

After 60 years today's space market encompasses not only traditional space companies but private ventures promising and, in some cases, providing launch services, space tourism, the commercialisation of near zero gravity and the introduction of constellations of low earth orbiting satellites delivering high speed connectivity and near real-time imagery.

Space is one of a few sectors where growth has remained remarkably resilient and this has been possible due to an increasingly diverse range of satellite enabled broadcast and connectivity services, while government/institutional customers have continued to seek to improve the ability to navigate, monitor and observe the environment, climate, resources and each other.

The desire to be able to do this must be supported practically, safely and affordably. The space market is a complex eco-system of orbital networks, ground support and control and of course the most noticeable, the ability to launch and position satellites into precise orbits so they can begin interplanetary journeys.

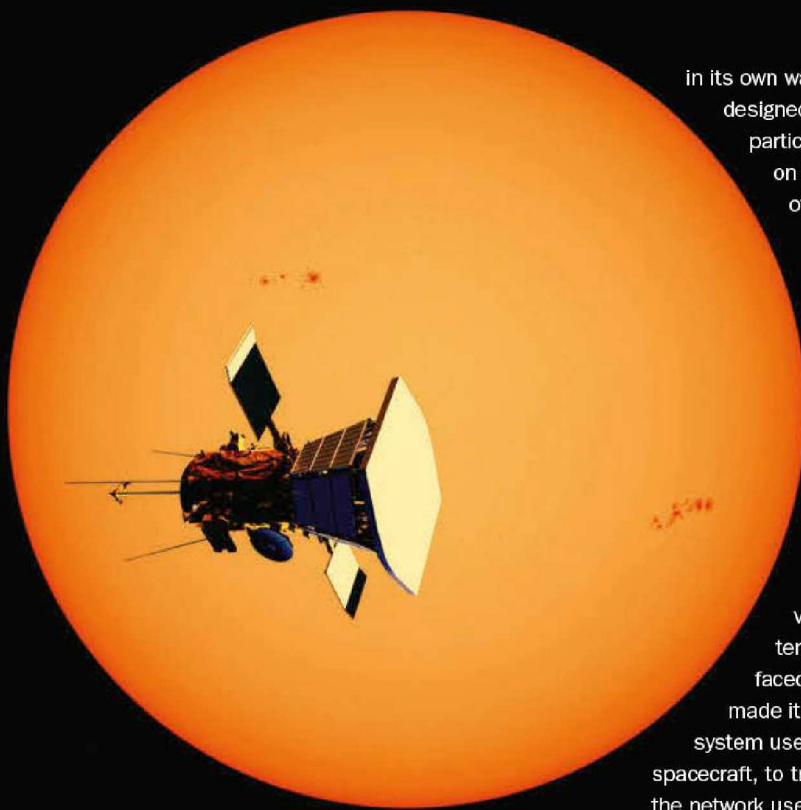
From the early space flight heritage in 1968 (the Olympus satellite), through the first ESA qualification in 1975, to today, Smiths Interconnect has provided connectivity products and expertise to prime and equipment contractors who produce the launch vehicles, payloads and ground systems. The company's solutions have been integrated into over 800 satellites and deep space probes.

That engagement has been built on a number of critical steps that have included the establishment of ESA qualification that commenced in 1975 and which remains today, as well as investments in processes, facilities, product development and skilled staff who conceive, design, produce and ensure the efficacy and reliability of the products where failure is simply not an option.

It is not an option in space

# Resilient growth within space technology

A leading supplier to the space industry Smiths Interconnect understands the need for high reliability in harsh environments, as **Alan McNeil and Roberta Rebora** explain



Above: NASA's Parker Solar Probe

applications, because there is no physical access for maintenance, and they cannot be returned to base for repair. Such harsh environmental conditions require space products and systems to be highly rugged, reliable, and durable. They require that the primary functions, like navigation and communication are supported by the safest and most high performing connectivity solutions of all the mission-critical systems.

## Unique designs

Each of the product types supplied by Smiths Interconnect is unique

in its own way with almost all designed specifically for a particular application based on our understanding of the rigours that the products are expected to endure during manufacture, test, launch and the mission itself.

For example, ruggedised D-sub miniature connectors, supplied by Smiths, are designed to withstand the high vibration and extreme temperature fluctuations faced in space – and have made it possible for the data system used on NASA's Orion spacecraft, to transmit more data than the network used in the Space Shuttle era while also eliminating extraneous signal noise.

Orion, part of NASA's Artemis programme, also uses Smith's ultra-reliable KA family of PCB connectors in its power systems, featuring Hypertac Hyperboloid technology.

The shape of the contact technology (a basket of wires) allows the socket points to be completely surrounded by the length of the mating pin. This provides a far greater and a more reliable contact surface than in traditional connector designs which means that there is less likelihood of contact failure even when

the component is subject to extreme mechanical shock and vibration.

The company's high-speed D-sub connectors and harnesses were part of NASA's successful Orion test flight to conduct a full-stress test of the Launch Abort System (LAS). The test proved that Orion could pull astronauts to safety in the event of an emergency during launch.

The connectors had to withstand the extreme levels of mechanical shock and vibration produced by the LAS and test data from 890 sensors was sent in real-time to ground sites, as well as recorded by 12 on-board data recorders for evaluation by NASA scientists.

Smiths Interconnect's microwave high power waveguide circulators, loads and transitions are also being used within the data and control transmission systems of the Parker Solar Probe, a NASA robotic spacecraft. It was launched in 2018, with the mission of repeatedly probing and making observations of the outer most part of the Sun's atmosphere. In 2024 it is expected to approach to within 3.83 million miles from the centre of the Sun, achieving a top speed of about 430,000 miles (700,000km) per hour.

The Parker Solar Probe has just successfully completed its second close approach to the Sun.

In the Cosmo SkyMed Second Generation constellation that has been orbiting since December 2019, the company provided high performance microstrip circulators embedded into the active antenna Transmitter/ Receiver modules, as well as low profile solderless interposers for the core electronics of the satellite. The interposer's reduced size adapts well to limited space constraints, allowing for a smaller, lighter design of the main equipment and easy installation and replacement.

Also included were high performance coaxial isolators for the equipment payload, as well as right angle spring probe connectors for the

antenna harnessing connection. These connectors provide streamlined routing of the cable harnessing, simplifying the antenna's mechanical structure and allowing for a plug-in modular approach.

These connectivity solutions are equipped with IDI spring probe contact technology, designed to optimise performance in high reliability, multi-cycle applications while offering excellent resistance to shock and vibration.

### Manufacturing challenges

Space standard design and test approaches allow delivery of highly reliable products by ensuring the capability of the product before it enters into service. The manufacture of space products is challenged by what most would consider extreme product requirements for faultless operation and maintenance.

In May 2019 Smiths Interconnect committed to create a centre of excellence in Dundee for product qualification and testing. The investment demonstrates the company's optimum commitment towards being world class and the partner of choice for such innovative connectivity solutions.

The laboratory offers a one-stop shop for critical qualification and testing of Smiths Interconnect's products in Europe. The structure is equipped with in-house multipaction

Above: Smith Interconnects' high speed D-sub connectors



testing and SRS mechanical shock testing system, both in dedicated and environmentally controlled areas.

The facility can now replicate deep space in terms of vacuum and heat with high power amplifiers and vacuum systems. It can therefore analyse high power devices that are used in space with regards to their breakdown voltage behaviour in a vacuum or near-vacuum environment.

This effect, called multipaction, can render a device useless and, thus degrades the reliability of the satellite. Being able to offer multipaction testing is a major benefit and a real point of competitive differentiation for Smiths Interconnect.

The facility also has a machine that can replicate the G-force for a rocket launch to assess what happens to products when they are launched. At maximum shock testing the SRS shock testing equipment generates up to 105dB+ of noise, and therefore requires a special soundproof room. Being in a dedicated and controlled area allows the use of the equipment to its full capacity during normal working hours for the first time.

Radioactive sources can also be used in the laboratory to simulate the sun's radiation which is quite a complicated test process.

In summary, in space applications, whether satellites, manned space flights, or ground support equipment, high reliability in really harsh environments is a necessity.

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Below: The SpaceNXT MWC connector

