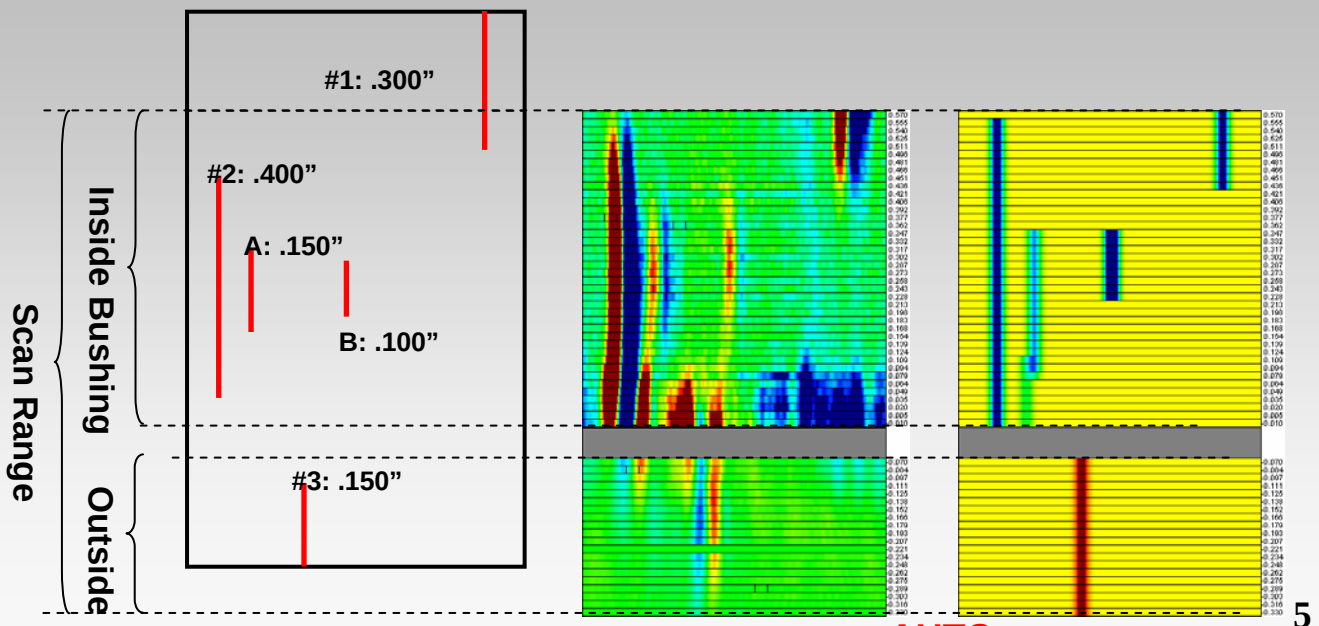
80mil Thick
Al-Ni-Bronze Alloy Bushing

Steel Hole Lug



Specimen Setup

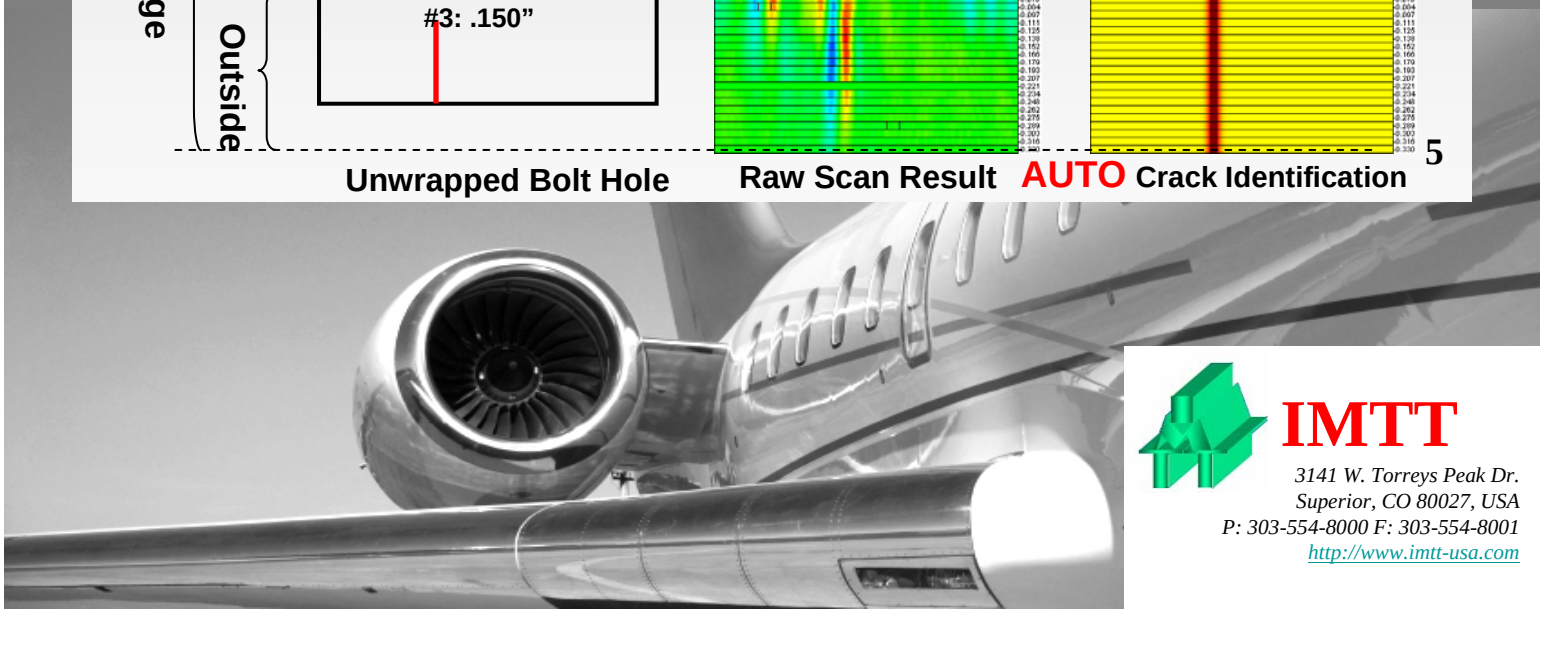
Scan Result:



Unwrapped Bolt Hole

Raw Scan Result

AUTO Crack Identification



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Automated Bushing Inspection System BSH 0.5

Feature Summary

- Bushing ID size from 0.35”—0.60” upon customer request
- Through 0.032”—0.125” thick Inconel-718 bushings
- Detect crack as small as 0.06” × 0.02” through 0.063” thick bushing in aluminum substrate
- Possible working with other bushing materials
- Built-in 2-axis motor controller
- Built-in real-time crack identification software
- Completely automated inspection procedure
  - Automatic locating predetermined scan areas
  - Automatic loading predetermined instrument settings
  - Automatic image display
  - Automatic noise removal and crack identification
  - 2-Dimentional crack image display

Specifications

Dimensions: 9”(L), 4”(W), 2”(H)
Weight:1.5 lbs
Probe drive frequency: 4kHz – 80kHz

Vertical scan:

- range: 0”—1.8”
- Resolution: 0.001”
- Speed: 0.1”/s

Rotary scan:

- Angle Range: 0-360°
- Resolution: 1°
- Speed: 0 - 20 revolutions/s

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Automated Bushing Inspection System BSH 1.5

Feature Summary

- Bushing ID size from 0.50”—2.00” upon customer request
- Through 0.032”—0.160” thick Al-Ni-Bronze bushings
- Detect crack as small as 0.100” × 0.05” through 0.080” thick bushing in steel lug
- Possible working with other bushing materials
- Built-in 2-axis motor controller
- Built-in real-time crack identification software
- Completely automated inspection procedure
  - Automatic locating predetermined scan areas
  - Automatic loading predetermined instrument settings
  - Automatic image display
  - Automatic noise removal and crack identification
  - 2-Dimentional crack image display

Specifications

Dimensions: 6.5”(L) ,4.5”(W), 2.2”(H)
Weight: 2.4lbs
Probe drive frequency: 2kHz – 20kHz

Vertical scan:

- range: 0.0”—1.5”
- Resolution: 0.001”
- Speed: 0.1”/s

Rotary scan:

- Angle Range: 0-360°
- Resolution: 1°
- Speed: 0 - 20 revolutions/s

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Instrument SSEC II-S

Special version for scanner control

General

- A modification of conventional eddy current instrument
- A computerized software system by connecting the instrument to a PC through a USB connector
- Accommodate IMTT's FG_RFEC probes and all other conventional eddy current probes
- Increased sensitivity
- Enhanced functions including:
  - Automatically optimizing drive current and pre-gain at given frequency
  - Added a new probe mode – simulated differential reflection mode for better background noise removal
  - Built-in custom signal processing algorithms
- Capable of control up to two step motors

Specifications

Frequency Range:

- 100Hz – 4MHz
- Driver output: ±8V; max. 100mA

Sample Rate: 100Hz-10kHz with a resolution of 12bit

Gain:

- Pre Gain: -20dB – 60dB
- Post Gain: 0 – 40dB

Filter:

- 30-1KHz hardware low pass filter
- 0-1KHz digital low/high/band pass filter

Phasing: 0 - 359º in 1º increments

Inputs / Outputs: DB-9 for probe, DB-9 for optical switch, USB-B connector to PC

Alarms: software setup alarms

Probe Types: reflection/RFEC probes, differential probes, absolute probes

Power supply: 110V 60Hz AC

Operating temperature: 0 – 55ºC (32ºF - 131ºF)

Storage temperature: -30ºC – 75ºC (-22ºF - 167ºF)

Humidity: 5 to 95%

Weight: 2.4lbs

Dimension:12"(L)x8.7"(W)x1.7"(H)

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