

Metrology Overview

Winter JMUM
Nellis AFB, NV
November 16, 2011

<http://metrology.survice.com>
<http://www.survice.com>

About SURVICE

A collage of four images: a computer monitor with a blue 'X' on the screen, a fighter jet, a tank with a large explosion coming from its turret, and a soldier in full combat gear holding a rifle.

SURVICE Engineering was founded with a focus on applying systems engineering to support the design, development, testing, and fielding of US combat systems that are safe, survivable, and effective.

A black helicopter with red accents, shown in flight.

SURVICE currently employs personnel in offices across the United States which includes recognized experts in a wide range of aircraft, ground, and sea systems.

A large white naval ship, possibly a destroyer, sailing on the water.

SURVICE Metrology is a division of SURVICE Engineering which was established after years of using metrology equipment in our core business.



Ridgecrest Office
Ridgecrest, CA

Additional Field Offices:

*Philadelphia, PA
San Diego, CA
Socorro, NM
Warren, MI*



Dayton Area Operation
Dayton, OH



**Corporate Office &
Aberdeen Area Operation**
Belcamp, MD



Huntsville Area Operation
Huntsville, AL



Eglin Area Operation
Ft. Walton Beach, FL



Applied Technology Operation
SURVICE Metrology Center
Research and Development Group
Belcamp, MD



Patuxent River Office
Lexington Park, MD



Washington Area Operation
Dumfries, VA

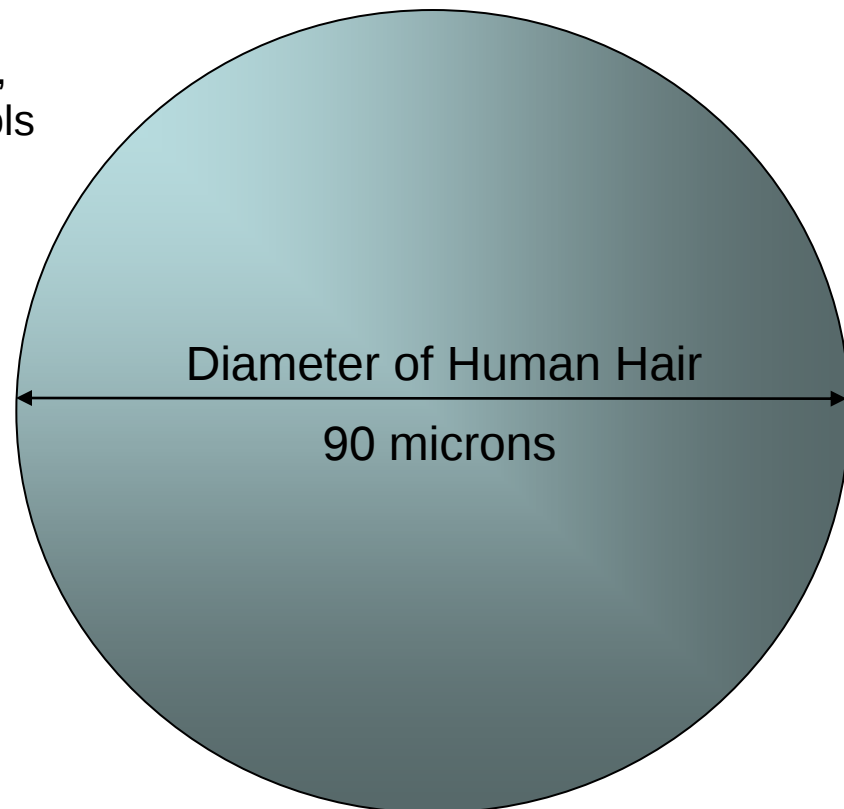
SURVICE Metrology Mission Statement

The goal of SURVICE Metrology is to establish a world-class business unit that provides integrated metrology solutions, dimensional inspection and modeling services, custom engineered solutions, and advanced R&D capabilities in the field of metrology.

What is Metrology?

- Metrology is the study of measurement
 - Although we have been known to use micrometers, calipers, and tape measures, we generally use high-end laser-based tools to rapidly and accurately measure objects
 - We have a lot of tools ...

•
1 micron

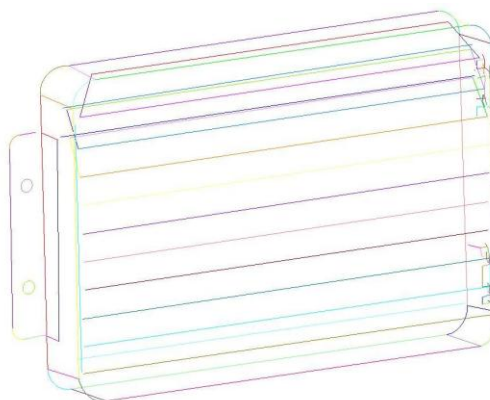
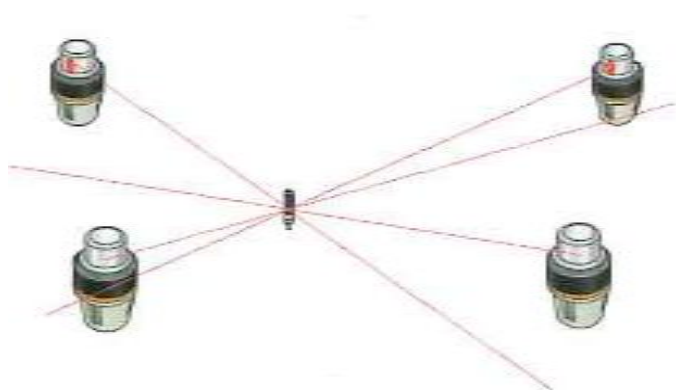


One Thousandth of an Inch = 25.4 microns

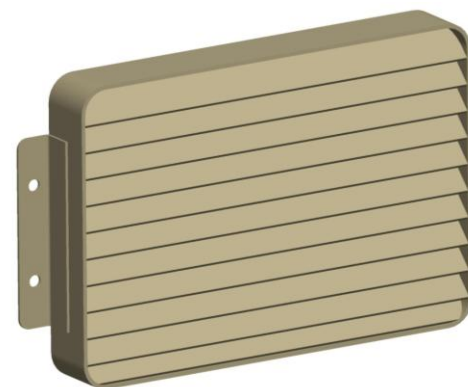
Existing/Legacy Systems

	Nikon Indoor GPS	Nikon Coherent Laser Radar	FARO/ROMER Arms	FARO Laser Tracker X	Breuckmann optoTOP-HE Scanner
					
Scan Volume	scalable	60 m	8-15 ft	70 m	Unlimited when combined with photogrammetry
Operation	Indoor/ Outdoor	Indoor/ Limited Outdoor	Indoor / Outdoor	Indoor/ Limited Outdoor	Indoor
Portability	Two person operation/ transportation	Two person operation/ transportation	One person operation/ transportation	One person operation/ transportation	One person operation/ transportation
Accuracy	200 µm	50 µm	25 µm	20 µm	15 µm
Contact/Noncontact	Contact	Noncontact	Contact/Noncontact	Contact	Noncontact
Unique Features	- Point measurement - Multiple sensor tracking - Wireless data collection - Multiple simultaneous collection - Increased line-of-sight	- Automated collection - Non-line-of-sight with mirror - Close- or long-range scanning	- Ideal for reverse engineering of aircraft parts	- XtremeADM instant beam acquisition - Instant-on Laser - Automated compensation	- Multiple fields of view depending on size of object required accuracy - Very fast data acquisition

- Large volume with 200 μ m (0.008") accuracy
- Minimal calibration time with permanently fixed transmitter stands
- Infrared lasers emitted by the transmitters are received by detectors in the wand and used to triangulate position in 3D space.

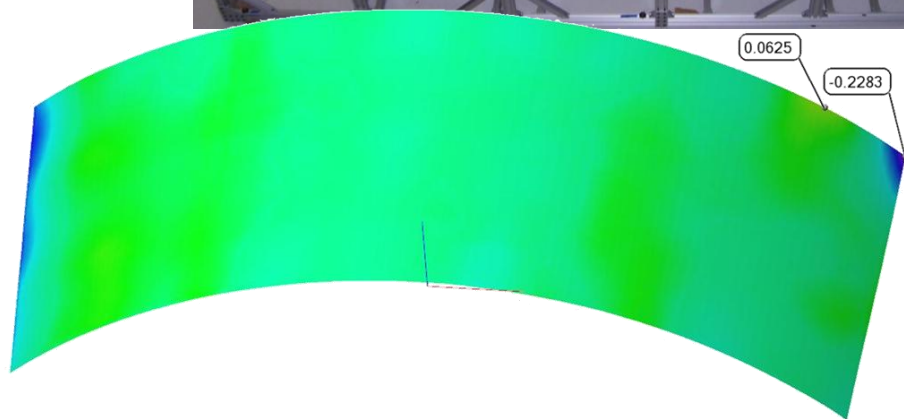
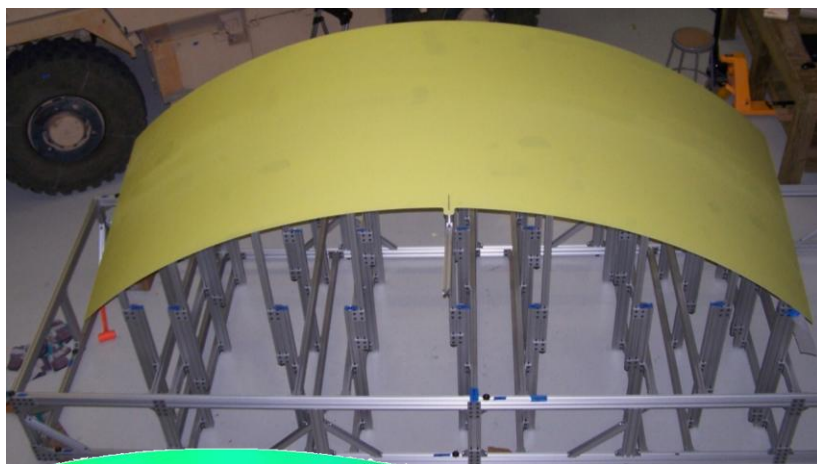


Data collected in Spatial
Analyzer



Imported and Modeled
in
ProEngineer/Solidworks

Coherent Laser Radar (CLR)

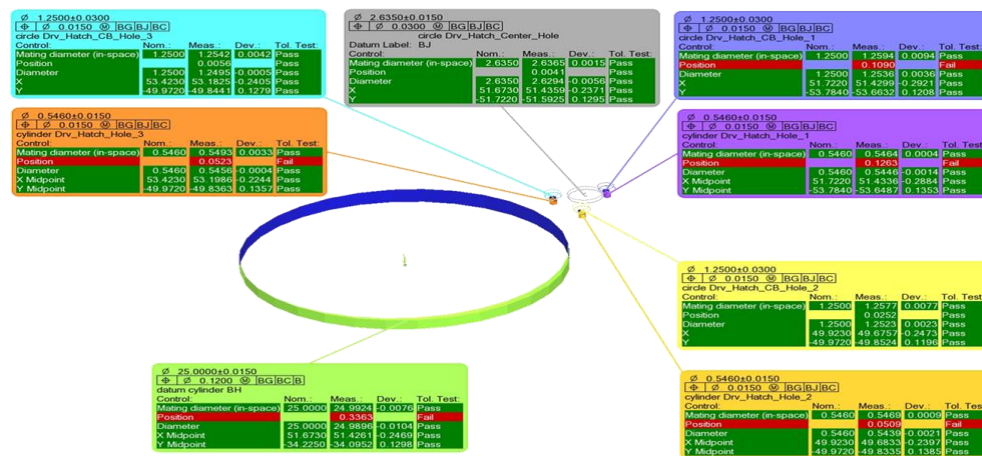
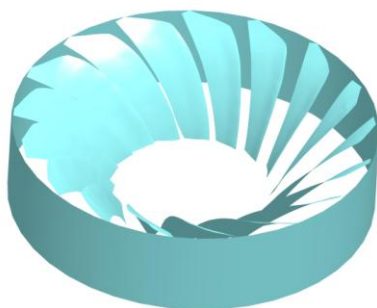


- Large volume laser scanning with 50µm (0.002") accuracy
- Focus based system
- Up to 60m range
- Ability to scan 'hard to reach' areas with the use of an optical mirror

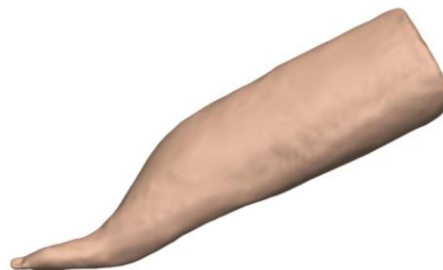
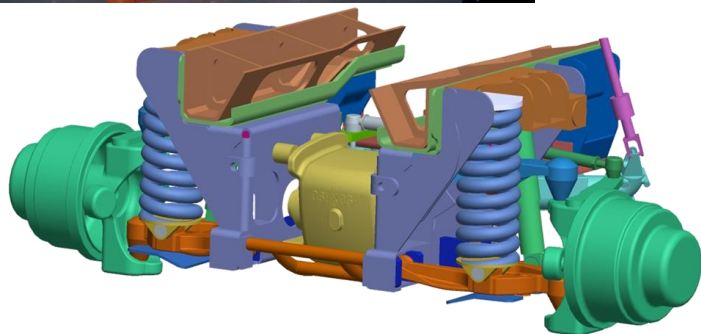
Laser Tracker



- Large volume surveying/measuring device with 20 μ m (.0008") accuracy
- Used for both modeling and dimensional inspection
- Ability for 'Real-time' measurements to quickly and accurately build part alignments during construction
- Portability and durability allow for usage in various manufacturing settings

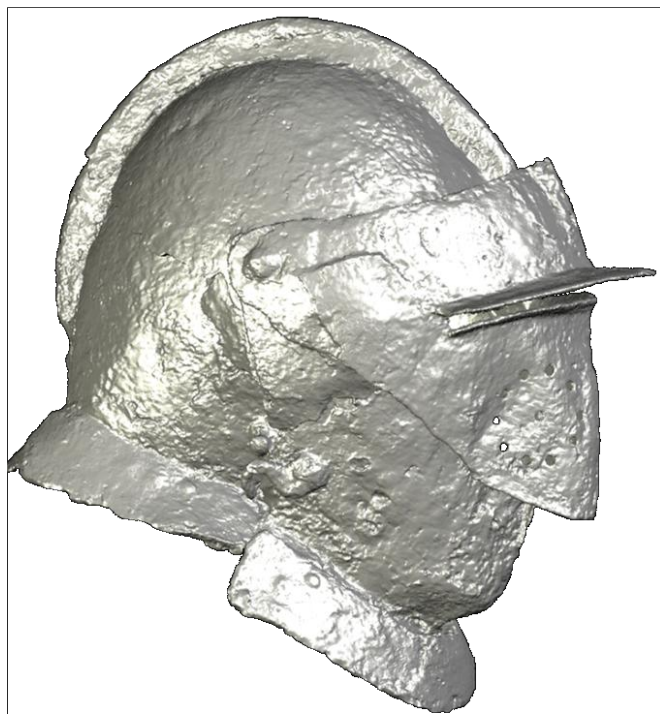


- Point probing and laser scanning device with $25\mu\text{m}$ (0.001") accuracy
- No line of sight (LOS) issues
- Model directly into CAD package
- Portable Coordinate Measuring Machine (CMM)



Structure Light Scanners (Brueckmann OPTO-TOP)

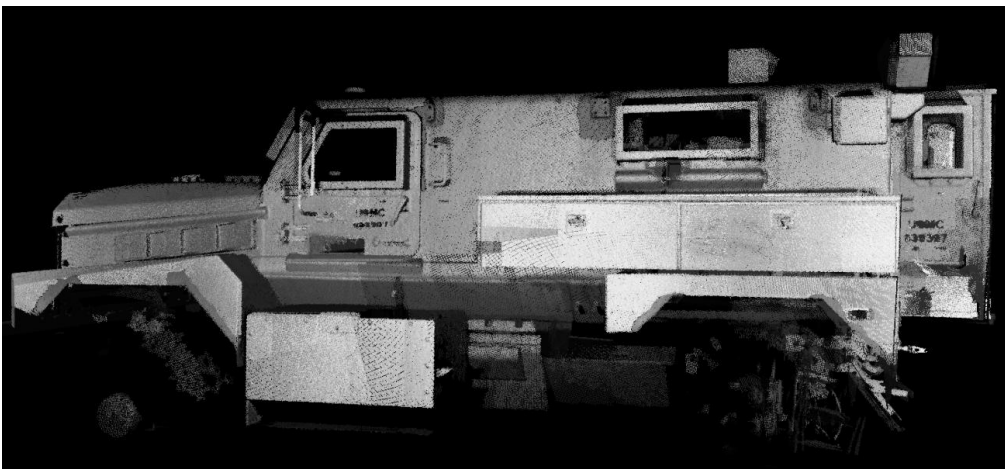
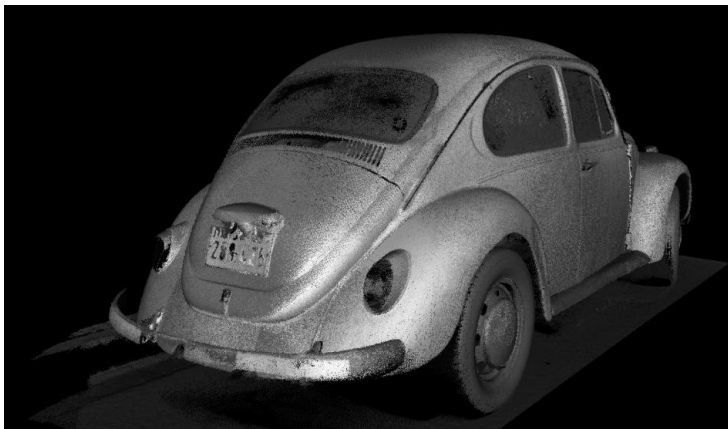
- White-light scanning with $15\mu\text{m}$ (0.0005") accuracy
- Interchangeable lenses for varying fields of view (FOV)
- Fast data capture



Emerging Technologies

	MANTIS	SURPHASER	CT Scanner
			
Scan Volume	0.5 – 4.5 m per frame	0.4-30 m	1 m3 scan volume
Operation	Indoor/ Outdoor	Indoor/ Outdoor	Indoor
Portability	One person operation/ transportation	One person operation/ transportation	Non-portable
Accuracy	0.5 mm at ≤ 1 m	500 μ m	Up to 2 μ m
Contact/Noncontact	Noncontact	Noncontact	Noncontact
Unique Features	-Video capture at 10 FPS -Each frame generates its own point cloud	- Automated collection - Up to 1.2 million points per second	- 225-450kV - Linear curved detector - Microfocus

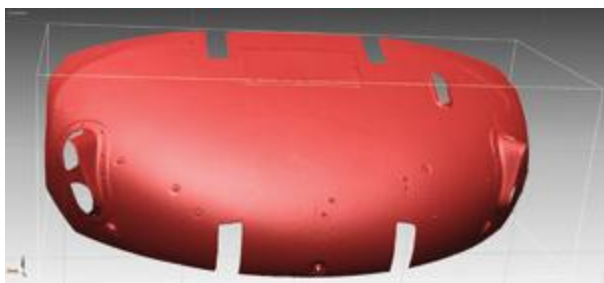
- Large volume video capturing
- 10 frames per second each generating it's own point cloud
- Very high accuracy



MANTIS



SURPHASER

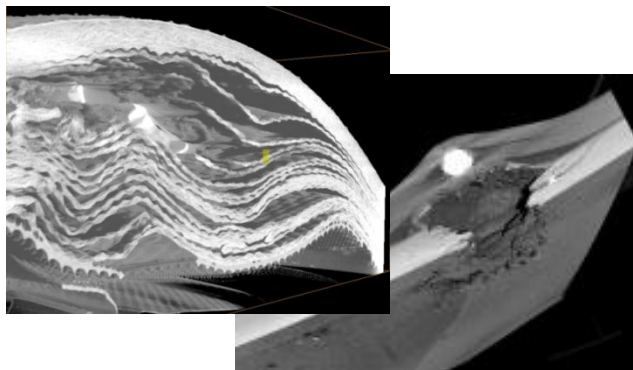


Images courtesy of Mimic Studios, Inc.

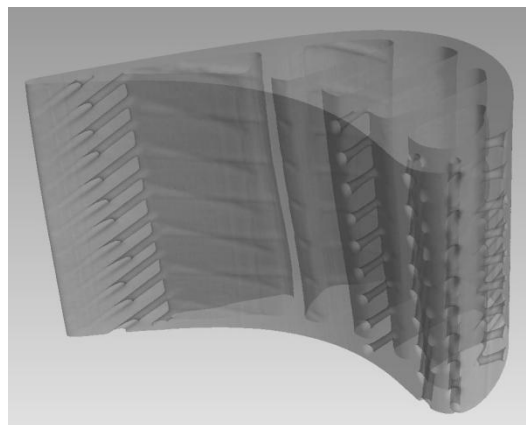


- Large volume laser scanning with 500 μ m (0.02") accuracy
- Phase Shift, Hemispherical Scanner
- Up to 30m range
- 360° x 270° field of view

CT Scanner



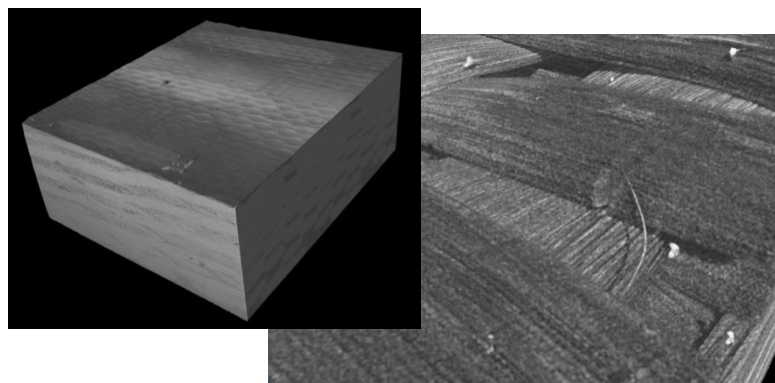
Post-Test Armor Scans



Turbine Blade Scan



Electronics



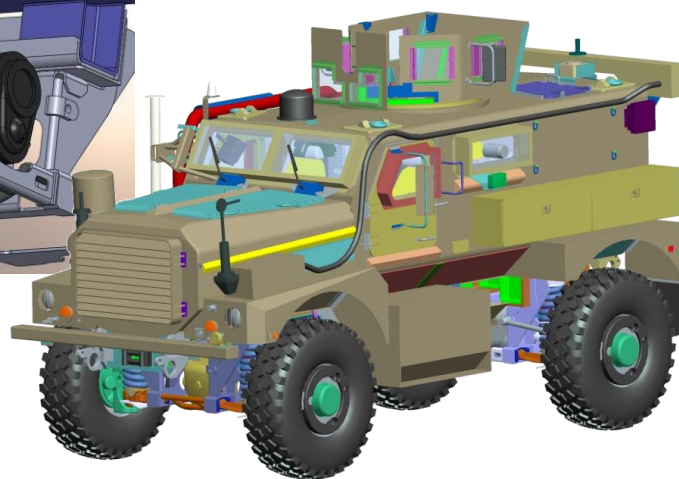
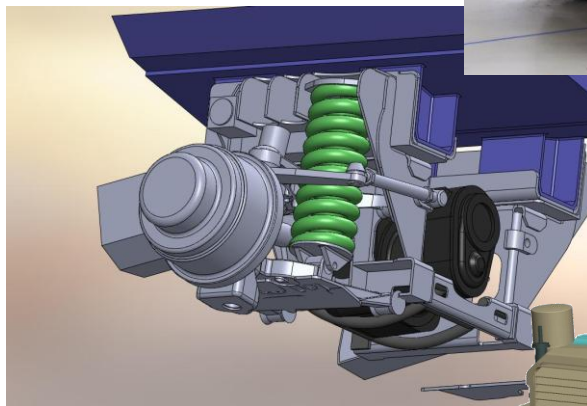
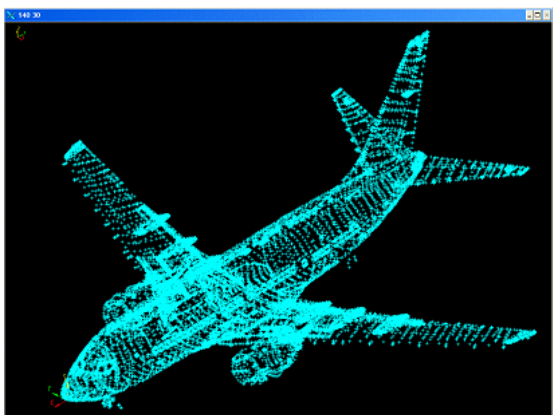
Graphite-Epoxy Scan

Nikon CT Specifications:

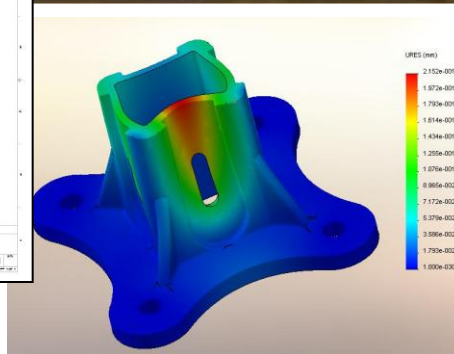
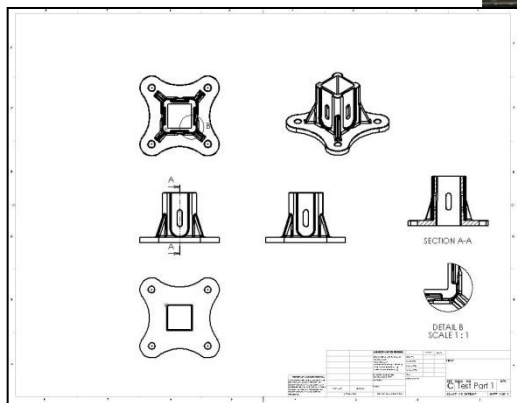
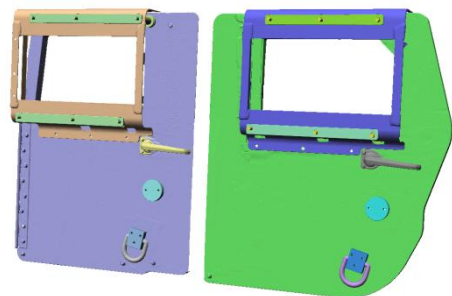
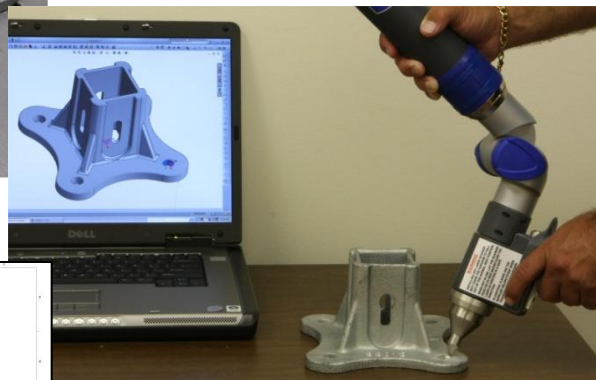
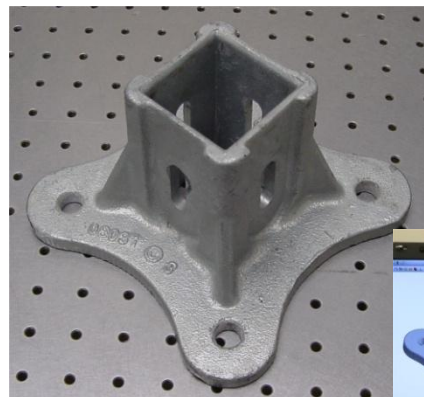
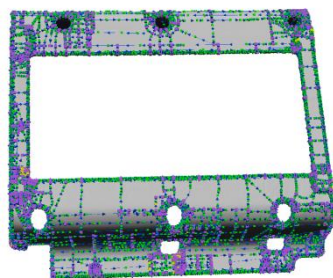
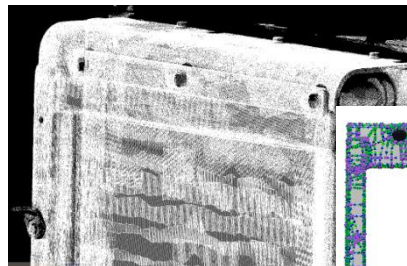
- 225-450kV
- Microfocus
- Linear curved detector
- 1 m³ scan volume

Metrology Applications

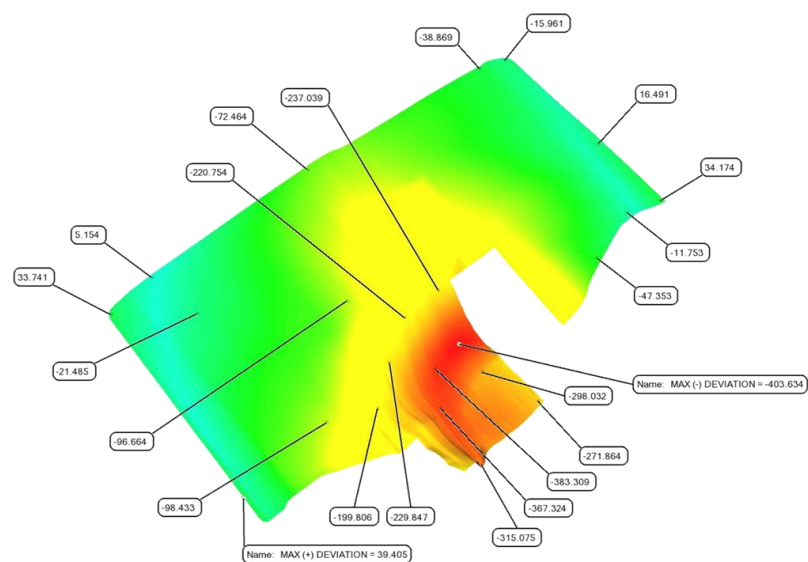
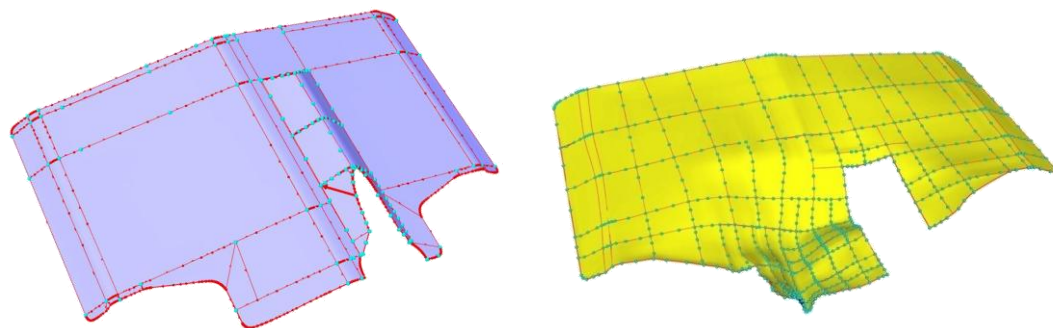
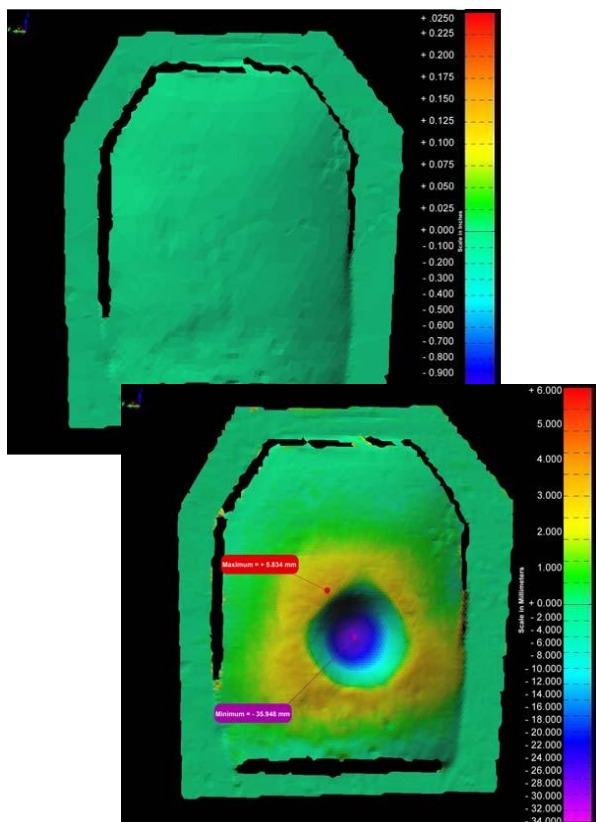
Target Development & Exploitation



Reverse Engineering



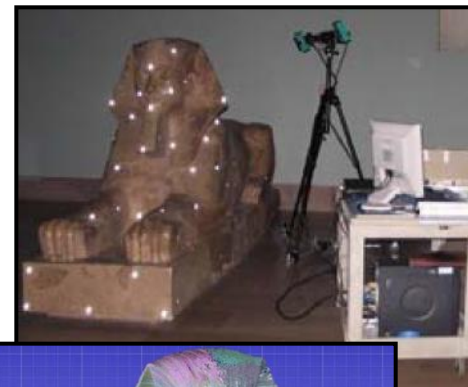
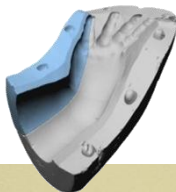
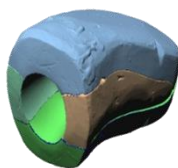
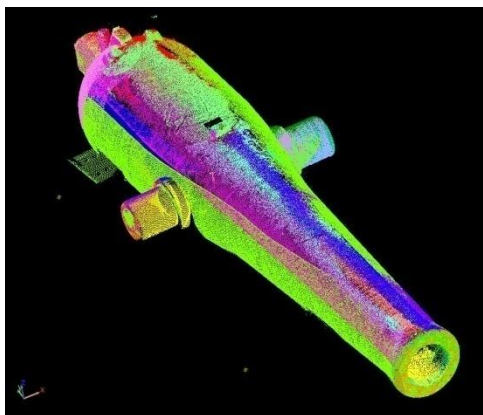
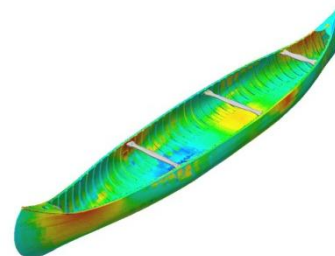
Test and Evaluation Support



- SureSet™
 - Processes, procedures, and customized software that guarantee accuracy and efficiency for large-scale construction in Hydroelectric industry



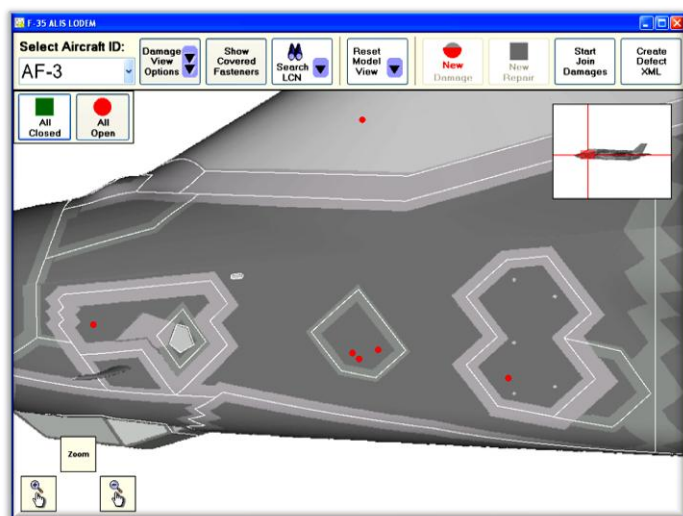
Antiquities



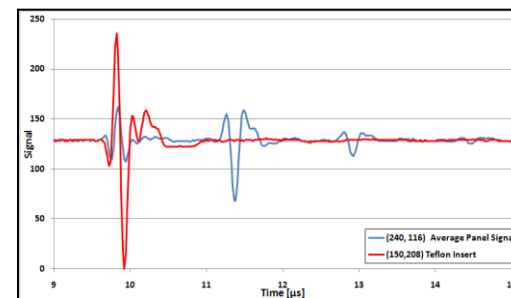
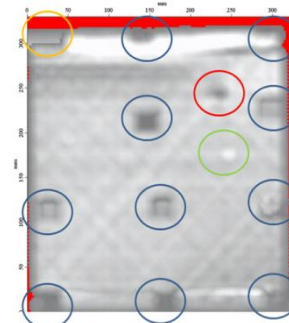
Custom Systems Integration Examples

Customized Metrology Solution for Aircraft Maintenance

- Aircraft Damage Locator (SBIR AF06-102)
- Automated Tool for Reporting Aircraft Damage and Queuing and Screening Repair (SBIR N07-116)
- Improved Approaches to Nondestructively Test Aluminum Structures (SBIR N06-132, subcontract to SpaceMicro)

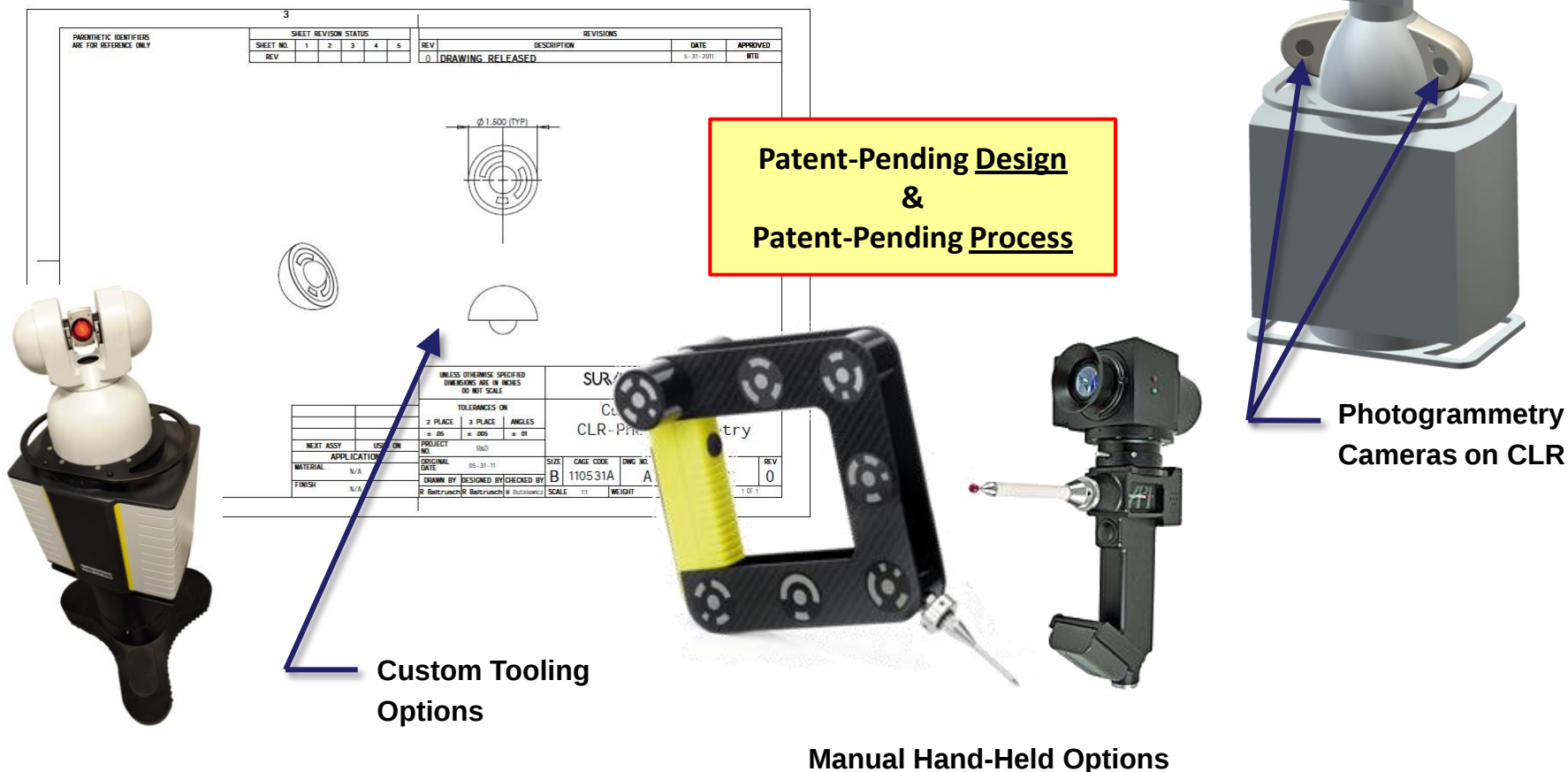


**Modular and
Extensible
Architecture**



Enhanced-CLR Photogrammetry-Enhanced Coherent Laser Radar

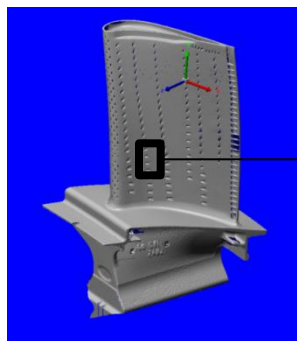
- Key Characteristics Metrology Solution (SBIR AF112-119)
 - Providing automation of dimensional inspection using laser radar



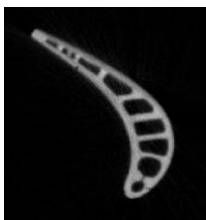
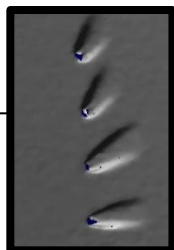
Other SBIR/STTR R&D Efforts

Specialized Application Development

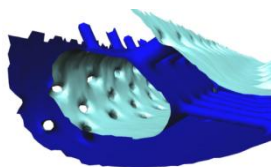
- Small Hole Measurement (SBIR AF093-121)
- Autonomous Hydrographic Surveying (SBIR SBIR 8.4.4N & N091-088)
- Full Field Strain Measurement (STTR N09-T010)



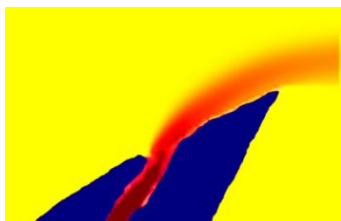
Optically Scanned Blade



CT Scanned Blade

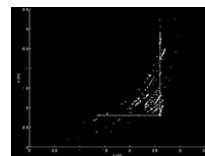
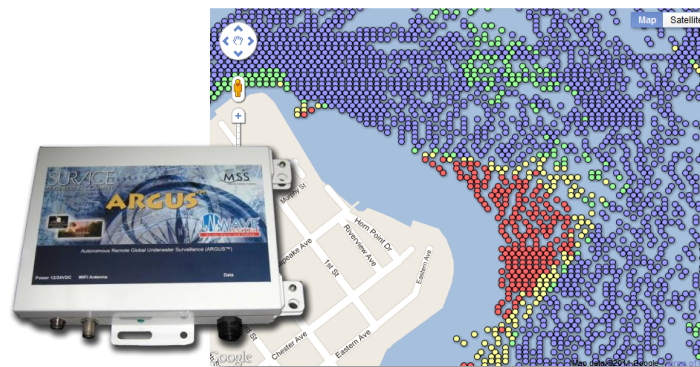


Combined Geometry

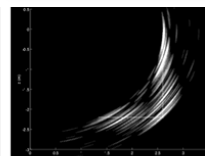


CFD Analysis

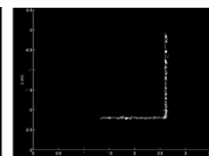
(Using SURVICE-Developed Apollo™ CFD Engine)



(a) Side Scan Response

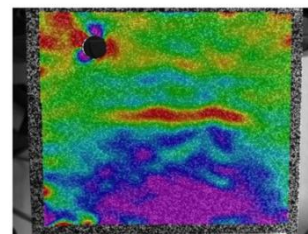
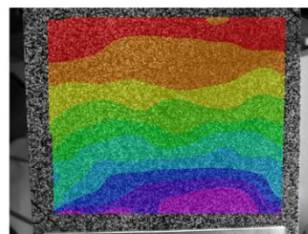


(b) Multibeam Response



(c) C3D Response

Argus™ Hydrographic Surveying
(<http://argus.survice.com>)



Full Field Strain using Digital Image Correlation

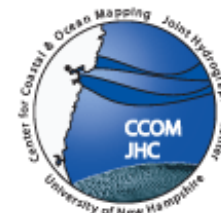
University Collaborations

- University of Delaware
 - Center for Composite Materials (UD-CCM)
 - [SBIR N07-116](#), Automated Tool for Reporting Aircraft Damage and Queuing and Screening Repair
 - [SBIR N07-098](#), Fire Integrity in Advanced Ship Structures
 - [STTR N09-T010](#), Full Field Strain Measurement
 - Mechanical Engineering Department (Senior Design Projects)
 - 2008: NDI Metrology Vector Bar (supporting NAVAIR SBIR), ASME Semi-Finals
 - 2009: Hydrographic Sensor Pod (supporting SPAWAR SBIR)
 - 2010: Metrology Tool for Pipe Modeling (supporting MRAP program)
 - 2011: Next-Generation Virtual Reality Equipment Vest
- University of North Carolina at Charlotte (UNNC)
 - Center for Precision Metrology (CPM)
- University at Buffalo, SUNY
 - High Performance Computing & Computation Fluid Dynamics (CFD)
 - [SBIR N102-173](#), Fire Simulation and Residual Strength Prediction Tool for Aluminum Ship Structures During and After Fire



University Collaborations

- University of New Hampshire
 - Center for Coastal and Ocean Mapping (UNH-CCOM)
 - SURVICE Autonomous Remote Global Underwater Surveillance (ARGUS) units providing bathymetric data from CCOM research vessels
 - Industrial Consortium partner
- Washington College – Chestertown, MD
 - Center for Environment and Society (CES)
 - ARGUS units providing data from CES research vessels
- University of Iowa
 - High Performance Visualization
 - NVIDIA



- Metrology has applications across a broad spectrum of uses
- Technology in this field is rapidly evolving
- Custom solutions are feasible to meet user-specific needs

Contact Information

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