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TRANS1TION 01' SPACE TECHNOLOGIES TO NDE

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ABSTRACT

Assurance of the integrity and performance of aerospace structures, particularly those that arc made of composite, materials, requires effective NDE techniques that can be applied rapidly over large areas. The service inspection of such structures should be performed at field settings since the removal of components from such structures for N DE at depot or shop facilit ics is not econom ital. When NDE is performed manually, the detection and characterization of defects arc labor intensive, time consuming and tbc results arc subjected to human errors. These limitations of the standard NDE methods arc challenged by the R&D community and efforts arc made to develop portable, user friendl y inspection systems that can rapidly and automatically scan large areas of complex structures and locate all tbc detrimental material condit ions. Addrcssi ng these challenges has been an evolut ionary process that followed the technology trend, and unique devices were developed to support the inspectors in field conditions. This development requires multidisciplinary areas of physics, telerobotics, neural networks, material science, imbedded computing and automated control.

Such interdisciplinary science and technology areas arc being developed and employed at the Jet Propulsion laboratory (JPL). The spacecraft and telerobotic devices that arc involved require unique NDE techniques to assure the success of its one-of-a-kind highly visible missions. The most famous mission, tbc Mars Pathfinder is an example of such space exploration programs. The rover is an example of a JPL telerobotic technology, it can remotely and autonomously perform scanning and probing, which arc key requirements for portable NDE scanners. The JPL missions arc driven by strict cost constraints and require operation at harsh conditions over a distance of many million of miles. Unique methods and instruments that can bc used for effective NDE were developed offering powerful capabil it ics for rapid NDE seaming of aerospace structures. The NDE&AA Lab of JPL is developing and implementing unique NDE technologies and is transferring them to terrestrial applications. These technologies include unique NDE methods, advanced actuators (polymer muscle actuators, ultrasonic motors, etc.), noninvasive medical treatment and diagnostics as wc11 as telerobot ic scanning devices. Recentl y, tbc rover technology was used to const ruct a crawler that is driven by ultrasonic motors and employing suction cups to control its adherence to tbc surface of aircraft structures. For tbc inspection of composite structures of the lander, rover, etc., a rapid leaky Lamb wave NDE method was developed. These examples of the emerging JPL technologies that arc under development for NDE will be reviewed in this presentation.

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