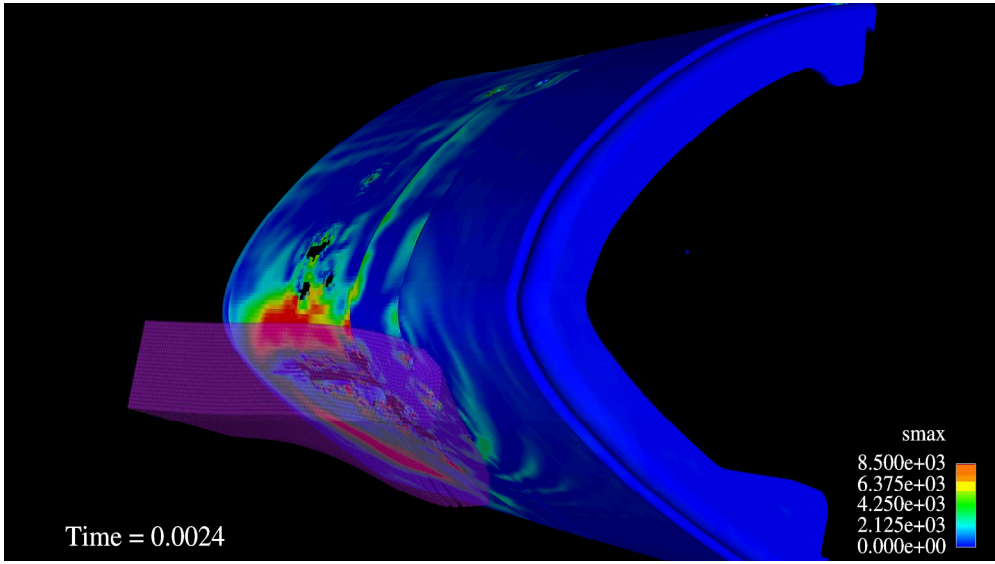
SAND2011-0705C

LDRI Orbiter Inspection System

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Motivation

- Space Shuttle Columbia failed during re-entry (2/1/203)
- Ensuing investigation revealed a piece of foam had pierced the orbiter's wing
- Columbia Accident Investigation Board Recommendation 6.4-1
  - "Accomplish an on-orbit Thermal Protection System (TPS) inspection, using appropriate assets and capabilities, early in all missions."



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LDRI

- Required to provide TPS inspection and 3D measurement capability
- Scannerless Range Imaging system
- First flew on STS-97
- Adapted to meet the return to flight requirements
- Sits at the end of the 50-foot long Orbiter Boom Sensor System (OBSS)

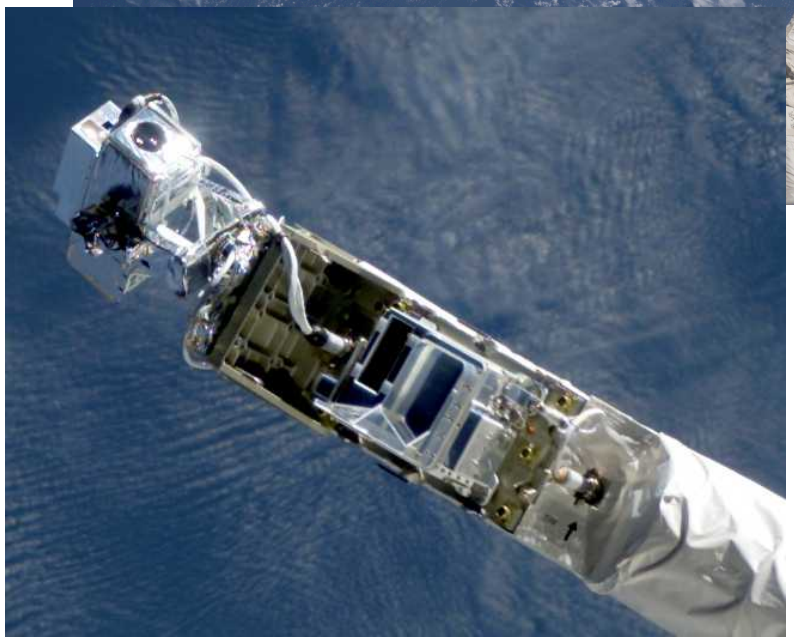

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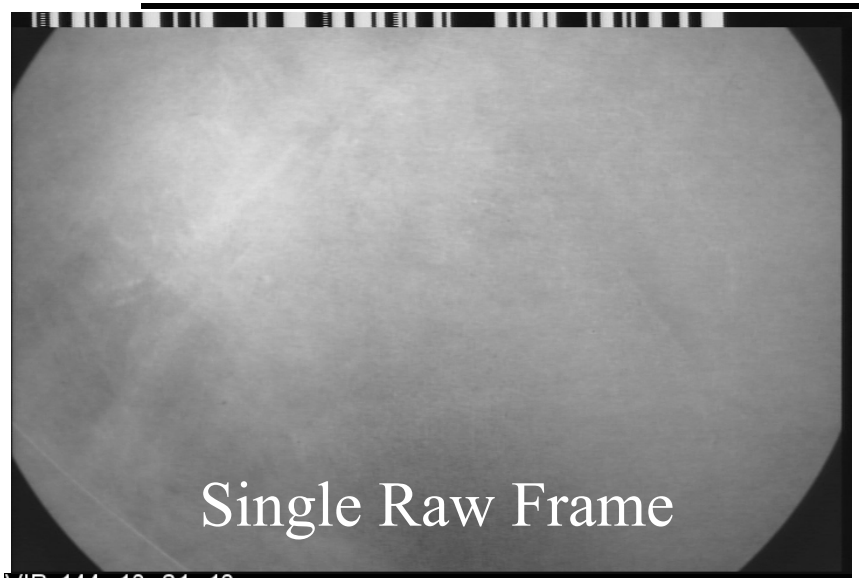
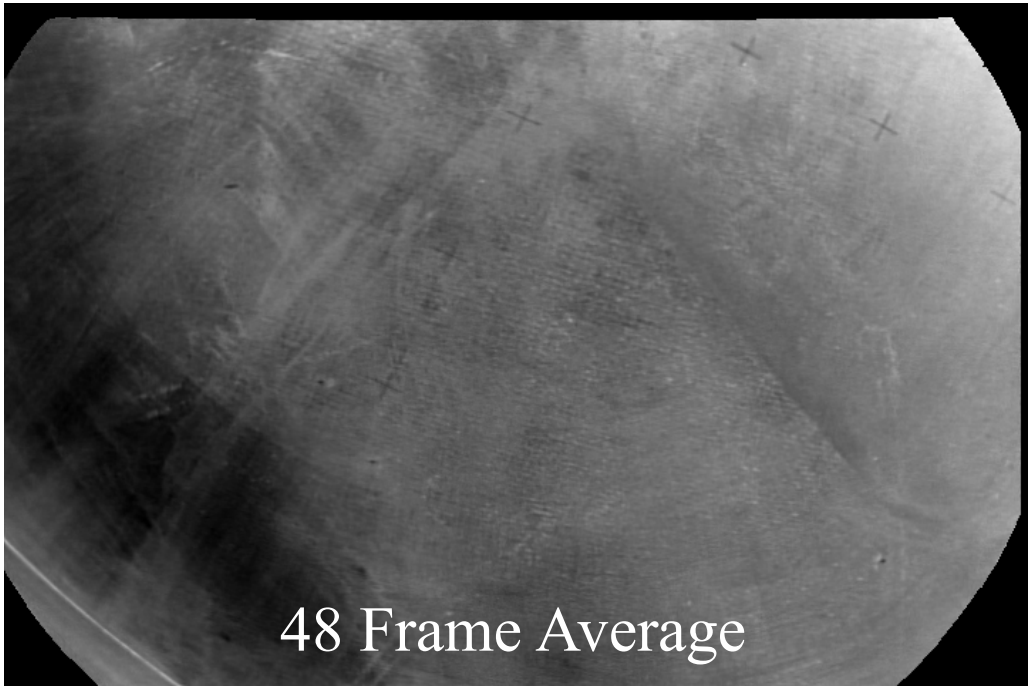
Image Processing





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STS-114

- Return to flight mission and first flight of the LDRI
- Supported by 20+ Sandians at Mission Control in Houston

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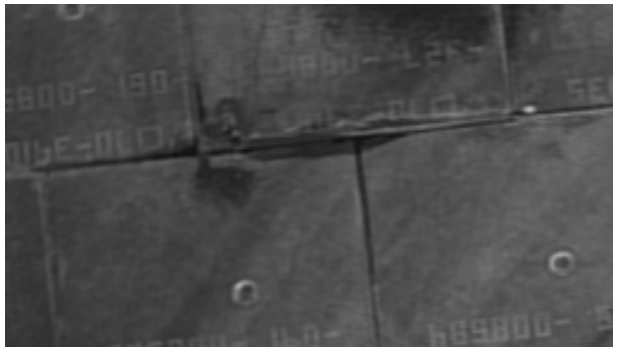
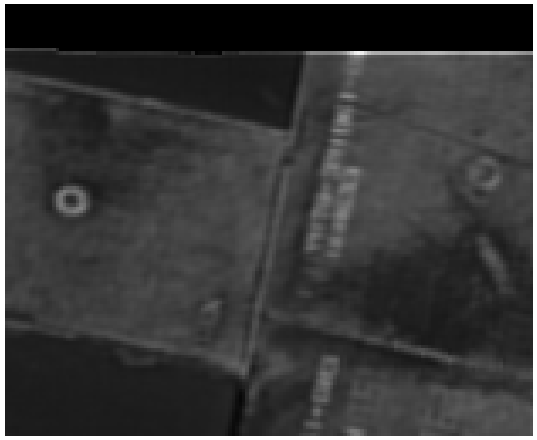
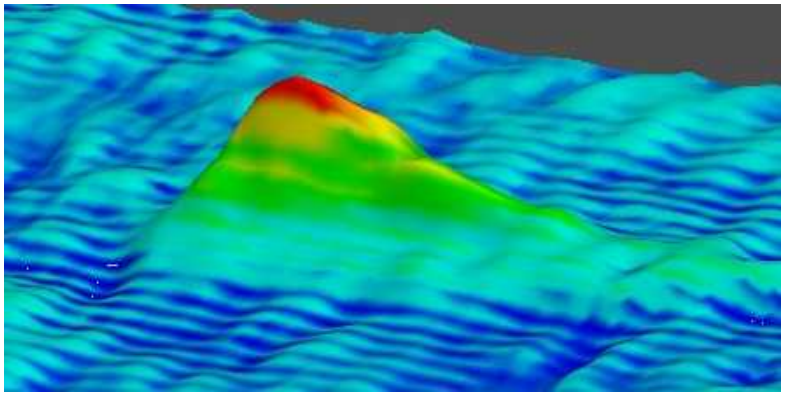
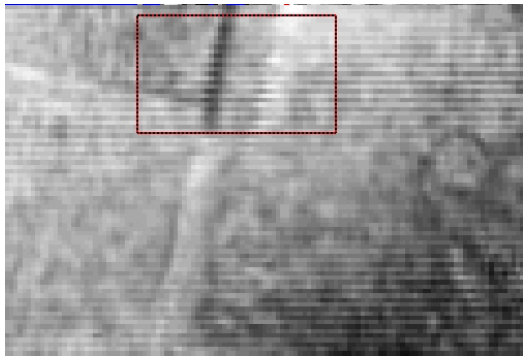
STS-114

- Two pieces of gap filler loosened and were removed prior to re-entry









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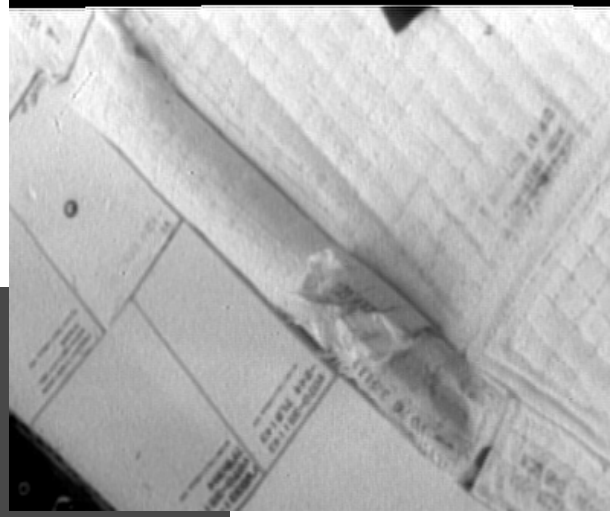
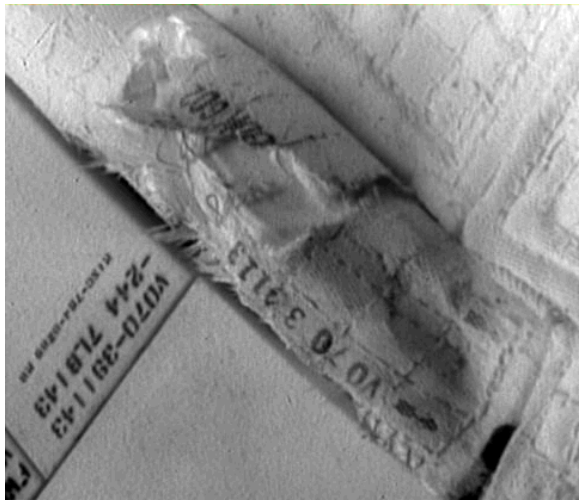
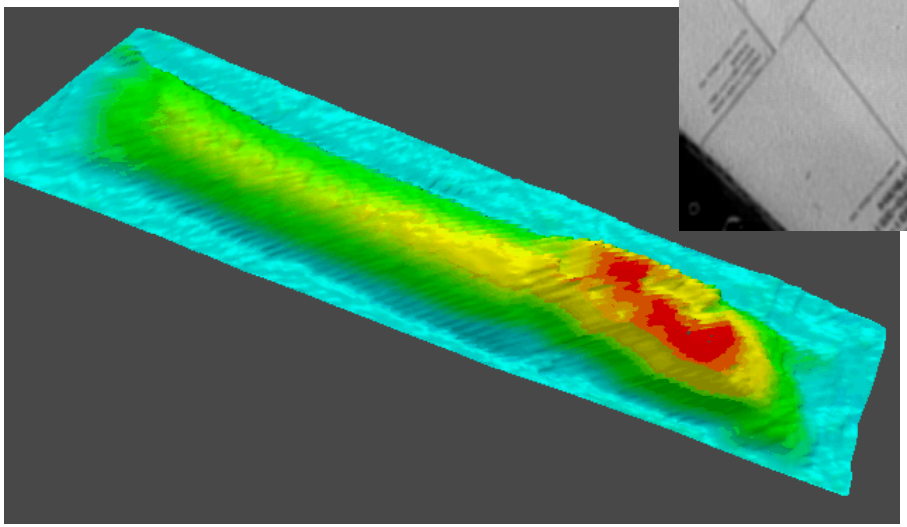
STS-114

- TPS Blanket billowed out due to MMOD strike
- Cleared for re-entry as-is

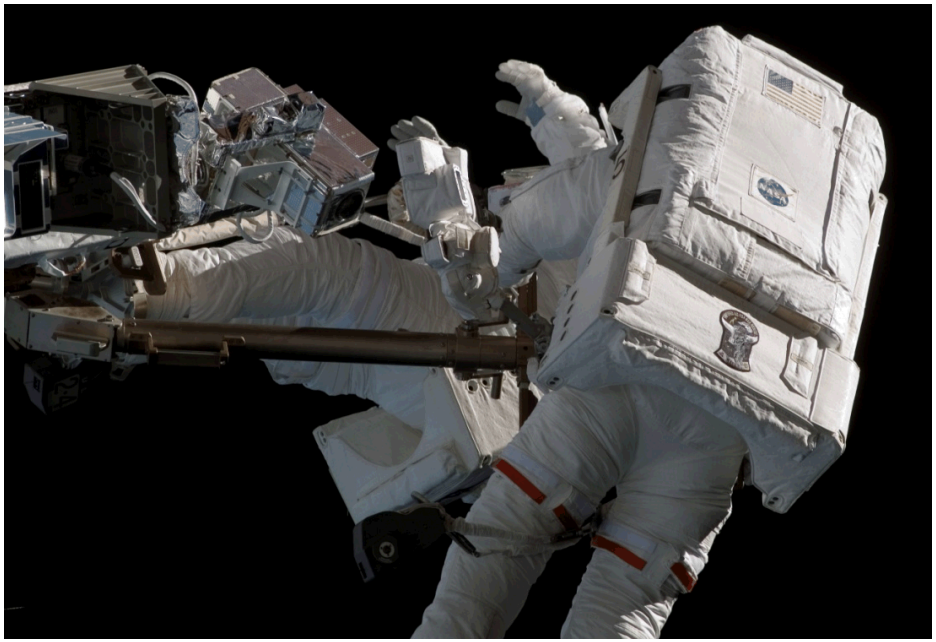


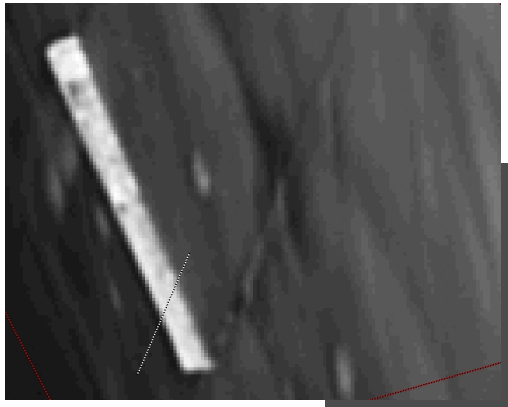


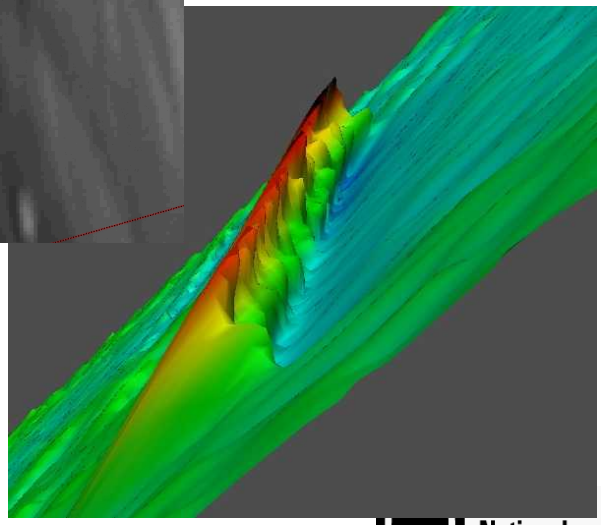


STS-121

- Another protruding gap filler was identified. Cleared to re-enter as-is
- Astronauts tested the OBSS as a work platform

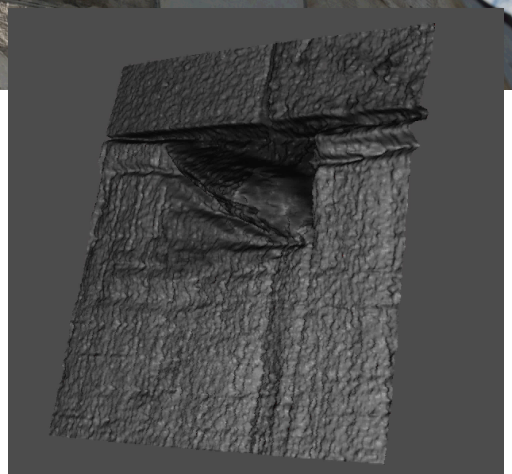






STS-117

- OMS pod blanket partially detached during launch. Repaired during EVA with pins and surgical staples



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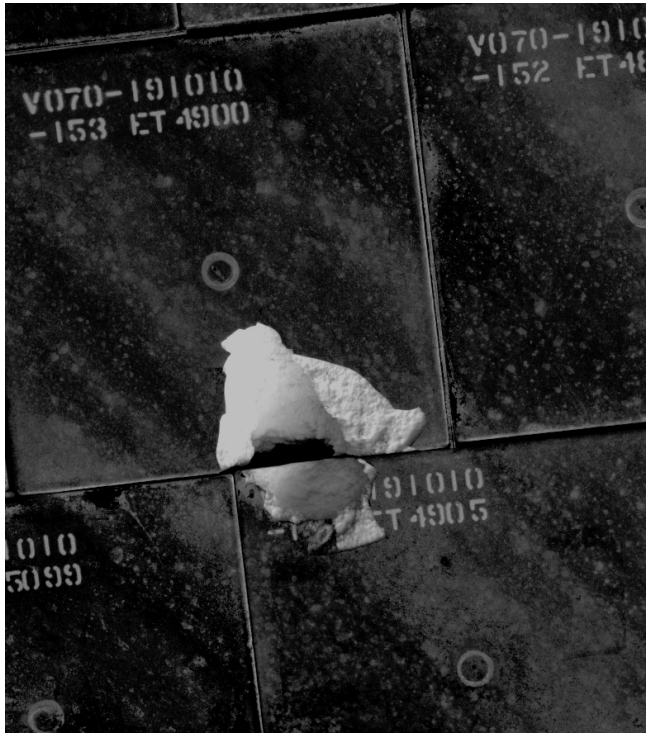
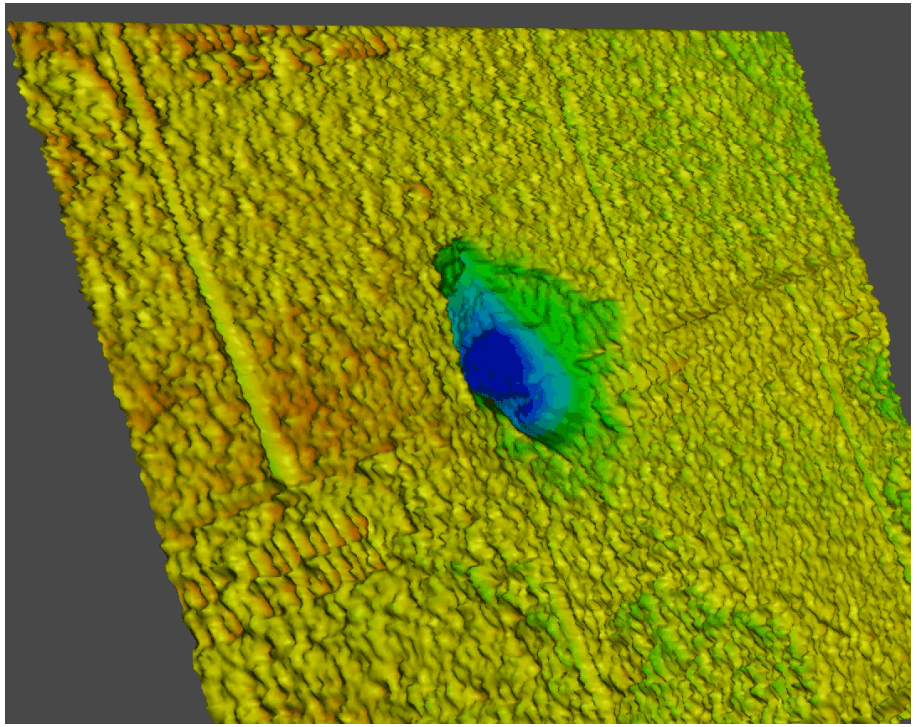
STS-118

- **Belly tile gouge identified and examined. Cleared to re-enter as-is**





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Other Project Milestones

- Supported 19 missions over 6 years with 3 more missions planned prior to the Shuttle's retirement
- Complete software rewrite after the 5th mission
  - Transitioned majority of operations to NASA personnel
  - Reduced Sandia crew from 20+ to 7
- LDRI was left on the Space Station for 3 months with no problems.
- Found alternate data downlink path after the Orbiter's high-speed antenna failed on STS-131
- Team members have travelled during tropical storms and evacuated due to hurricanes