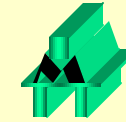




28-30 November 2006 • San Antonio, Texas



*Innovative Materials Testing
Technologies, Inc.*

Improving NDI Reliability

How can NDI Tool Developers Help ?

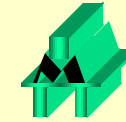
Yushi Sun, Tianhe Ouyang, Xinle Yang, Haiou Zhu,
Changhong Sun, Weiqiang Wan, Choon-Hoe Yeoh

IMTT Inc.

3141 W. Torreys Peak Drive, Superior, CO 80027
Tel. 303 554 8000; Fax. 303 554 8001



28-30 November 2006 • San Antonio, Texas



*Innovative Materials Testing
Technologies, Inc.*

NDI Reliability Improvement

**Can NDI Tool Developers Contribute
to Improve NDI reliability ?**

ABSOLUTELY !

Challenges In Achieving NDI Reliability

Human factor as most critical one and typically involved in:

- **Manual Scanning Process.**
- **Poor Inspection Conditions, or Operator's Physical/Psychological Condition.**
- **Complicated/Difficult NDI Operations.**
- **Inadequate Operator Training.**
- **Flaw Identification from Complex Technical Data due to Geometrical or/and Material Variations.**



28-30 November 2006 • San Antonio, Texas



*Innovative Materials Testing
Technologies, Inc.*

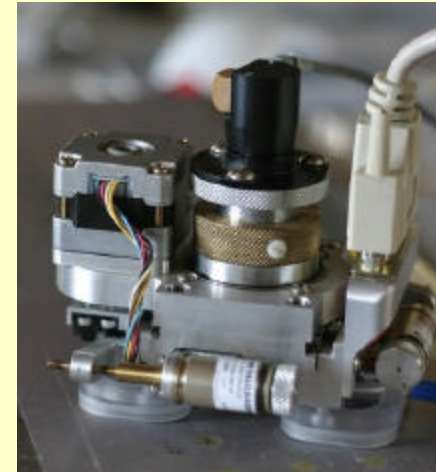
NDI Tool Developer CAN HELP !!!

Overall IMTT's approach includes:

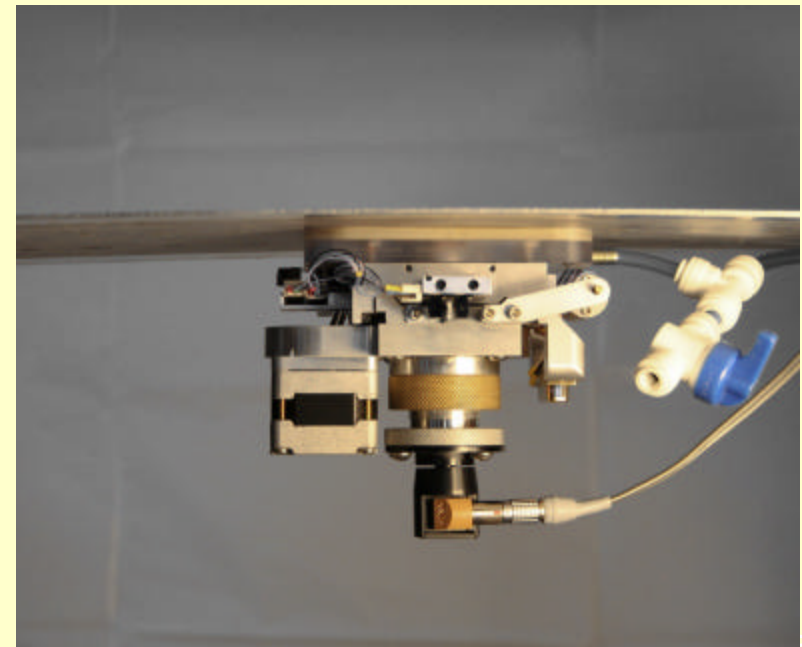
- **Improving quality of NDI tools to greatly enhance their capability, reproducibility and repeatability.**
- **Minimizing human factor during NDI process by:**
 - **Adding motorizing and automating the overall inspection process.**
 - **Enable advanced instrumentation design with latest computer and information technology.**
 - **Building smarter tool with artificial intelligence and digital signal processing technology.**

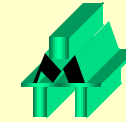
Example No. 1: Auto-Centering Crack Detection System for Lap-Joint Inspection

**(Motorized Scan for Both In-Hanger
& Field Applications)**



- 1. Automatically Locate Fastener Center Location.**
- 2. Accurate 2nd Layer Crack Detection Using FG_RFEC Probe.**
- 3. Miniature System, Easy To Handle.**
- 4. Self-contained, Self Holding On Aircraft, Free Of Position Dependency.**
- 5. Distance Control Through Instrument.**
- 6. Automated Decision Making, No Human Involvement.**





**Example No. 1: Auto-Centering Crack Detection System
for Lap-Joint Inspection (cont.)**

POD Record

FAA/AANC panel test results:

Date: 10/06/2006

Device: IMTT Auto-center RFEC scanner

Total fastener tested: 239

Crack size (POD 90): 75.7mil

Crack size (POD 90/95): 85.8mil

False call rate: 1.67%

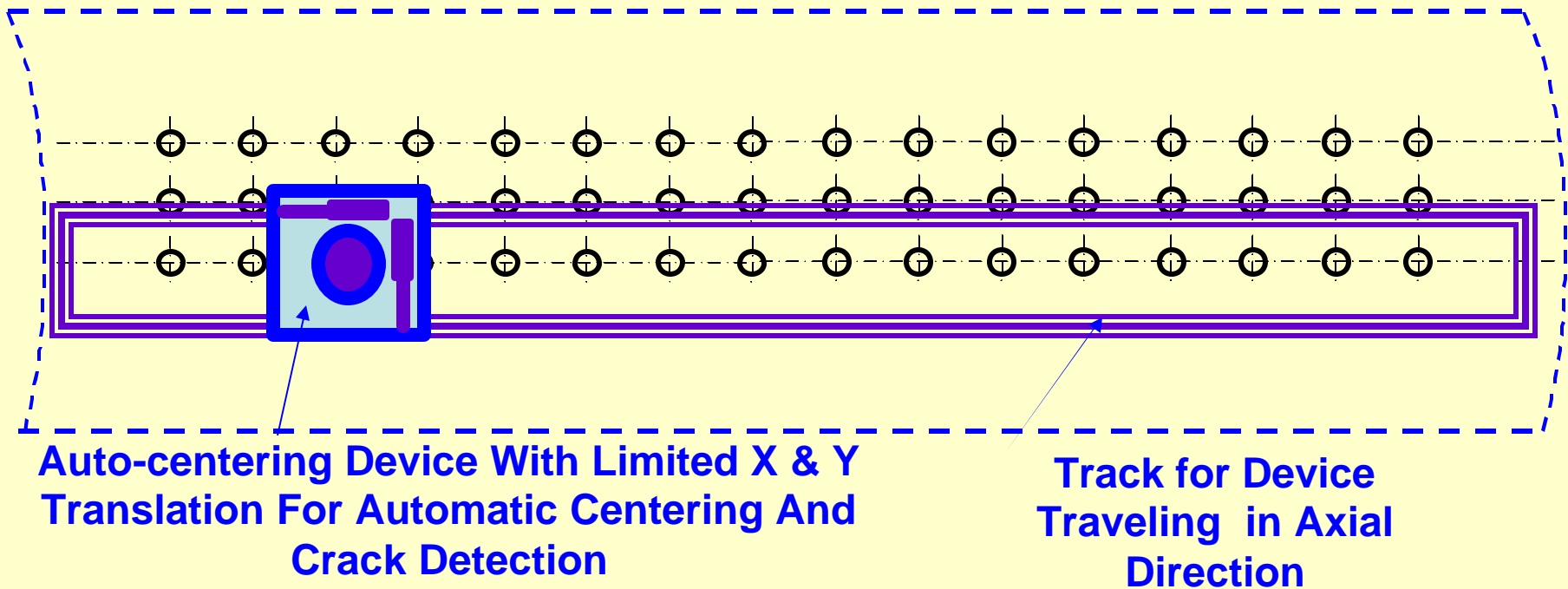
Comparison

The best test results from other EC Techniques:

Crack size (POD 90): 109mil

False call rate: ~1%

Example No. 2: Automated Lap-Joint 2nd Layer Crack Detection System (Pre-Programmed Scan - Automation)



Example No. 2: Automated Lap-Joint Lower Layer Crack Detection System (cont.)

Major Features

- **Completely Automated Inspection Process, No Human Involvement.**
- **Relatively High Inspection Speed And Low Cost.**
- **Automated Decision Making, Recording And Reporting.**
- **FG_RFEC Probe For Accurate 2nd Layer Crack Detection.**
- **Self-Contain, Self Holding On Aircraft, Free Of Position Dependency.**
- **Computerized Distance Control.**
- **Miniature Device & System, Easy To Handle.**

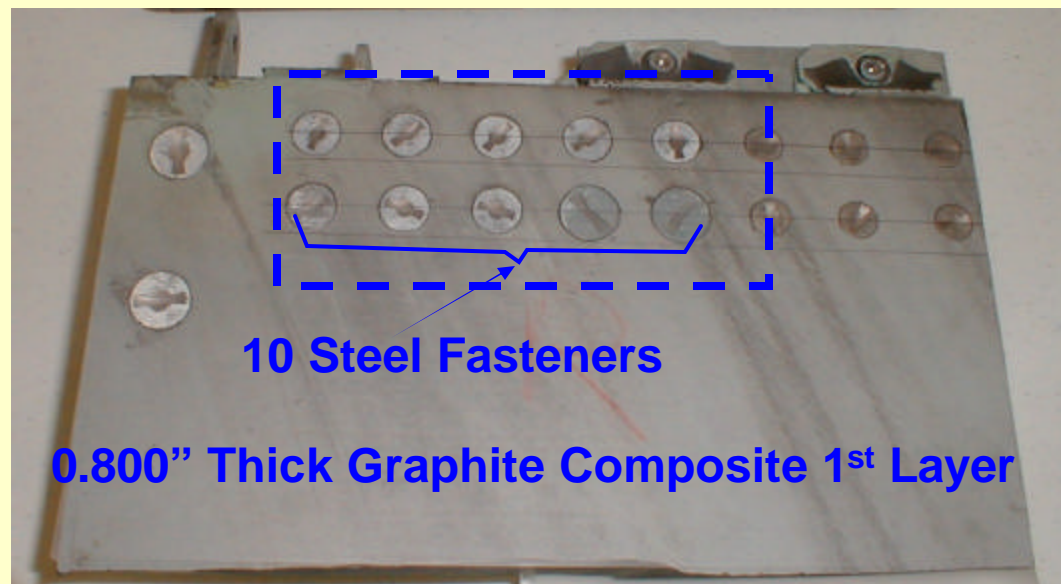
Example No. 3: Crack Detection with Removal of Groove Signals

in F-18 Wing Structure w/ A 0.800" Thick Graphite Composite Top Layer

(Incorporated Artificial Intelligence
for Removal of Artifacts in Crack Detection)

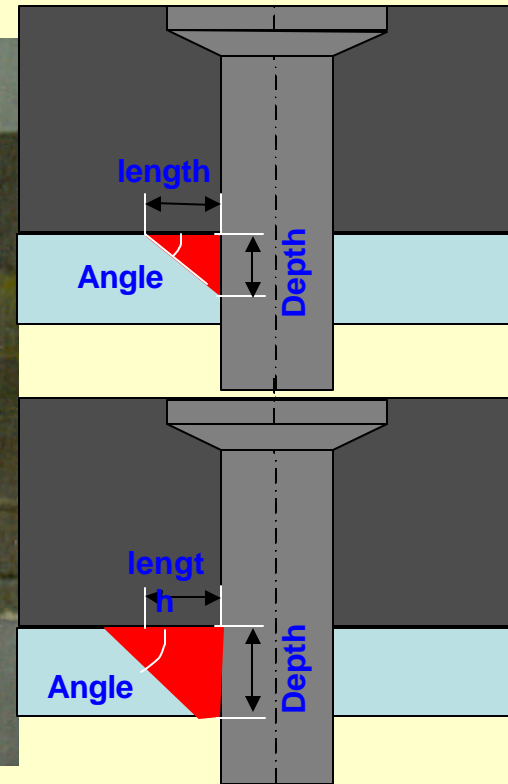
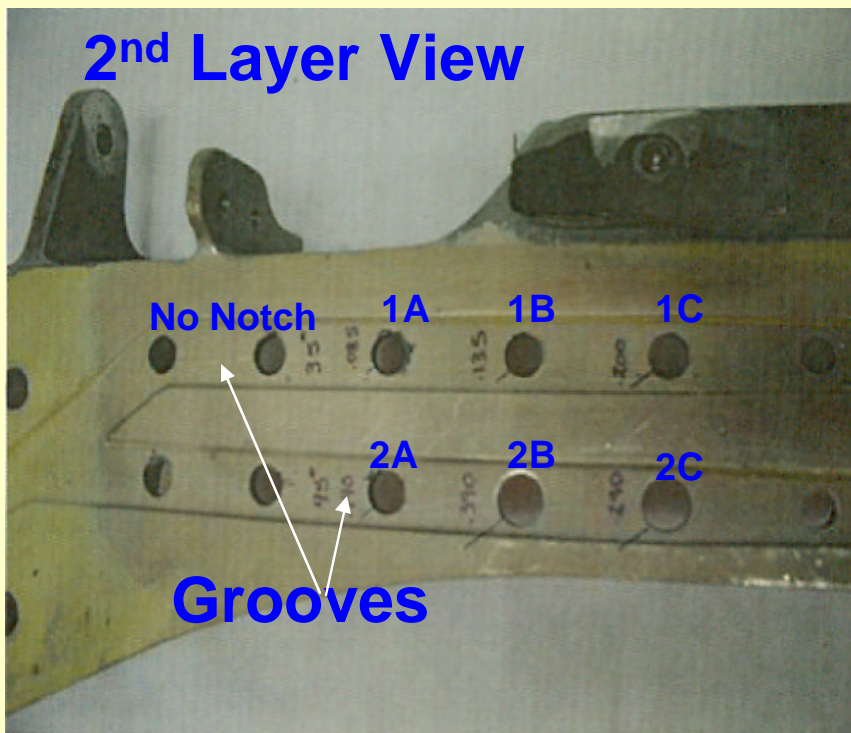


Motorized FG_RFEC Probe



Example No. 3: Crack Detection with Removal of Groove Signals (cont.)

EDM Notch Data for the Specimen

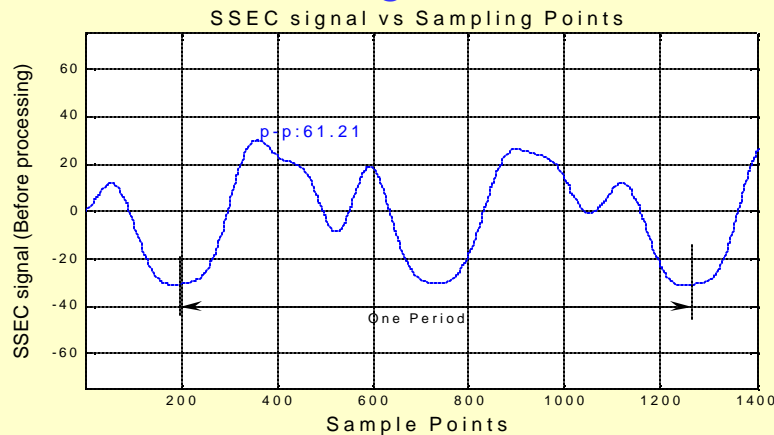


EDM	1A	1B	1C	2A	2B	2C
length	0.085"	0.135"	0.200"	0.145"	0.290"	0.240"
Angle	35°	35°	35°	45°	45°	45°
Depth	0.060"	0.095"	0.145"	0.145"	0.200"	0.200"

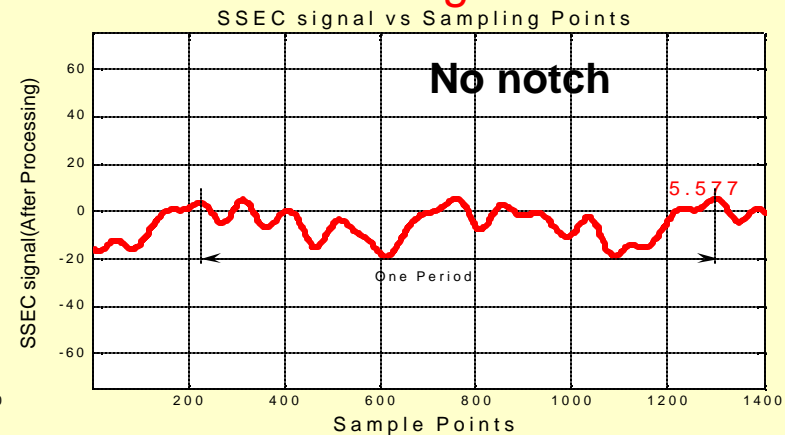
Example No. 3: Crack Detection with Removal of Groove Signals (cont.)

Typical Results

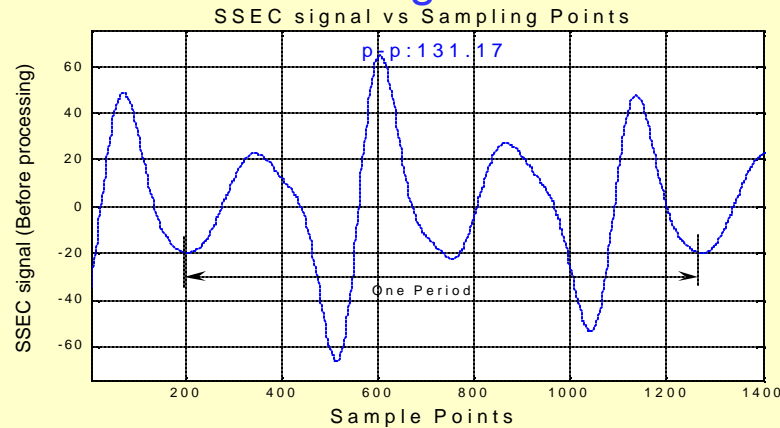
Before Processing



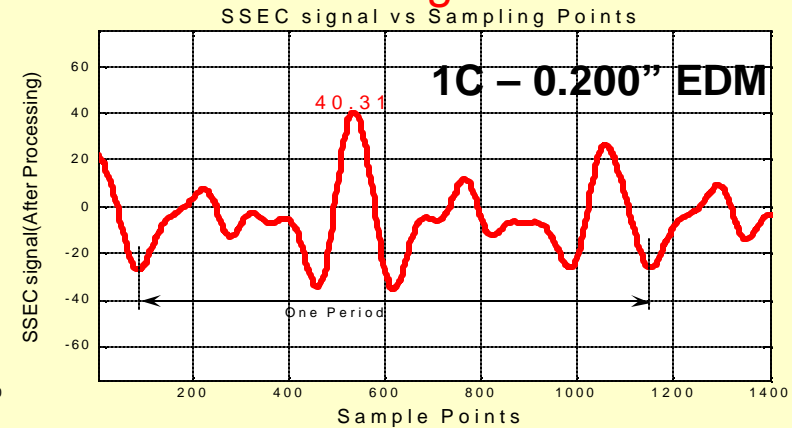
After Processing



Before Processing



After Processing





Example No. 3: Crack Detection with Removal of Groove Signals (cont.)

Improvement of S/N Ratio

Fastener No.	S/N	
	Before Processing	After Processing
1 st Row, No Notch	Reference	
1A (35° , 0.085" long)	1.20	1.37
1B (35° , 0.135" long)	1.76	5.18
1C (35° , 0.200" long)	2.09	6.80
2 nd Row, No Notch	Reference	
2A (45° , 0.145" long)	1.01	1.83
2B (45° , 0.290" long)	4.44	6.49
2C (45° , 0.240" long)	4.44	8.67



28-30 November 2006 • San Antonio, Texas



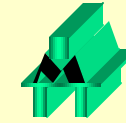
*Innovative Materials Testing
Technologies, Inc.*

Incorporating Advanced Computer and Information Technologies Into NDI Tools

- 1. High speed scanning process control and real-time data processing.**
- 2. Smarter tools leveraged from advanced signal processing and artificial intelligence technology.**
- 3. Utilizing latest computer storage technology to enable advanced database driven reference scanning technique.**
- 4. Utilizing Computer networking technology (wired/wireless) for remote control, communication and visualization applications.**



28-30 November 2006 • San Antonio, Texas



*Innovative Materials Testing
Technologies, Inc.*

Teaming NDI Tool Developers with NDI Operators and/or Aircraft Manufacturers

***IMTT is ready to collaborate with NDI
Operators and/or aircraft
manufacturers to accelerate the
development of these emerging
revolutionary NDI tools and ultimately
improving NDI reliability***