



National Aeronautics and
Space Administration



Instrumentation

ShuttleSCAN 3-D

High-Speed Three-Dimensional Laser Scanner with
Real-Time Processing

NASA Ames Research Center offers for license its patented ShuttleSCAN 3-D surface scanning and profiling technology. Originally developed for critical, real-time inspection of damage to the thermal protection tiles of the Space Shuttle, this advanced system can be used for a wide range of commercial applications from product quality control to autonomous navigation. Powered by the onboard Surface Profiling and Characterization Engine (SPACE) processor, ShuttleSCAN provides real-time analysis of surfaces ranging from the small (such as circuit boards) to the large (such as panels or roads).

BENEFITS

- High-speed 3-D scans: Creates more than 600,000 3-D points/second among the highest available
- Fast results: Provides results in real time from the integrated SPACE processor
- Versatility: Scans areas from square centimeters to square meters
- High resolution: Detects details smaller than .001 inch (with smallest field of view architecture)
- Small footprint: The small 7.25 x 5.5 x 5.4-inch size and lightweight package (2.9 lbs) is also power efficient (over 1000 scans from the re-chargeable lithium battery)
- Wireless: Offers 802.11G wireless or Gigabit Ethernet wired connectivity

technology solution



NASA Technology Transfer Program

Bringing NASA Technology Down to Earth

THE TECHNOLOGY

How It Works

The scanner operation is based on the principle of Laser Triangulation. The ShuttleSCAN contains an imaging sensor; two lasers mounted on opposite sides of the imaging sensor; and a customized, on-board processor for processing the data from the imaging sensor. The lasers are oriented at a given angle and surface height based on the size of objects being examined. For inspecting small details, such as defects in space shuttle tiles, a scanner is positioned close to the surface. This creates a small field of view but with very high resolution. For scanning larger objects, such as use in a robotic vision application, a scanner can be positioned several feet above the surface. This increases the field of view but results in slightly lower resolution. The laser projects a line on the surface, directly below the imaging sensor. For a perfectly flat surface, this projected line will be straight. As the ShuttleSCAN head moves over the surface, defects or irregularities above and below the surface will cause the line to deviate from perfectly straight. The SPACE processors proprietary algorithms interpret these deviations in real time and build a representation of the defect that is then transmitted to an attached PC for triangulation and 3-D display or printing. Real-time volume calculation of the defect is a capability unique to the ShuttleSCAN system.

Why It Is Better

The benefits of the ShuttleSCAN 3-D system are very unique in the industry. No other 3-D scanner can offer the combination of speed, resolution, size, power efficiency, and versatility. In addition, ShuttleSCAN can be used as a wireless instrument, unencumbered by cables. Traditional scanning systems make a tradeoff between resolution and speed. ShuttleSCANs onboard SPACE processor eliminates this tradeoff. The system scans at speeds greater than 600,000 points per second, with a resolution smaller than .001". Results of the scan are available in real time, whereas conventional systems scan over the surface, analyze the scanned data, and display the results long after the scan is complete.



APPLICATIONS

The technology has several potential applications:

- Inspection of aircraft and spacecraft fuselage surfaces, wings, etc.
- Autonomous navigation by mobile robots (e.g., Mars Rover)
- Inspection of pipelines (oil, natural gas, water) for corrosion-related defects
- Optical 3-D scanning of printed circuit boards for inspection and positioning
- Scanning reusable metal hardware sealing surfaces to detect flaws that would impact sealing ability
- Scanning industrial machined parts for dimensional accuracy
- Road surface profiling

PUBLICATIONS

Patent No: 7,375,826

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