Revitalizing the Space Shuttle's Thermal Protection System with Reverse Engineering and 3D Vision Technology

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- **Abstract:**
- The Space Shuttle is protected by a Thermal Protection System (TPS) made of tens of thousands of individually shaped heat protection tile. With every flight, tiles are damaged on take-off and return to earth. After each mission, the heat tiles must be fixed or replaced depending on the level of damage. As part of the return to flight mission, the TPS requirements are more stringent, leading to a significant increase in heat tile replacements.
- The replacement operation requires scanning tile cavities, and in some cases the actual tiles. The 3D scan data is used to reverse engineer each tile into a precise CAD model, which in turn, is exported to a CAM system for the manufacture of the heat protection tile. Scanning is performed while other activities are going on in the shuttle processing facility. Many technicians work simultaneously on the space shuttle structure, which results in structural movements and vibrations.
- This paper will cover a portable, ultra-fast data acquisition approach used to scan surfaces in this unstable environment. The presentation will discuss the entire process used to produce a quality tile in a fraction of the time and cost of older techniques. After proven successful on the STS-114 mission, the 3D Vision scanning procedure is now used for all three shuttle processing facilities.

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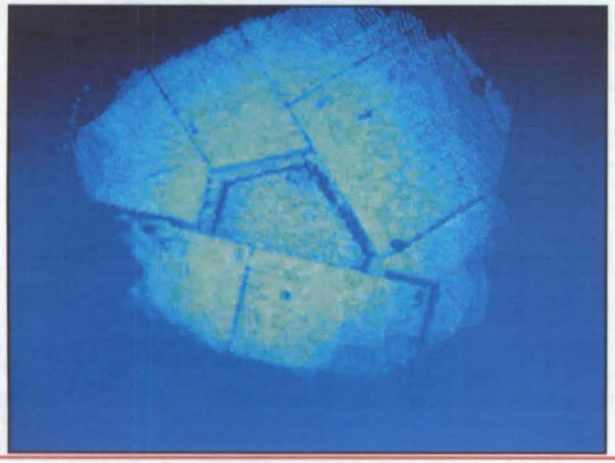

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14. ABSTRACT

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The replacement operation requires scanning tile cavities, and in some cases the actual tiles. The 3D scan data is used to reverse engineer each tile into a precise CAD model, which in turn, is exported to a CAM system for the manufacture of the heat protection tile. Scanning is performed while other activities are going on in the shuttle processing facility. Many technicians work simultaneously on the space shuttle structure, which results in structural movements and vibrations.
This paper will cover a portable, ultra-fast data acquisition approach used to scan surfaces in this unstable environment.

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