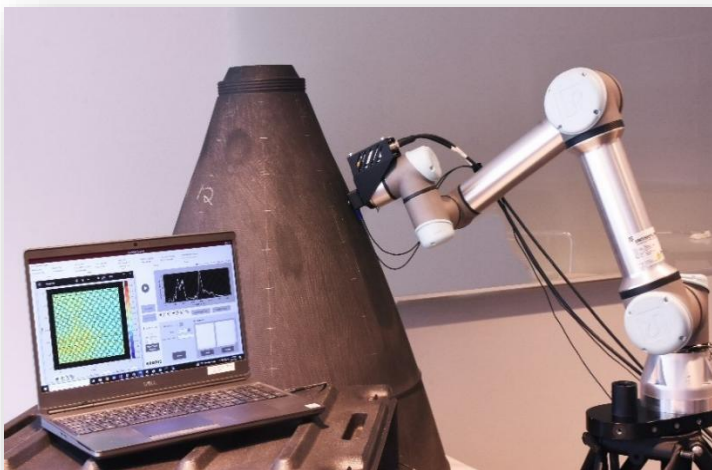


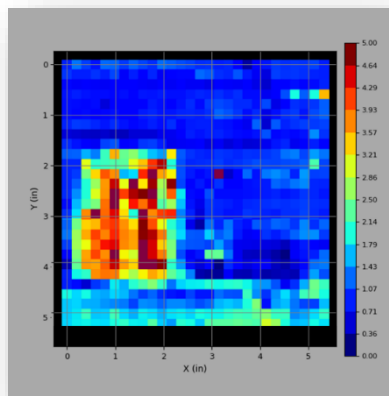
### ULTRASPEC®

The unique aspect of the UltraSpec® device is the use of a wide frequency range when interrogating a material. When this is coupled with the custom Kratos SRE data analysis software, it produces a highly sensitive nondestructive evaluation technique that can be employed for challenging inspection applications. UltraSpec uses a long-duration swept-frequency excitation pulse in contrast to the short-duration, large-amplitude excitation pulses used in traditional ultrasonic spectroscopy applications. The technique offers substantial signal-to-noise improvement and can be tailored to application-specific frequency ranges while still using a wide range of standard ultrasonic probes. Spectral analysis, resonance characteristics, and processed time reflections provide the user with more information to assess the material or structure being inspected. The technique has been proven to successfully perform challenging inspections and produce material insights that cannot be provided by other methods.



#### ***Advantages of Kratos SRE's ultrasonic spectroscopy technique include the following:***

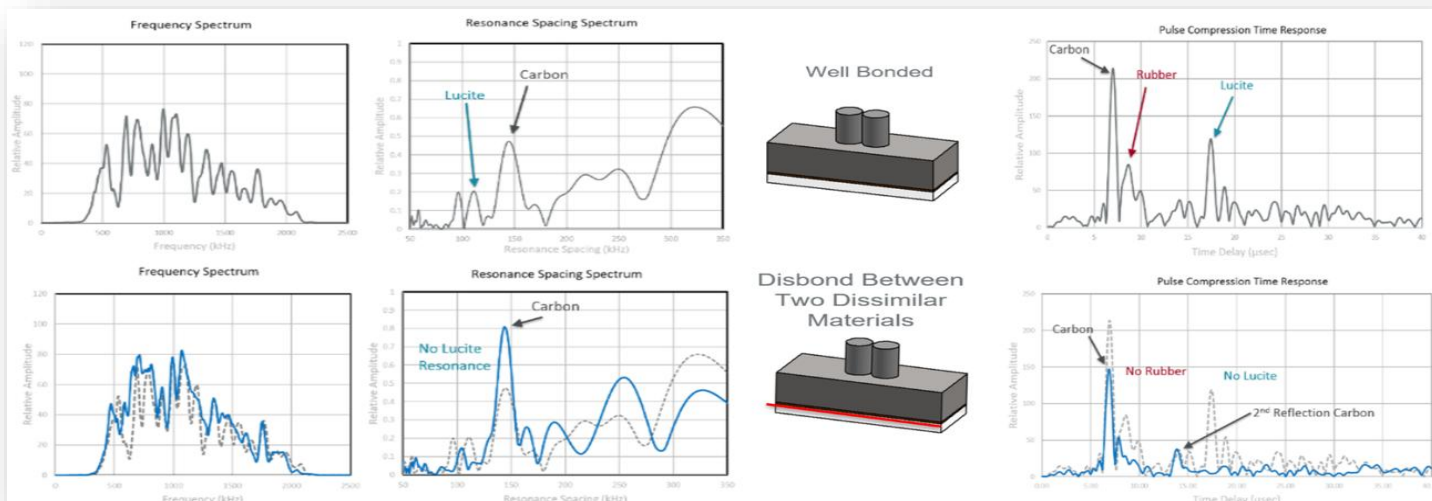
- Dramatically improved signal-to-noise ratio and dynamic range
- User-defined (material, application-specific) frequency range, pulse shape, and duration
- Three classes of data for analysis: spectral response, resonance behavior, and time reflections
- Focused inspections at different depths or critical material interface regions within a complex stack-up
- Advanced approach for applications where traditional nondestructive evaluation measurements are inconclusive



#### ***Capabilities made available by Kratos SRE's ultrasonic spectroscopy technique and resulting applications include the following:***

- Multimaterial, multilayer component inspection
- Bond inspection
- Thick, attenuative billet inspection (>10" thick)
- Hidden corrosion detection
- Matrix characterization of composites
- Porosity detection
- Measuring velocity as a function of temperature
- Detection of micro-cracking in carbon composite materials
- Carbon composite bond to metal liner
- Characterization of material deterioration properties

UltraSpec® provides information on the resonance behavior of the material. Unlike other “resonance” or “pulse-echo” methods, the frequency range is user-definable and tailored to the material, not the transducer’s distinct frequency. For example, the method has been successfully used to assess thick composite materials (billets) for microcracking and perform a bond assessment where two dissimilar materials are changing in thicknesses, or the adhesive thickness or properties are not constant.



#### Recent improvements:

- Integration with commercially available XY scanners
- Streamlined analysis with UltraSpec Acquire™
- Advanced Interpretation Module
  - Generic self-referencing (in situ reference) methods
  - Human-assisted analysis for challenging point-of-inspection applications
  - Advanced peak/valley tracking capabilities within frequency and time
- Finite element modeling capability

