

## Application report



Tesat Spacecom has been putting its trust in Ersas selective soldering technology for more than 20 years

*The space mission Sentinel 2 – with Tesat equipment on board – transmits data using laser technology.*

## Pioneer passion for space!

As one of the market leaders in the field of communication engineering payloads for satellites, Tesat-Spacecom can look back on 50 years of experience in aviation and aerospace. Around 1,100 employees develop, manufacture, integrate and test systems and devices for telecommunication via satellite on the 60,000 m<sup>2</sup> site in Backnang, Swabia.

More than 700 successful aerospace projects, many in cooperation with the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt DRL), have been completed by Tesat Spacecom. The Swabian company has been relying on selective soldering technology from system supplier Ersas since 1998 – and have flown well with it.

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*Friendly takeover: Ersa ECOSELECT 2 replaces the VERSAFLOW 40/50 (in the background).*

More than 700 aerospace projects, over 2,500 devices in orbit, in total more than 350 million operating hours in space – the balance at Tesat Spacecom GmbH & Co. KG, which last year returned revenue figures of 300 million euros and is celebrating “70 years at the Backnang site” in 2019, is extremely impressive. Alongside complete systems, the Tesat product range includes highly reliable devices such as travelling wave tube amplifiers, multiplexers, switches and modulators which are delivered to all leading satellite manufacturers around the globe. More than half of all telecommunication satellites in orbit have Tesat devices on board. The Swabian space pioneers were also involved on 21st February 2008, when aerospace history was written with the set-up of a laser link between two satellites in low earth orbit (LEO): the German radar satellite TerraSAR-X and the US-American defence satellite NFIRE, both equipped with laser communication terminals (LCT) from Tesat-Spacecom, set up the first orbital laser link in history that day. The jubilee terminal and success story “LCT135” can send data at a speed of up to 1.8 Gigabit per second – over distances of up to 80,000 kilometres! Fast, safe and perfectly noise-immune. Even if both satellites are moving away from each other on different orbits at absolute orbit speeds of around 30,000 kilometres per hour.

When a satellite is being prepared for launch into space, every single little detail has to be just perfect. Because once the satellite is in space, direct access is no longer possible – when in position at over 900 km above the earth (the Inter-

national Space Station ISS orbits the earth at a height of around 400 km), it will be around one hundred years before the service life of the satellite is spent and it falls back to earth, in geostationary orbit (height of 36,000 km) this is extended to several million years!

#### ABSOLUTE ZERO DEFECT RATE

Understandably, the requirements made on aerospace technology have always been extremely demanding – on account of radiation every single satellite component has to hold its ground for years under tough conditions in space. As a result, all the components undergo very extensive testing on the ground, where failures will lead to costs of a few hundred or 1,000 euros – but are comparatively easy to eliminate. This is different in space, where problems directly lead to immense cost explosions. With comparatively few possibilities of influencing anything. For this reason, an absolute zero defect rate applies to Tesat production including electronics manufacturing. This means right down to the tiniest of switches and connectors, and applies to each individual PCB as well of course. Even the tiniest of production faults can have fatal consequences and has to be avoided at all costs.

#### Facts

##### Tesat-Spacecom

**Revenue:**

300 million euros

**Employees:**

1,100

**Space projects:**

more than 700

**Devices in orbit:**

2,500

**Operating hours in space:**

over 350 million

[www.tesat.de](http://www.tesat.de)



*The Tesat Spacecom plant in the heart of Backnang.*

Setting for trouble-free production.



Tesat Spacecom's vision is to be constantly exploring new paths, boldly and with a passion, looking for pioneering solutions that go beyond current standards – not only in terms of the final products but including development and production too. Thus Tesat Spacecom examines various production areas at regular intervals to see whether automation can be advanced in any way. In the 1990s they recognised early that it would be necessary to get as far away as possible from manufactory production methods in soldering in particular. The processes that were under consideration had to be made more independent and optimised – in terms of quality and speed as well as costs. "In 1998 Tesat Spacecom decided in favour of a VERSAFLOW 40/50 selective soldering system – this system, that Ersa had launched on the market only two years previously, was relatively unknown in the branch, but had those responsible at Tesat Spacecom completely convinced," says Meinrad Eckert, who has been Area Sales Manager for Ersa for 35 years.

And he goes on: "In addition, an infra-red camera was installed in our first selective soldering system, which already registered the energy flows during soldering and established the thermal load on the components – including appropriate documentation, quite literally a real highlight." Even if this option made up one third of the actual machine price, it was absolutely vital in order to prevent components intended for orbit becoming damaged during automatic soldering. "This initial worry was unfounded, however. In the meantime, our technicians for electronics manufacturing have the necessary experience and can say on the basis of microsections that the automated soldering spots are just as good or even better, and also have a lower thermal load," says Helga Eich-Beetz, Team Leader Infrastructure at Tesat Spacecom. The documentation is important and necessary since it enables traceability down to the individual assembly. Otherwise things could get difficult, because Tesat provides a 15-year guarantee for its components and assemblies, which means all manufacturing protocols have to be stored for this long period.

The weight, power and small size of the CubeLCT makes new big data applications possible for CubeSats: With a size of only 0.3 U (approx. 10 x 10 x 3 cm) and a mass of about 350 g it is able to set up a direct connection to a downlink station over a distance of up to 1,500 km – at data rates of up to Mbit/s.



#### CHANGE ON THE FLY FOR ERSA ECOSELECT 2

Following 20 years of trouble-free operation, the life cycle for the VERSAFLOW 40/50 at Tesat Spacecom came to an end as 2018 drew to a close. There were no plans to return to manual soldering, however, which would not have been permissible unless the company had been prepared to risk its aerospace approval status. Rather, a change on the fly took place at the Backnang site at



20 years of trouble-free production: Ersa VERSAFLOW 40/50 in the electronics manufacturing line at Tesat-Spacecom.

the turn of the year 2018/19, with the production line converting to another selective soldering system from Ersa: a compact ECOSELECT 2 which makes maximum positioning and process reliability possible in the same way as its predecessor. The system had already been purchased in 2013, but it was in operation for a business partner who was manufacturing for Tesat Spacecom. Since the beginning of 2019, the compact selective machine has been manufacturing at the Swabian site, with qualification and approval for soldering being granted within a few weeks in the fourth quarter of 2018 so that there was no production downtime at all.

The trend is moving towards smaller satellites in space, particularly at the comparatively low height of the earth orbit. It goes without saying that space pioneer Tesat Spacecom is setting new trends in this field, too: Building on more than 30 years of experience in the continual development of laser communication technology, the Tesat experts have developed new solutions for communications in space – smaller, smarter, more versatile for numerous new application areas. These include dedicated laser communication terminals for Low Earth Orbit applications for use in large satellite constellations as well as for so-called Cube-Sats – small, cube-shaped earth observation or scientific satellites in the format 10 x 10 x 10 cm weighing less than 1,000 grams. What all terminals have in common is the intention of reducing size, weight and costs while retaining functionality. The first Cube-Sat from Tesat Spacecom is expected to be launched in the first quarter 2019. Either way – the requirements for the mini satellites are just as

high as for their larger counterparts, including those related to the new mobile telecommunications standard 5G.

#### CONVERSION TO LEAD-FREE SOLDERING TECHNOLOGY PLANNED

At the moment, Tesat Spacecom electronics manufacturing still relies on leaded technology. Initial trials are under way, however, to convert to lead-free. These are taking place in parallel to ongoing production, because selective manufacturing in Backnang is a single-source solution. Tests in the real environment of the Ersa demonstration and application centre in Wertheim am Main are planned for 2019, so that a second line will be available sooner or later. Whereas in the past production of a single satellite could take up to a year, Tesat Spacecom is already planning for one satellite per day. "We are of course delighted that our VERSAFLOW 40/50 worked so reliably for 20 years – had the control failed, we would hardly have been able to provide an adequate substitute within one day. This is no problem in the case of ECOSELECT 2, since we stock spare parts for more than ten years and our service department is prepared for all eventualities," says Ersa Sales Manager Meinrad Eckert. Global communication will only be possible via space in future. Tesat Spacecom is the first company in the world to develop and supply devices for optical broadband communication in space which can currently achieve high transmission rates of 5.5 Gbit per second. Whatever the requirements for soldering on the ground in Backnang are, Ersa is ready as a reliable partner for all electronics manufacturing issues. ■

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