

Abstract
Space-Qualifiable Six-Axis Fiber Alignment Technique

A six-axis, laser-weldable fiber alignment technique is described that addresses the need for robust, precision-aligned packaging of fiber-coupled optical devices such as fiber coupled lasers and acousto-optic modulators. Specifically, this alignment scheme incorporates the intrinsic stability and rigidity of laser welded bonds in order to meet the needs of long-term (> 5 years) NASA space flight missions. Common bonding methods that employ epoxies and solders often allow component creep over time, precluding them from being used for missions where misalignment of optical components would be detrimental and in-flight adjustments to the alignment are not practical. The alignment technique described herein utilizes a ball and socket approach, allowing active alignment of an optical fiber through six degrees of freedom. Once the fiber is aligned, it is then laser welded in position. Controlling machining tolerances, weld schedules, and weld order minimizes post-weld shift caused by metal shrinkage, resulting in alignment tolerances that are in the micron to sub-micron regime.