

Use of Magnetostrictive Sensor Monitoring Technology (MsSMT) for the Evaluation of Adhesively Bonded Patch (Patent Pending)

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Discussion of Problem

Defects in aircraft structure can sometimes be repaired using adhesively bonded patch

Once the bonded patch repair has been completed, it is necessary to inspect the region to

- Verify that the defect is not growing
- Verify the quality of the patch



Technical Approach

Bond MsSM probe unit onto the aircraft structure

Collect reference waveform (has data from the bonded region as well as the defect)

Process collected data to determine changes in

- Bond quality
- Defect size



Laboratory Experiments of MsSM with Bonded Patch and Defect in Aluminum Plate



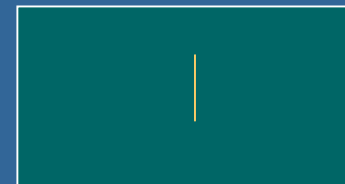
**1/16-inch-thick,
8 x 4 inch Aluminum Patch**



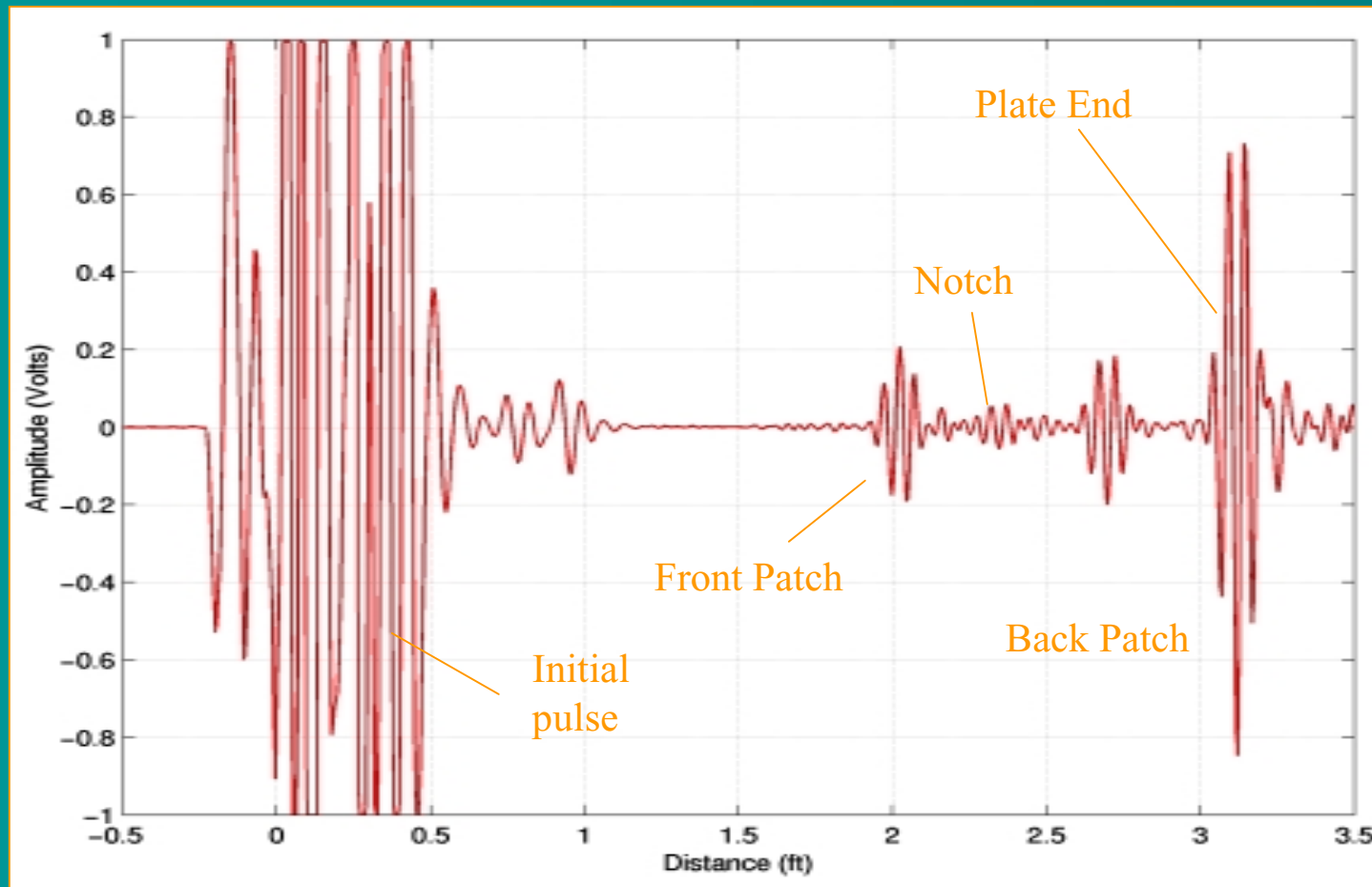
**51-percent-thickness-deep,
2-inch-long Notch Defect**

**0.125-inch-thick,
3 x 1 ft Aluminum Plate**

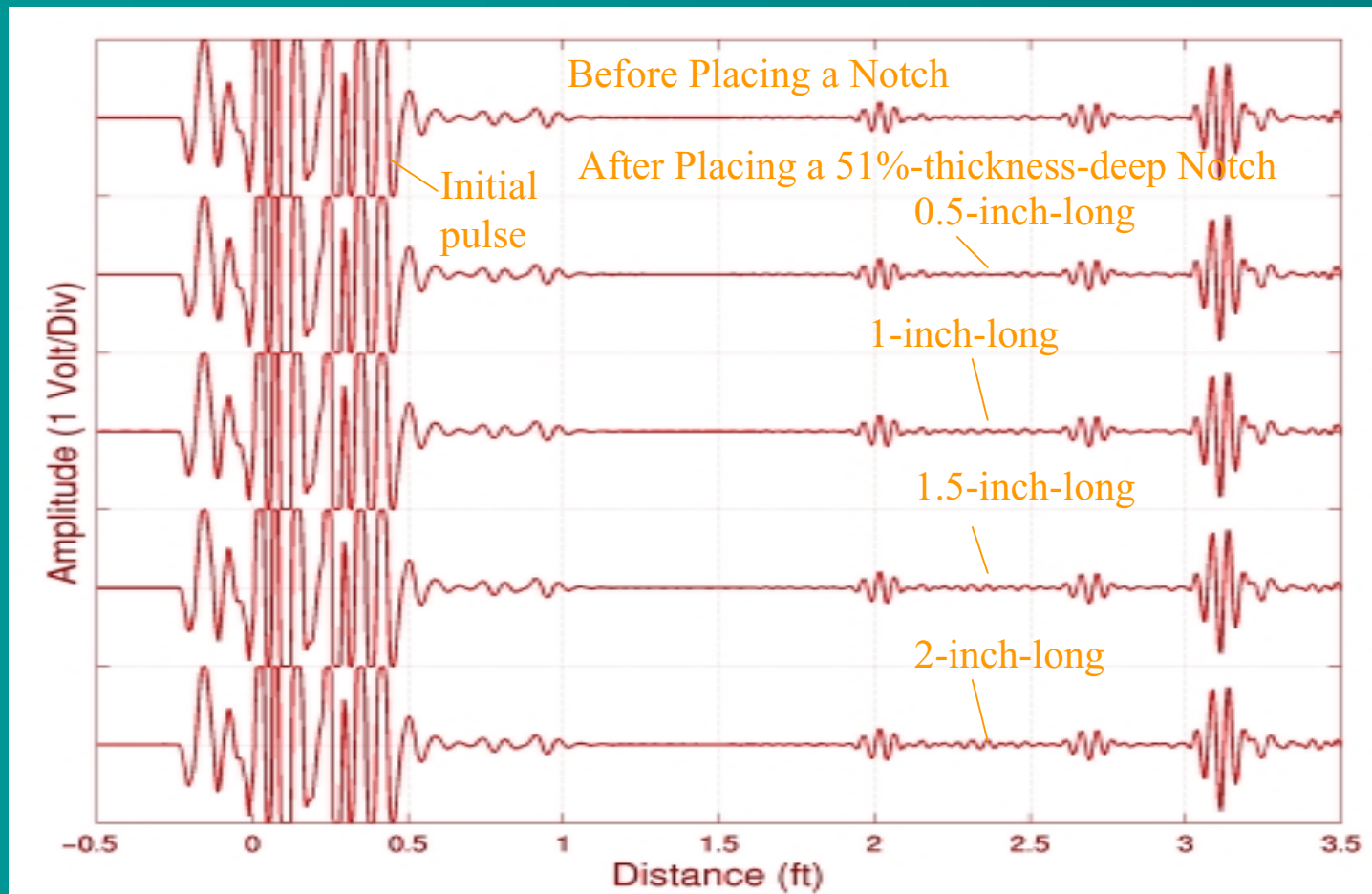
MsS Probe



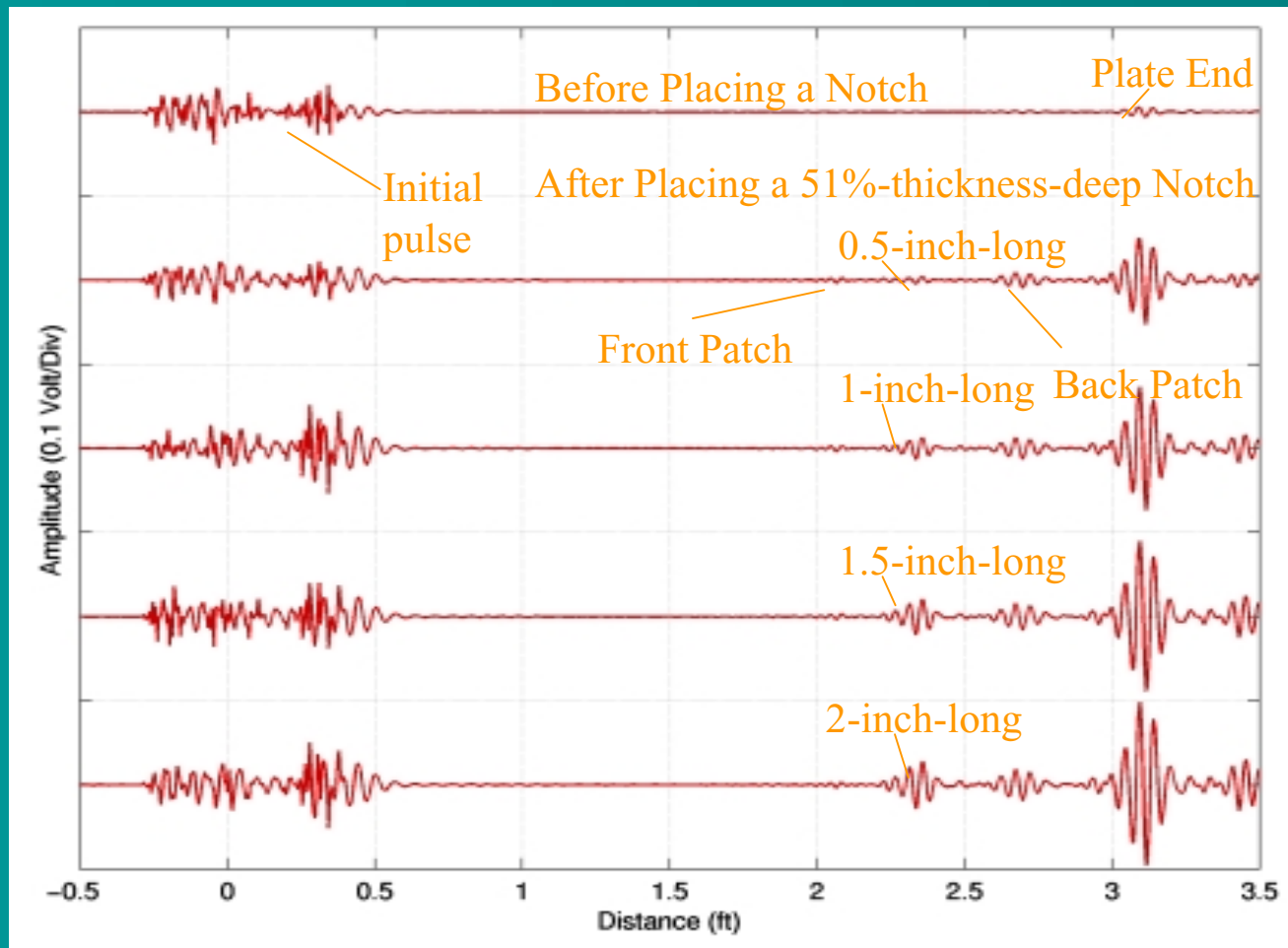
Aluminum with Patch Bonded over 51-Percent-Thickness-Deep, 2-Inch-Long Notch Defect



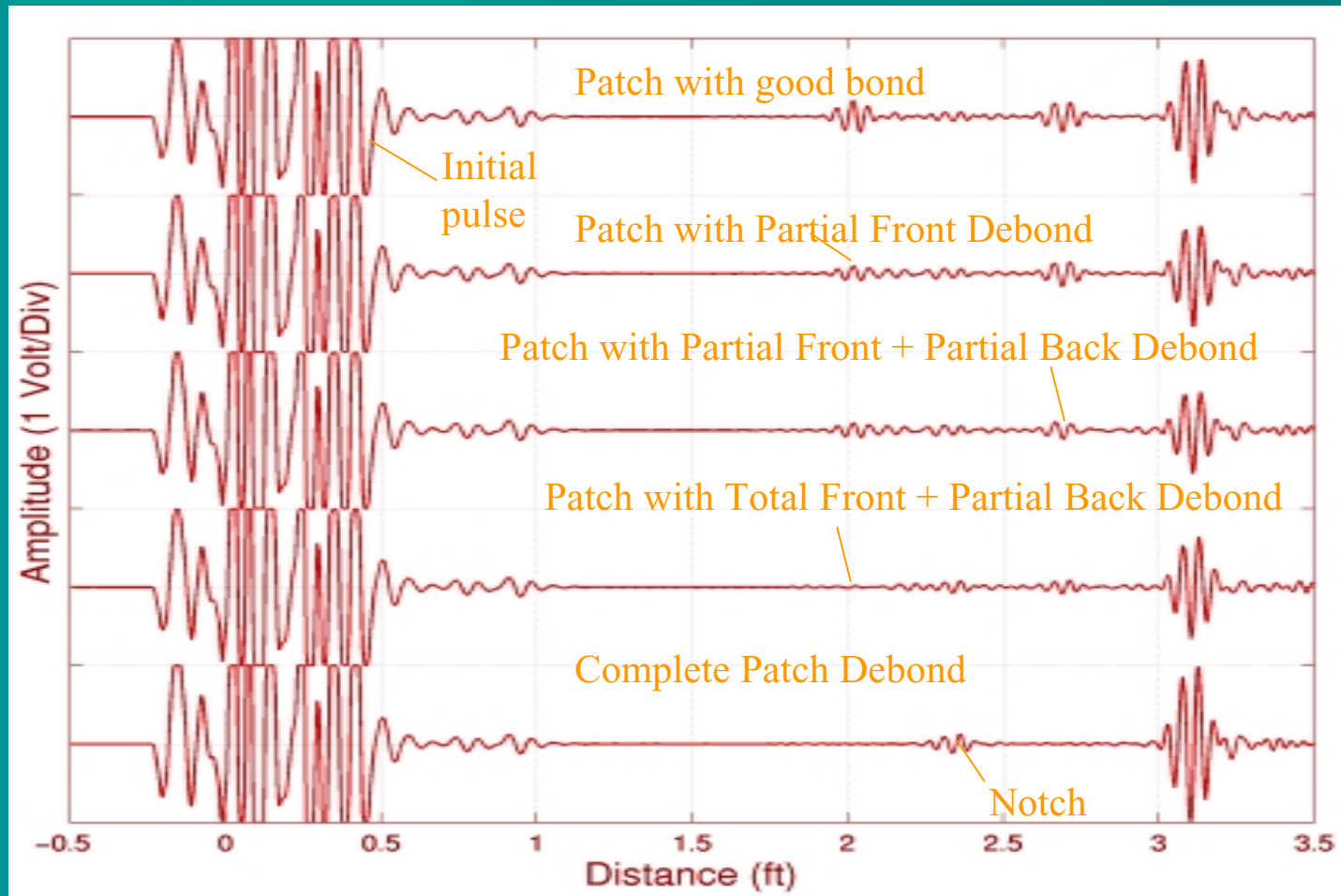
Aluminum with Patch Bonded and Defect Growing



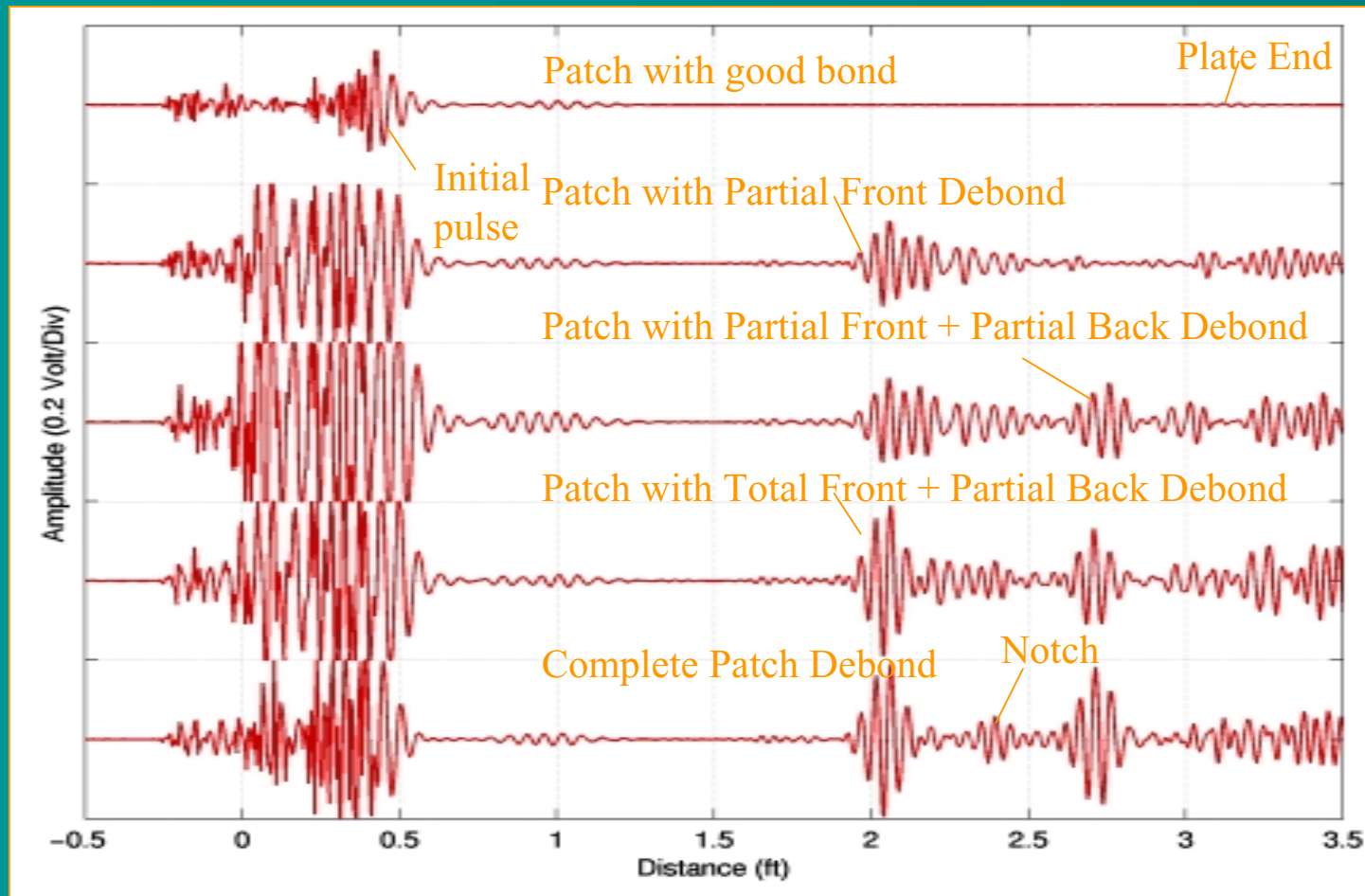
After Applying Waveform Differential Algorithm in Time Domain to Monitor Notch Growth



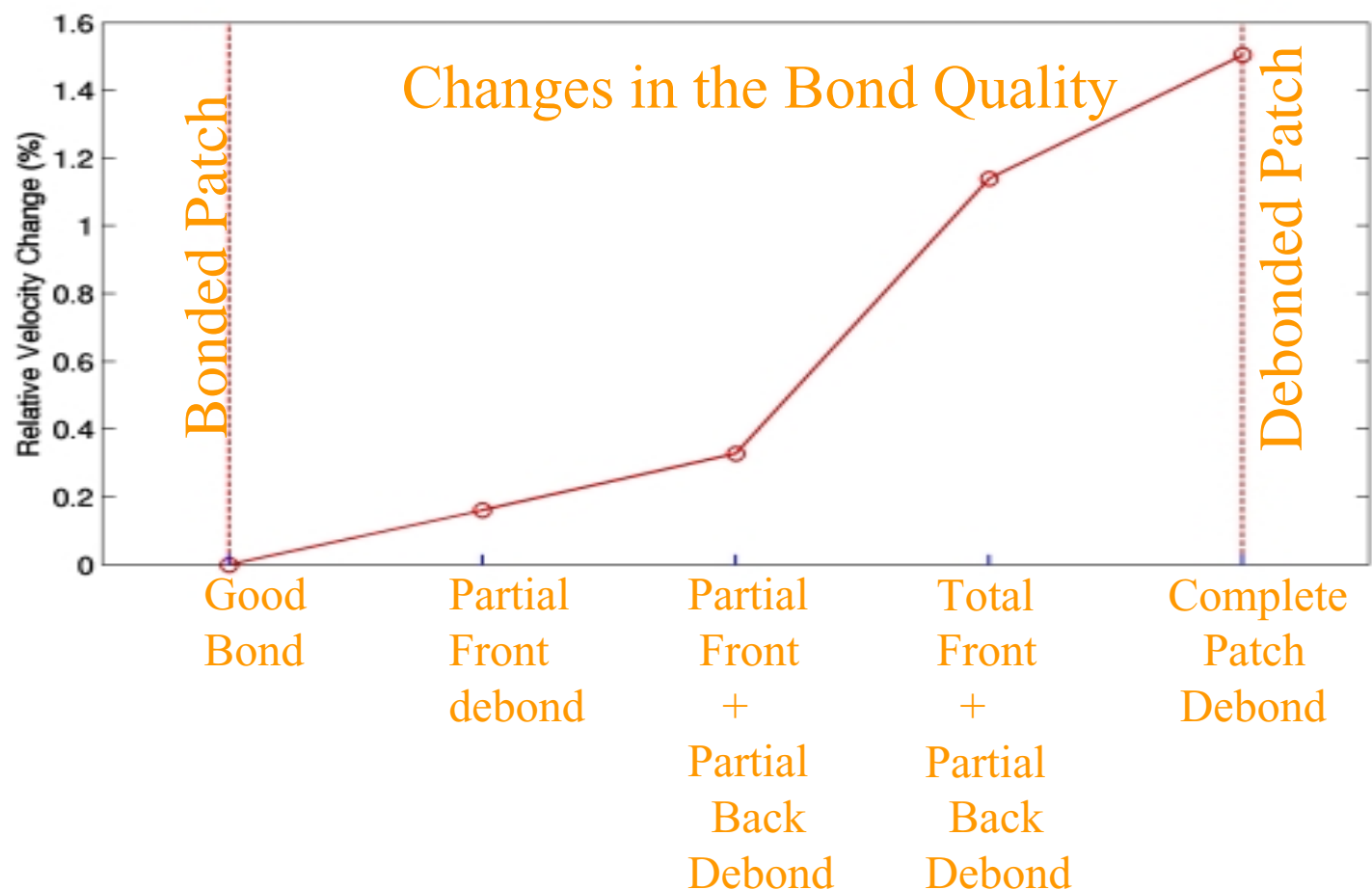
Aluminum with Patch and Defect with Changes in the Bond Quality



After Applying Waveform Differential Algorithm in Time Domain to Monitor Patch Bond



Relative Velocity Change of Guided Wave in Patch Region with Changes in the Bond Quality



Results

Southwest Research Institute applied the MsSM to monitor the quality of adhesively bonded patch and the notch growing under the patch.

- (1) Waveform differential algorithm was developed that allows the detection of a notch growing and bond-quality change in sequential MsS signals.
- (2) Change of the bond quality in patch region could be identifiable using relative velocity change of guided wave.



Future Work to be Conducted on MsSM with Bonded Nickel MsS Probe

Laboratory evaluation on honeycomb composite structures

Laboratory evaluation on graphite epoxy patches

Preliminary development of flat sensor coil that could be read out by a remote sensor

Field demonstration of MsSM with bonded nickel MsS probe on aircraft structure

Investigation of variations in magnetic property of nickel MsS probe as a result of the aerospace environment

