**21-7: Evaluation of Optical Distortion Measurement Techniques for Curved Optical Surfaces**

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**Activity Type:** New Start

**Primary STMD Taxonomy:** TX13.2 Test and Qualification

**Start TRL:** 3 **End TRL:** 5

**Executive Summary:** KSC’s Applied Physics Laboratory has extensive experience in developing distortion measurement tools for flat optics. Based on this experience, we sought to extend this capability to curved optics, and developed a system for measuring distortion in the Artemis astronaut helmet assembly. This early, pre-CIF system was based on an image comparison method capable of discerning 0.125 diopter change variations in the helmet visor optics. However, it didn’t provide the desired noise floor of 0.0125 diopters. This CIF-funded project developed an alternative method with increased, yet user selectable, sensitivity based on moiré interferometry that exceeds the desired noise floor. A visor positioning system was created with a pair of computer controlled rotary stages and an optical system consisting of lighting, a high resolution digital camera, Ronchi ruling, and a focusing mirror. Image processing software was created to determine the distortion from captured images based on changes in the line spacing and thickness. Lastly, a software model capable of predicting results for different curved surfaces was developed, will allow future portability to other curved optics. The details of this system will be released under a NASA Technical Memorandum. The first operational use with a production Artemis visor was conducted mid-April 2022.