Linden Photonics Inc.

Optical μpackaging

**Subject: Linden Photonics awarded a Phase II SBIR contract to develop Next Generation Aircraft Wiring Insulation**

**Aircraft Harness History & Problems**

Teflon/Kapton/Teflon (TKT) composite tape insulation was introduced in 1992 (Specification No: MIL-W-22759). It consists of three layers of tape helically wound on stranded nickel plated copper wire. Kapton is used for strength and dielectric properties. Teflon surrounds the kapton since kapton suffers severe hydrolysis and arc tracking problems. TKT insulation suffers from three major problems. 1) Tape construction abrades when it is pulled through conduits during installation since the tape edges catch even on small protrusions. 2) Tape composite is difficult to center – it starts to unravel and exposed kapton suffers severe hydrolysis. 3) Cost; and the inability to reduce cost since it has a single supplier – Dupont.

**Linden's Solution**

The problem with TKT construction can be solved by using extruded insulation, but thermoplastics insulations in the past have not met temperature, arc tracking and hydrolysis requirements. Linden Photonics proposes the use of a new class of high temperature, high strength materials, Liquid Crystal Polymers (LCPs), for use as extruded wire harness insulation, with the following properties: no thermal degradation up to $450^0$ C; very high tensile strength; excellent chemical stability; no hydrolysis problems even at elevated temperatures; extrudes well therefore low cost. Electrical properties, are excellent – dielectric breakdown voltage is 90 kV/mm vs. about 25 kV/mm for teflon and kapton. Testing shows that Linden's multilayer extruded insulation passes wet arc tracking and cut through tests.

**Weight Reduction**

LCPs are mechanically strong – close to the strength of some ceramics – so that insulation thickness can be reduced without compromising harness strength. Alternately, thickness of the metal wire could be reduced since much of the harness strength would accrue from the LCP insulation and not the wire – again reducing weight. Weight reduction is of primary importance to the program offices since a combat aircraft may have as much as 100 miles of harness on board.

**Phase II Testing**

Linden will conduct performance testing to demonstrate capabilities of two extruded constructions (Linden has filed patent applications for both designs): (a) Multilayer, LCP, fluorocarbon, extruded insulation; (b) Single layer LCP/fluorocarbon blended extruded insulation.

**Partners**

Linden will be partnering with major aircraft component manufacturers throughout the phase II effort.

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