

NASA's Challenges and Needs in NDE and SHM for Human Space Exploration

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NASA's rich history of human spaceflight provides the foundation for today's exploration vision: to maintain U.S. leadership in space, establish a lasting presence on and around the Moon, and pave the way forward to Mars and beyond. NASA Artemis missions will use the Space Launch System, the ORION Spacecraft, and the Human Landing System to return humans to the lunar surface and establish a permanent lunar basecamp. In support of the Artemis missions, NASA's Gateway Program will, through an international collaboration, establish humanity's first space station around the Moon. Accomplishing these ambitious goals will require innovative technologies and systems, some of which have not yet been demonstrated. Advanced materials, structures and manufacturing techniques will be the foundation of long-duration habitats on and around the moon as well as lunar and deep-space exploration vehicles. To successfully perform for extended periods of time in the harsh environment of space, these habitats and vehicles require equally advanced NDE and SHM techniques that can ensure they are both manufactured properly and are able to fully accomplish their mission. These techniques need to be robust and easily operated by astronauts who may have limited NDE experience and are wearing bulky spacesuits. NASA also plans on using robotic technologies to construct certain crucial infrastructure elements for extraterrestrial application. Potential elements to be built include habitats, landing pads and aprons, roads, blast walls and shade walls, and thermal and micrometeorite protection shields using both raw materials from Earth and materials existing on the lunar surface. Automated inspection techniques that can complement the robotic manufacturing of materials is therefore highly desirable. This presentation will discuss in detail some of the needs for advanced NDE and SHM technologies as NASA pursues its vision for the human exploration of space, along with some examples of how these needs have been addressed in the past.