Optical Fiber Array Assemblies for Space Flight on the Lunar Reconnaissance Orbiter

Optical fiber array bundle assemblies are used in a high performance space flight application.

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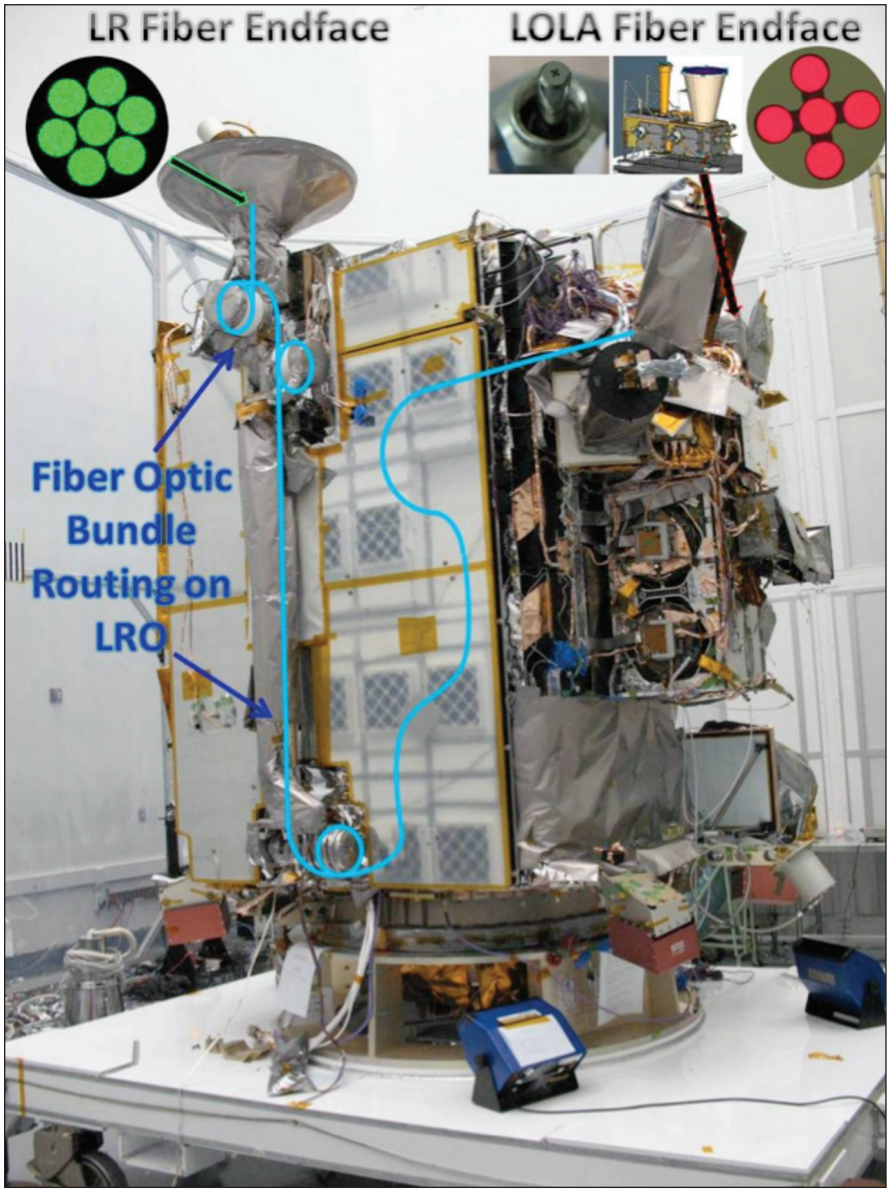
Custom fiber optic bundle array assemblies developed by the Photonics Group at NASA Goddard Space Flight Center were an enabling technology for both the Lunar Orbiter Laser Altimeter (LOLA) and the Laser Ranging (LR) Investigation on the Lunar Reconnaissance Orbiter (LRO) currently in operation. The unique assembly array designs provided considerable decrease in size and weight and met stringent system level requirements.

This is the first time optical fiber array bundle assemblies were used in a high performance space flight application. This innovation was achieved using customized Diamond Switzerland AVIM optical connectors. For LOLA, a five fiber array was developed for the receiver telescope to maintain precise alignment for each of the 200/220 micron optical fibers collecting 1,064 nm wavelength light being reflected back from the moon. The array splits to five separate detectors replacing the need for multiple telescopes. An image illustration of the LOLA instrument can be found at the top of the figure.

For the laser ranging, a seven-optical-fiber array of 400/440 micron fibers was developed to transmit light from behind the LR receiver telescope located on the end of the high gain antenna system (HGAS). The bundle was routed across two moving gimbals, down the HGAS boom arm, over a deployable mandrel and across the spacecraft to a detector on the LOLA instrument. The routing of the optical fiber bundle and its end locations is identified in the figure. The Laser Ranging array and bundle is currently accepting light at a wavelength of 532 nm sent to the moon from laser stations at Greenbelt MD and other stations around the world to gather precision ranging information from the Earth to the LRO spacecraft. The LR bundle assembly is capable of withstanding temperatures down to –55 °C at the connectors, and 20,000 mechanical gimbal cycles at temperatures as cold as –20 °C along the length of the seven-fiber bundle (that is packaged into the gimbals). The total bundle assembly is 10 meters long with two interconnections requiring precise clocking of the seven-fiber array pattern.



The integrated **LRO** showing the optical fiber bundle routing, the locations of the array assembly connectors, and the location of the LOLA instrument. Also pictured are 400X magnification images of the optical fiber array endfaces at the approximate locations in which they are integrated.

This work was done by Melanie Ott and Adam Matuszeski of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). *GSC-15930-1*