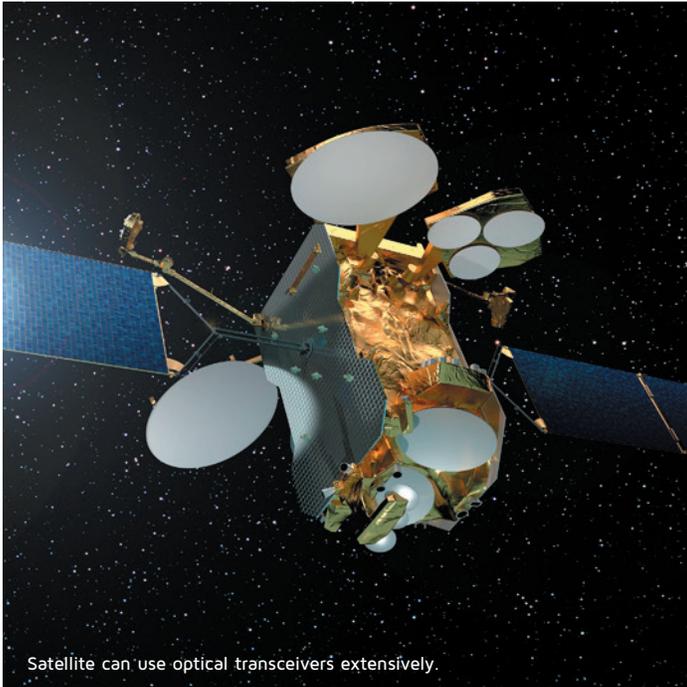


Optical interconnect within space vehicles in geostationary orbit



A new generation of Ka band geostationary communications satellite.

New generation communication multibeam satellites can have numerous Ka band spot-beams. Those multibeam satellites have an increased number of data lanes that can themselves support higher baud rate because of higher transmission frequency.

Information streams are directed from one beam to another inside a data processing switch. The data transfer rate of these switches is very high: high-throughput satellite deal with bandwidth of up to 1 Tb/s.

Optical interconnect solutions reduce payload weight and harnessing complexity.

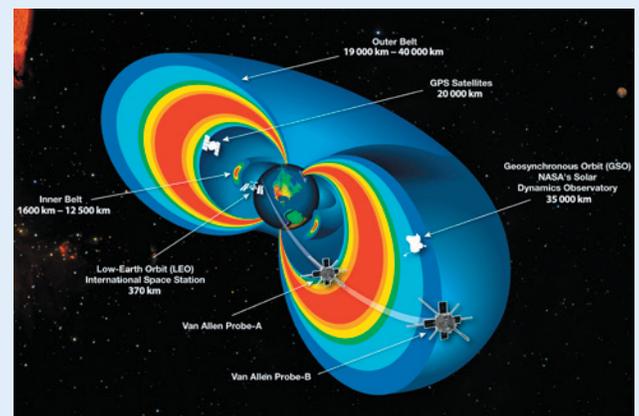
Digital payloads can be made more flexible if all the spot beam signals goes through switches. The same payload can be "repurposed" more easily from one client application to another, thus giving a faster ROI to payload developers and enabling more economical solution for satellite operators.

Optical interconnect makes high-throughput multibeam Ka band satellite a cost-effective solution and *SpaceABLE* and the *SpaceCONEX* radiation-resistant optical transceivers, with their intrinsic radiation resistance, are the best COTS optical interconnect for geostationary space vehicles.

Description of the application

When components, like embedded optical transceivers are deployed in space on a satellite or on a space vehicle, they are exposed to both protons and heavy ions from cosmic rays and solar flares. Unlike most electronic equipment designed for terrestrial use, hardware deployed in space must be radiation resistant.

Geostationary satellites are deployed at an altitude 36 000 km, hence, they are not affected by the radiation present in the two Van Allen belts. They, nonetheless have to contend with solar and cosmic radiation for the duration of their mission without incurring downtime.

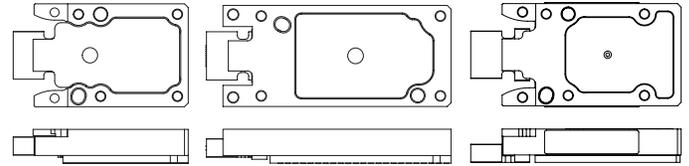


Van Allen belts representation.

SpaceABLE radiation-resistant optical transceivers

Leveraging its expertise in embedded optical communication modules for defense and aerospace, Smiths Interconnect is offering radiation-resistant optical transceivers aimed at the space market with the *SpaceABLE™* and *SpaceCONEX™* "radiation resistant" line of products.

We are taking environmental threats seriously when it comes to qualifying our radiation resistant modules and this is why we have placed so much effort on testing for heavy ions, protons and gamma rays. Reflex Photonics radiation resistant or "Space-grade" transceivers are engineered to withstand radiation doses >100 krad (Si). Furthermore, all our devices are tested following ECSS process and lot acceptance testing, and component pre-screening can be done for every batch of transceivers sold for this application.



Real size for *SpaceABLE* 10G SL Series 4TRX, 12TX, and 12RX (left), *SpaceABLE* 10G SL Series 12TRX (center), and *SpaceABLE* 28G 4TRX (right).

Space qualification tests summary

- **Proton testing:** Total Non-Ionizing Dose (TNID)
- **Heavy ion testing:** Single Event Effect & Latch-up (SEE and SEL)
- **Gamma Ray using Cobalt-60:** Total Ionizing Dose (TID)
- **Random vibration:** NASA GEVS, GSFC-STD-7000A
- **TVAC:** Vacuum < 5E-5 hPa
- **Outgassing:** ECSS-Q-ST-70-02C

SpaceABLE™ also passed standard *LightABLE™* qualifications

- **Vibration tests** per MIL-STD-883, Method 2007.3
- **Mechanical shock tests** per MIL-STD-883, Method 2002.4
- **Thermal shock tests** per MIL-STD-883, Method 1011.9
- **Damp heat tests** per MIL-STD-202, Method 103B
- **Cold storage tests** per MIL-STD-810, Method 502.5
- **Thermal cycling tests** per MIL-STD-883, Method 1010.8

Space qualification program technological partners



Benefits of using *SpaceABLE* optical solutions

- Meet highest level SWaP requirement.
- Smallest transceiver on the market, low weight
- SEE: heavy-ion tested.
- TID: Gamma rays tested.
- TNID: high energy protons tested.
- ECSS/ESCC/NASA standards
- Lot acceptance tests
- 12-lane parallel optical transceiver
- Up to 28 Gbps/lane
- Operation temperature from -40°C up to 85°C



Transceiver used in this application

SpaceABLE 10G SL Series 4TRX, 12TX, and 12RX, *SpaceABLE* 10G SL Series 12TRX, and *SpaceABLE* 28G 4TRX.

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