

Dynamic Inspection of composite to metal bond with air coupled and Squirted UT
A Dhvani Research Application Note



1st June 2015

AIR COUPLED NDT OF METAL COMPONENTS

NON-CONTACT WATER COUPLED AND AIR COUPLED NDT SOLUTION

Advances in composite manufacturing technology has led to the widespread application of composites owing to their very less weight to strength ratio compared to metals. They are used as substitutes for metals like in aircraft wings, casings like for satellites and for a variety of other applications. One of the important applications of composites is in thermal insulation as in the case of rockets and missiles. The motor tube which encloses the propulsion motor or the fuel is lined with a composite layer to give protection as well as thermal insulation. In this particular case the steel motor tube is lined with a sheet of high silica cloth and phenolic resin

which is baked in an autoclave for perfect bonding of the composite to the metal. Due to a number of variables like poor vacuuming, poor mixing of composites, temperature and pressure variations etc. there are chances of improper bonding leading to disbonds between the metal and composites. The interface between the metal and lining is inspected in pulse echo as well as through transmission modes using Squirted UT and air coupled UT. Two air coupled transducers scan the sample in through transmission mode while an immersion probe scan the sample in squirted mode UT where water is continuously pumped in between the probe and sample.

IN THIS ISSUE

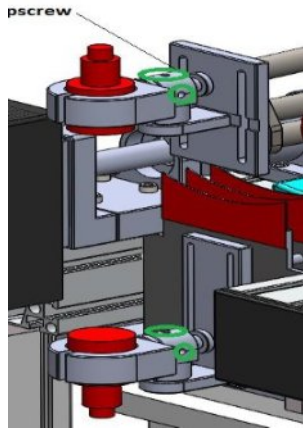
After the inspection the data is subjected to automatic defect reporting algorithm according to the party's acceptance criteria resulting in complete computer generated reports.

UT Transducers used

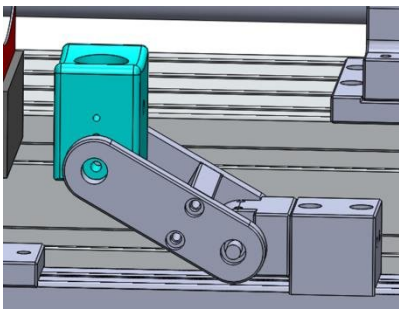
Air Coupled UT	225 KHz transducers
Squirted UT	5 MHz transducers

Both the inspections are carried out at the same time with the air coupled inspection leading the squirted mechanism as the presence of water on the surface may result in variations with the air coupled readings and also any drop of water falling on the

transducer surface may permanently damage it.



air coupled probes(red)

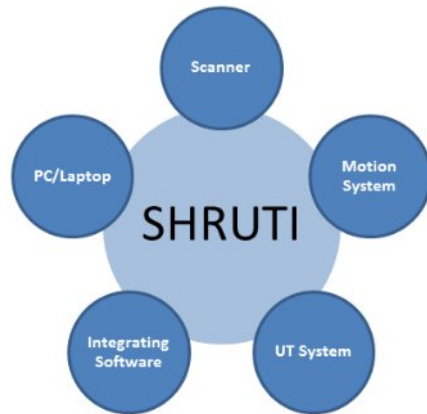


Squirted UT probe (blue)

The cycle time for one barrel is 30 minutes. The system used for the inspection is **SHRUTI**[®]. Scanning High Resolution Ultrasonic Inspection System is an indigenously developed customizable, automated, multi-axis robotic scanner. Along with ultrasonic probe, advanced data analysis (extut[®]) and image analysis packages (imagine[®], SimScan[®], SimSonic[®]), SHRUTI facilitates easy inspection of samples and components.

SHRUTI[®] offers very high resolution images of the test coupon with very high scanning speeds. The complete instrument control is through the software. Skeleton of the system is being

built from lightweight aluminum extrusions which are upgraded to Stainless Steel for heavy duty applications. All the electrical connections are rugged and properly routed following industrial standards offering very durable and reliable running.



The system employs rugged servo motors for motion requirements and had industrial standard safety interlocks.



System with sample

The system employs a centralized lubrication system to cater the lubrication requirements, centering rollers, pendent mechanism and auto cycle to reduce human intervention. The system is capable of running 24 x 7 with minimal human intervention. Both the pulser receivers are synchronized and interfaced with a central computer which controls both the pulser receivers and motion hardware at the same

time and records the data to a central repository.

ULTRASONIC TEST REPORT
(Through Transmission Technique)

Supply Agency / Client :		Component : Motor tube Laser Assembly						
Lot No / Tube No : calibration tube		Project : PINAKA						
Tube Dimensions : ID 202 mm, OD 206.4 mm, Length 1360 mm		Couplant : Air						
Ref used :		Equipment : RITEC RPR 4000						
Probes : 200 KHz Diameter 38 mm		Ref./Scan Settings : 70 dB						
Defect classification :		Critical						
	A	B	C	D	E	F	G	H
1	*	*	*	*	*	-	*	*
2	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-
10	*	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-

>60% of screen height :-
 <60% of screen height : *

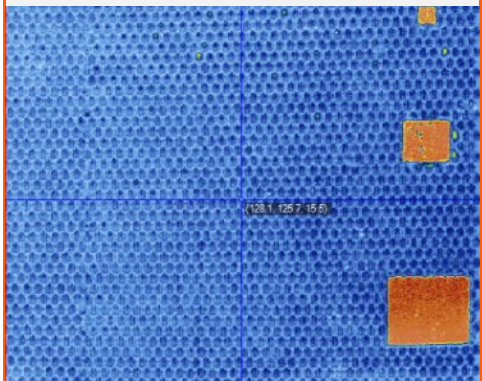
Remarks	Reject (A1)
INSPECTING AUTHORITY	
DATE	
APPROVING AUTHORITY	
DATE	

Sample Inspection report

The machine is calibrated with a reference sample which has simulated defects by means of Teflon inserts. The baseline data obtained from the reference sample is fed to the reporting algorithm for automatic defect identification

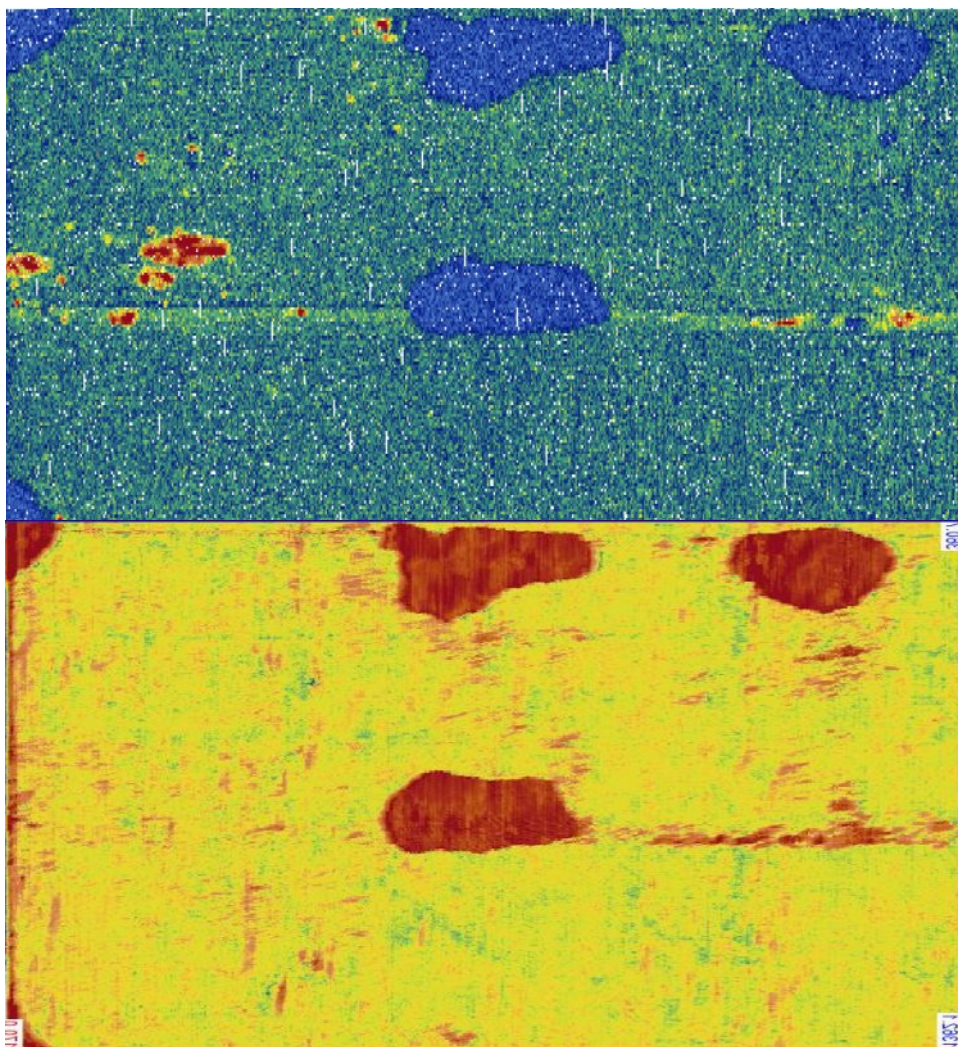
A Typical C Scan Of Honey Comb Structure with defects

Honey comb structure sandwiched between composite face plates are finds very wide applications in all areas below is a C Scan of the same.



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A Dhvani
Research
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Note

Chennai, INDIA



Air coupled and squirted UT C Scan images. The lengthier portion is along the axis and the width is along the circumference

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