



### 2.3.3 Connectors

The connectors must be physically aligned and there must be good contact between two fibers in order for there to be no discontinuity in the glass light guide.

Their capacity to be resistant to environmental conditions (surviving launch, the space environment and sometimes planetary landing) is important.

Diamond products are presented below.

Two connectors are proposed for evaluation and qualification under ECSS standards: the Mini-AVIM and AVIM connectors. The end of the program, anticipated by Q1 2012, should see the finalization of two detailed specifications.

## 3 Procurement procedure

Diamond has identified three principal phases and thus proposes three types of quality grades.

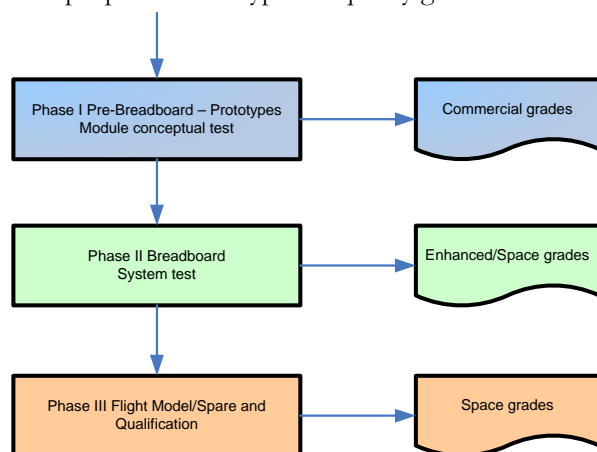


Fig. 3 Project phases

At this point in time, there are no standards for optical harness components. Some are in preparation but are due at the earliest in Q1 2012.

Therefore the harness must be qualified each time.

Diamond currently offers termination services, testing/qualification services and consulting services which correspond to its expertise.

Thanks to our efforts in the evaluation and qualification work carried out under the ESTEC contract, we expect to simplify the requirements for procurement.

## 4 Diamond products

Diamond is a well known developer and producer of optical connectors. The company was established in 1958 and has been the market leader in high quality optical connectors since the 1980s.

Information on the past projects can be found on our website.

### 4.1 AVIM

The AVIM connector was developed for an avionics application in the early 90's and has since survived several space missions. It is used on the space shuttle and included in various space missions.

This connector has been used in other harsh environment applications.



Fig. 4 AVIM connector and mating adapter

The full specification can be found on the Diamond website at:

[http://www.diamond-fo.com/en/markets\\_space\\_avim.asp](http://www.diamond-fo.com/en/markets_space_avim.asp)

### 4.2 Mini-AVIM

The Mini-AVIM is a recent addition to our space catalogue and has been developed as a lighter and smaller version of the AVIM. It contains the same ferrule and locking mechanism principle with a smaller package made entirely of titanium



Fig. 5 Mini-AVIM connector and mating adapter

The full specification can be found on the Diamond website at:

[http://www.diamond-fo.com/en/markets\\_space\\_miniavim.asp](http://www.diamond-fo.com/en/markets_space_miniavim.asp)

### 4.3 DMI-Space (Q1 2011)

The DMI-Space is a recent addition to our space catalogue. It has been partially tested by NASA and will be released by Q1 2011. It is a more robust version of the DMI connector, with all mechanical parts made from titanium, except the spring clip which is made from coated CuBe. It has by far the smallest and lightest proposed footprint.



**Fig. 6 DMI-Space connection (two connectors and a mating adapter)**

The full specification will be published by Q1 2011

## 5 Quality grades

To respond to the various phases, different grades have been defined. Each corresponds to a different quality process and has a different price.

The difference in prices between commercial → enhanced → and space grades are 1x, → 5x, and → 10x. This applies to termination services only.

### 5.1 Commercial grade

This process applies to telecom performance and optical performance, which are guaranteed through use in similar conditions. The telecom industry has thoroughly standardized the performance / environment and our datasheet corresponds to these established qualities.

### 5.2 Enhanced grade

- Custom-ageing through cycling during production
- Laser-engraved connectors
- 25% additional quantity to cover batch rejects
- Batch travel card

### 5.3 Space grade

- Product Identification Document (PID) containing
  - Bill of Materials
  - Optical performance
  - Screening test adapted to configuration
  - Non-conformance table for qualified product (if available) or customer specification (if provided) and batch acceptance test suggestion with offer (delta qualification).
- Production and Test Schedule (PTS)
- Certificate of Compliance
- Batch Screening Test report containing
  - Interferometric report for each connector
  - Parameter values before and after test with pass/fail criteria

## 6 Conclusion

We have presented the various components that comprise an optical harness and how they are standardized in the telecommunication and space industry.

A procurement procedure has been presented and should be used to request the proper grade for termination.

This white paper is published on our website and will be updated continuously with new information on this subject. Please note the version number in the bottom left of every page.

## Resources

1. *Optical Fiber Assemblies for Space Flight from the NASA Goddard Space Flight Center, Photonics Group*, Melanie N. Ott et al., ISROS 2009
2. *Evaluation test programme for optical fiber connector sets*, ECSS Basic Specification No. 2263010
3. *Gore Flexlite™ 1.2mm* datasheet