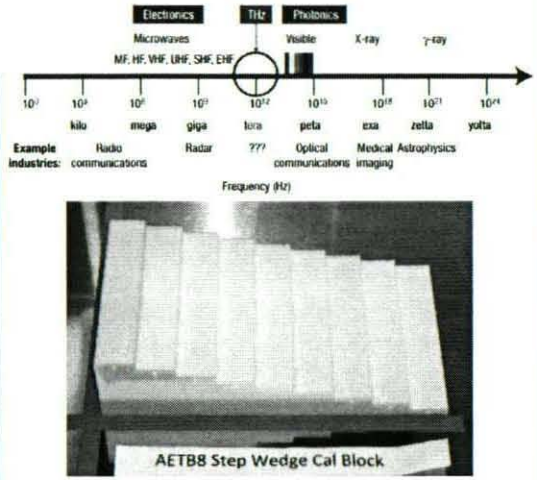
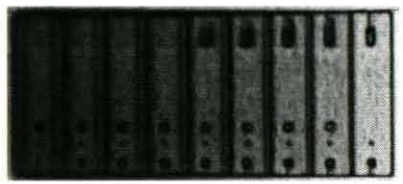
United Space Alliance

Terahertz (THz)

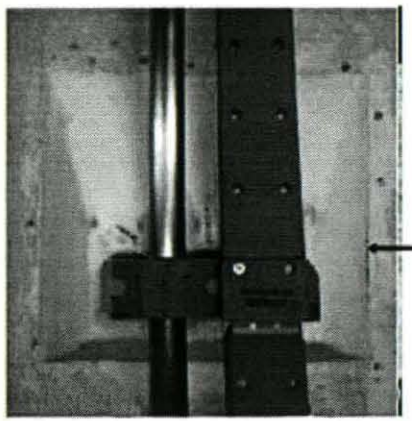
USA
United Space Alliance

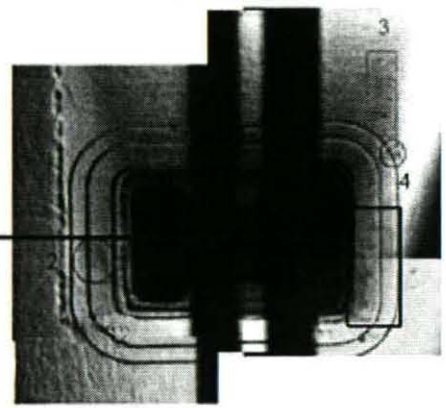
ET-133 Ice Frost Ramps





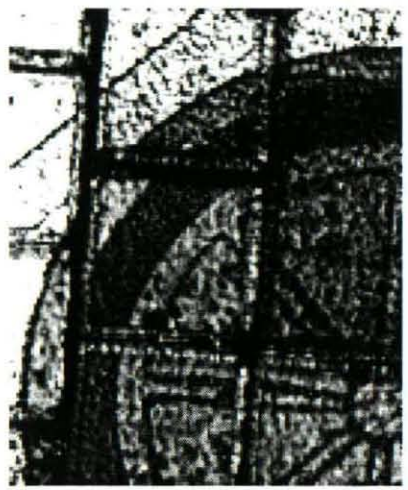
THz image





Corrosion Under Tile

Antenna Structure Under Orbiter Tile



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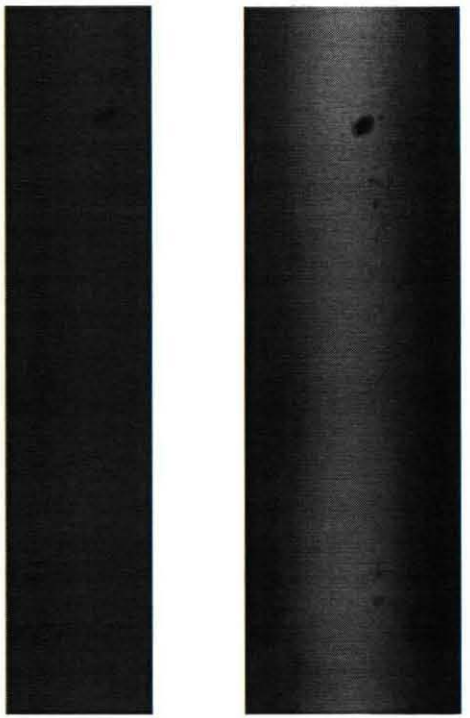
Robotic Inspection Facility

Primary Capabilities:

- **11-axis gantry robot with collision avoidance**
- **Digital X-Ray imaging with solid flat panels, or flexible detector screens**
- **Robotic manipulator tracks part position and adjusts inspection routine accordingly**
- **225 kV x-ray energy: Capable of penetrating 2" of steel and 5" of aluminum**
- **Flexibility to adapt a multitude of testing sensors to robotic masts**



Traditional Film

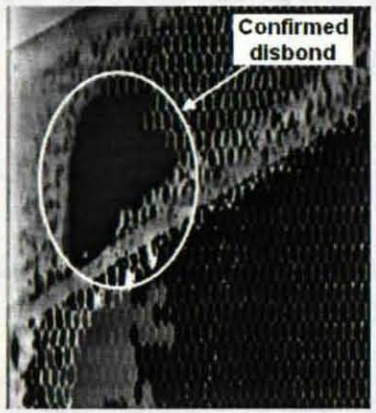
Digital Detector

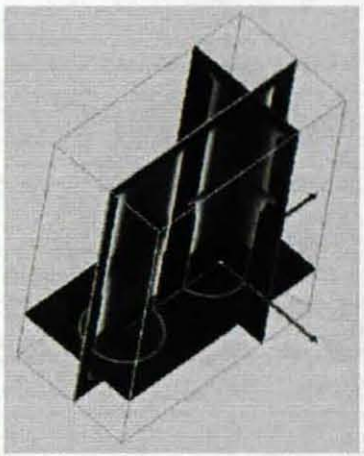
United Space Alliance

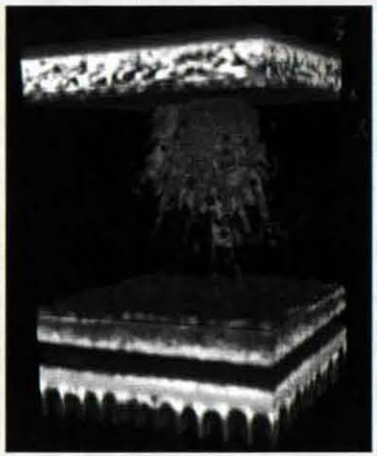
CAT-Scan & Laminography

Computed Tomography (CAT-Scan)

- Object is either secured on turntable, OR
- Robotic gantry can rotate around large stationary objects (up to 21 feet dia.)
- Result: Full 3D reconstruction of entire object volume and its internal geometry

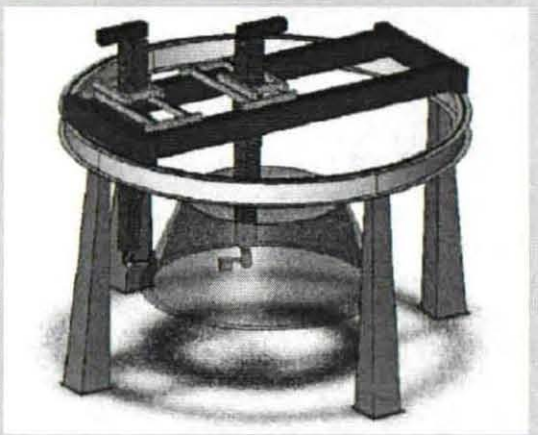




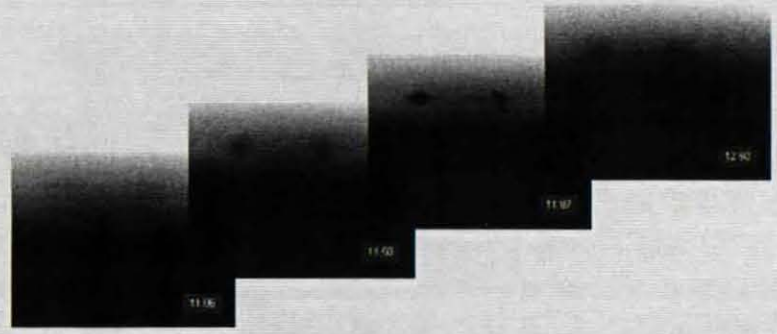


Laminography (Planar CAT-Scan)

- Object remains stationary
- Robot automatically acquires 9 x-ray images around region of interest
- Volumetric reconstruction generates a slice image sequence through part thickness
- Result: Obtain feature depth information, and review indications at greater definition



Traditional Film



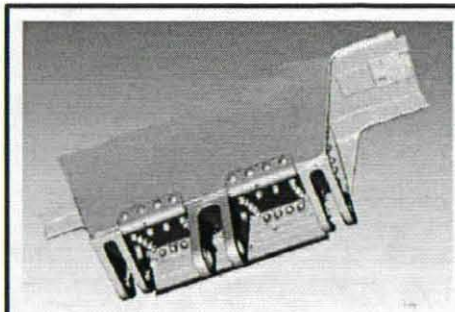
Laminography movie sequence of slice images

United Space Alliance

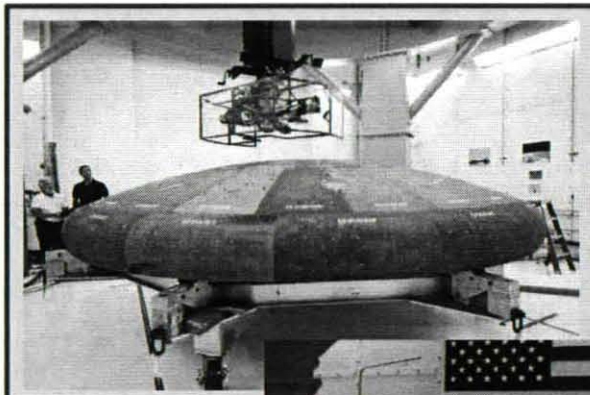
Laser Surface Profilometry

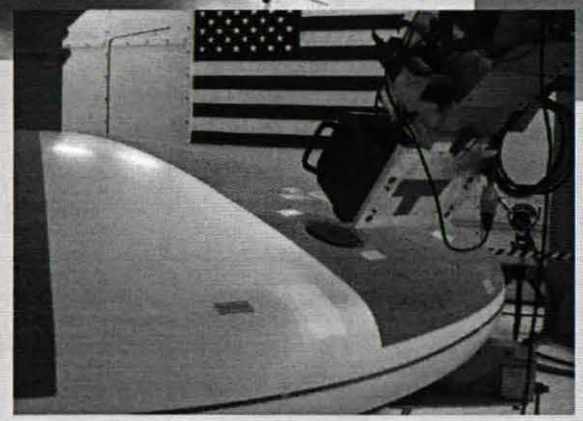
Primary Capabilities:

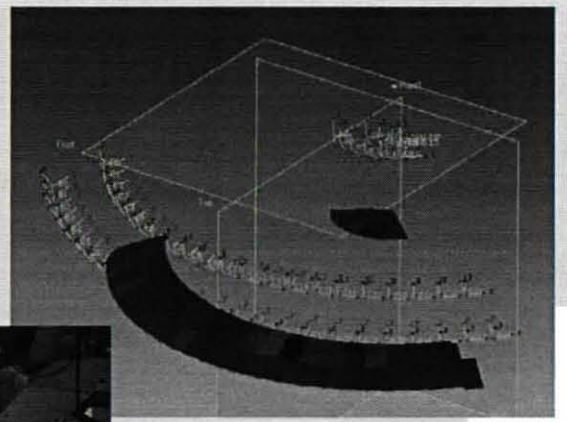
- Robot used to manipulate laser scanner throughout working envelope
- Position coordinates are stored with each scan
- Software automatically stitches resulting scans together
- Highly accurate 3D surface profile +/- 0.002" measurement tolerance
- Comparison against known "gold" standard (dimensional deviation mapping)



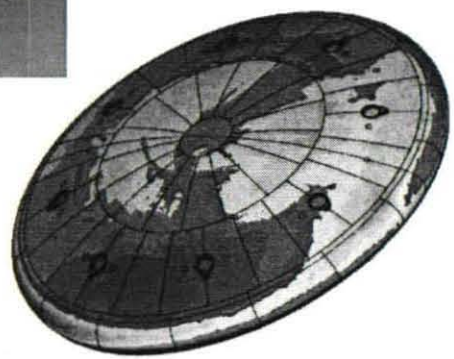
USAF C-5 Galaxy
Wing Spoiler Scan







Orion Capsule
Heat Shield
Profilometry Scan



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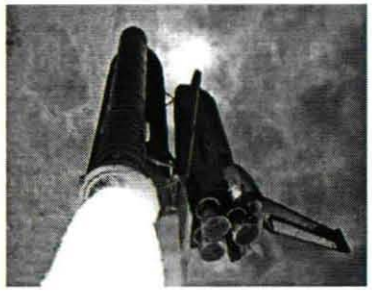
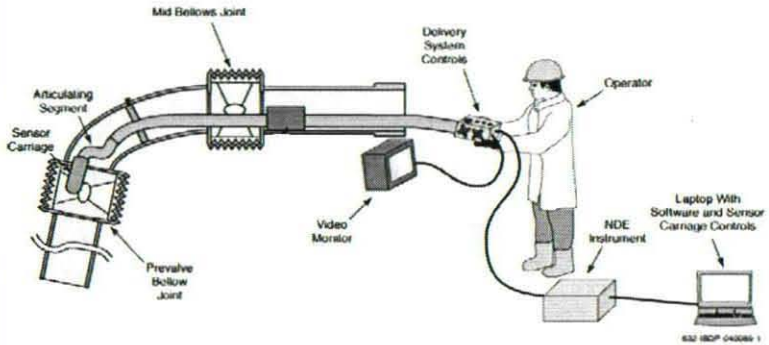
Remote Eddy Current

USA
United Space Alliance

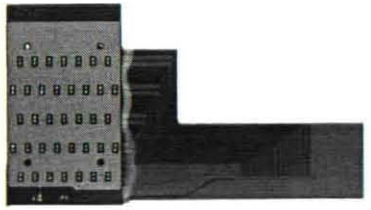


Goal: Inspection of Shuttle Main Engine Feedlines for Cracks

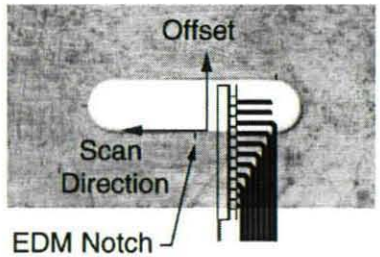
Feedline Flowliner Internal Design



Remotely Controlled Inspection System for Flowliner Slots



Flexible Multi-Element Eddy Current Sensor



Eddy Current Array Scan of Flowliner Slot

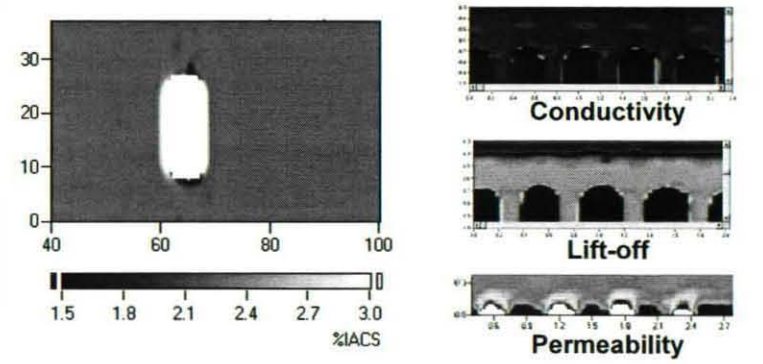


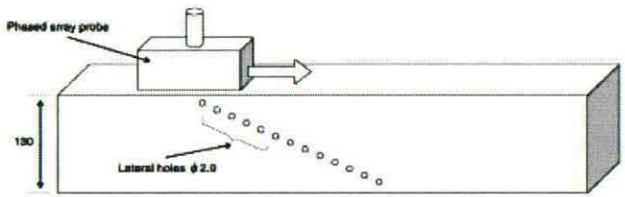
Image-Based Scan Representation

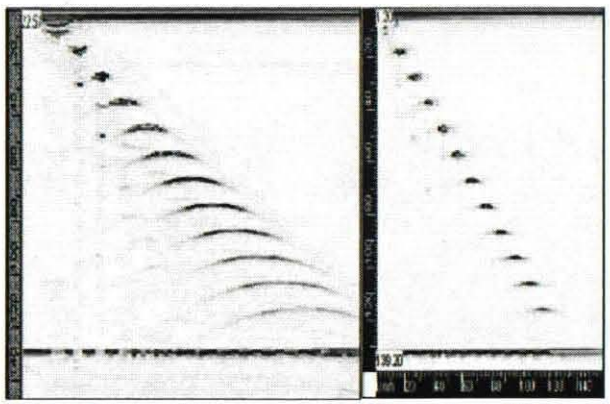
United Space Alliance

Ultrasonic Phased Array

Primary Capabilities:

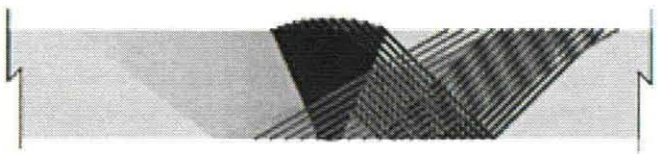
- **Software control of beam angle, focal distance, and spot size**
- **Multiple-angle inspection with a single, small, electronically-controlled multi-element probe**
- **Greater flexibility for the inspection of complex geometry**
- **High-speed scans with no moving parts**





●Without electronic focusing
(Past method: Focus is 25mm)

●Electronic focusing (DDF)



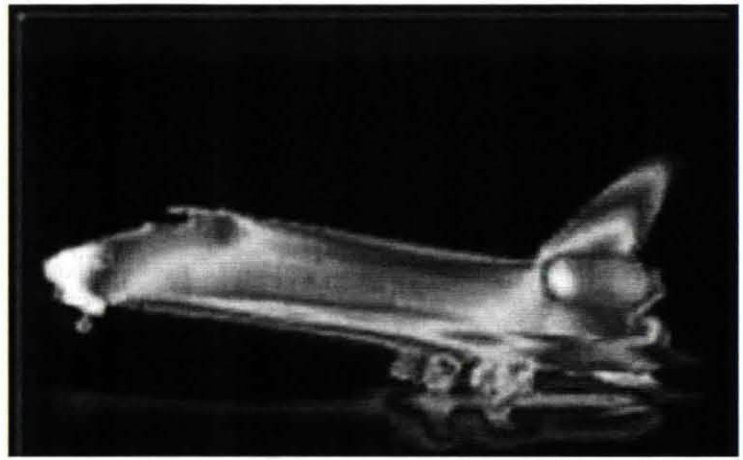
Phased Array scan of Space Shuttle crawler shoe

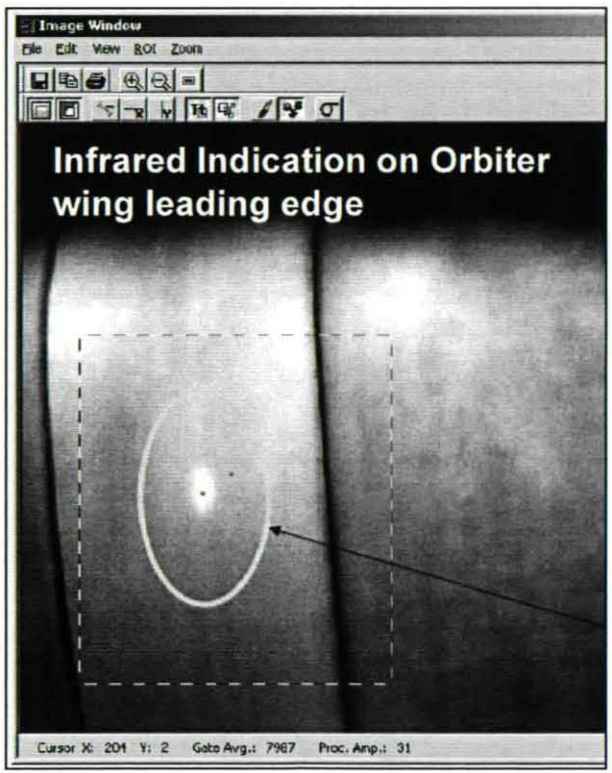
United Space Alliance

Infrared Flash Thermography

Primary Capabilities:

- Time lapsed thermal propagation movies
- Digital analysis of captured data
- Storage for acquired data
- 0 deg and 90 deg thermal imaging of metallic and composite structures
- Detects, disbonds, cracks, liquid levels, etc.



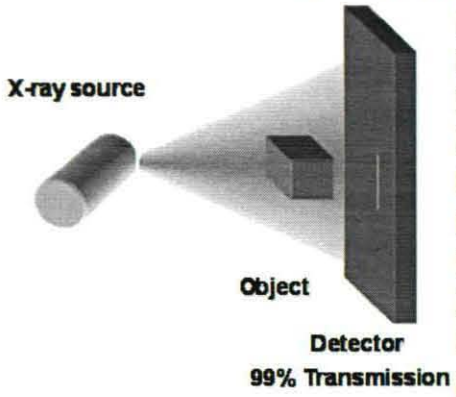


United Space Alliance

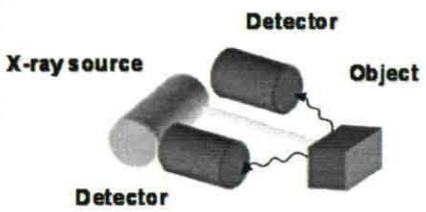
Backscatter X-Ray (BSX)

USA
United Space Alliance

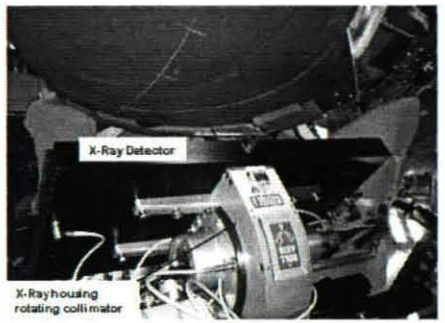
Traditional X-Ray Imaging

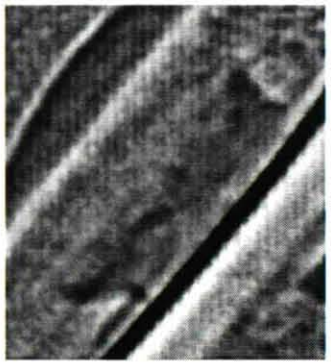


Backscatter X-Ray Imaging

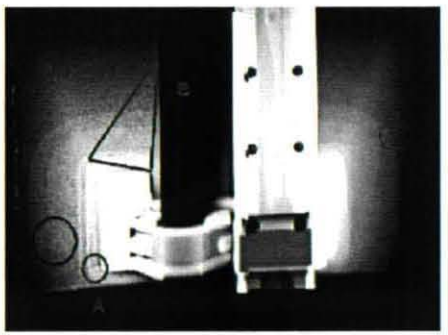


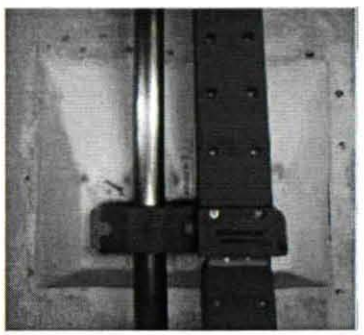
OV-104 Atlantis Nose Cap Chin Panel Repair



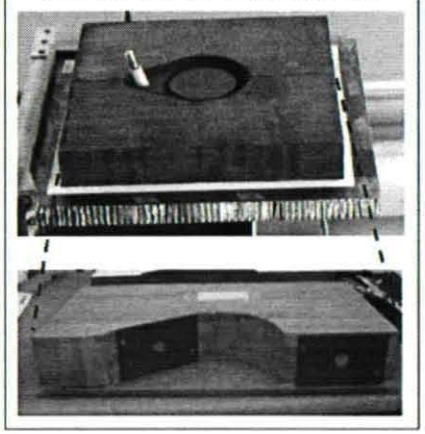


ET-133 Ice Frost Ramps





Orion TPS sample with RTV voids built into PICA block bond line:



Through Transmission

BSX