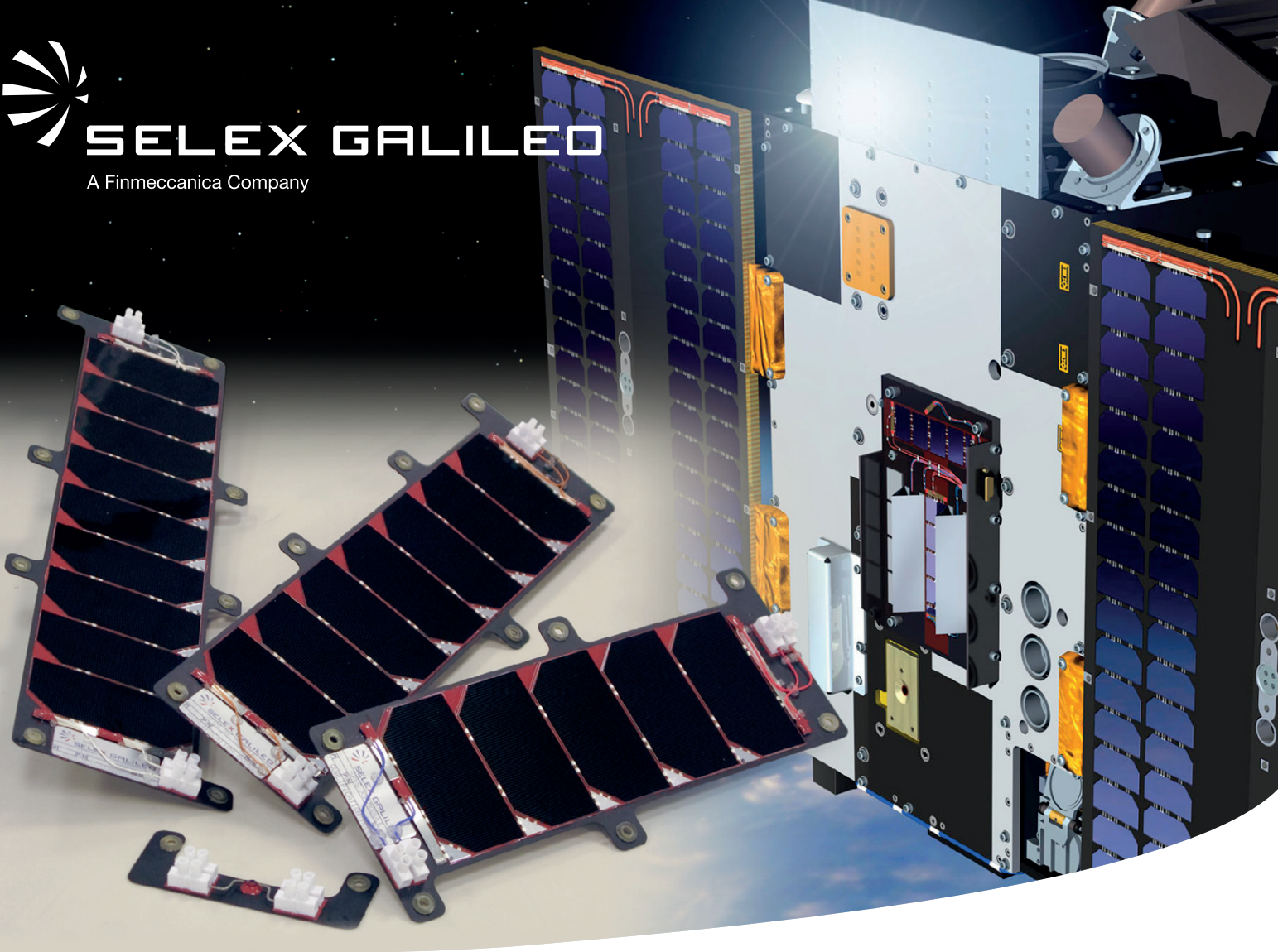




SELEX GALILEO

A Finmeccanica Company



SPVS™ - SPACE PHOTOVOLTAIC SHEET

PLUG AND PLAY SOLAR GENERATORS FOR SMALL SATELLITE APPLICATIONS

SPVS™ is a modular solar generator which is made up of building blocks that can form solar cell strings of different lengths. The resulting networks are dedicated to small satellite applications.

SPVS™ has been optimized so it can be adapted to different structures and mechanical constraints, without losing a good balance between performance and cost. SPVS™ uses a GaAs TJ cell on an Al substrate based solar generator instead of the traditional one integrated onto composite CFRP+Al substrate. Each module is autonomous in terms of the supporting structure and connection terminals, as a blocking diode can be directly mounted at the end of the last module for each string. Furthermore the electrical connection between modules and cell strings to the spacecraft (S/C) is simplified by the use of small terminal blocks.

SPVS™ weights between 90g and up to 140g for the largest configuration.

Three standard module sizes are currently available; made up of five, seven and nine series cells. This provides a total

module area from around 26 cm by 9 cm and up to 45 cm by 9 cm for the largest (excluding fixation winglets). In addition, another small module of 2 cm by 9 cm can be installed at the end of each string on the blocking diode function.

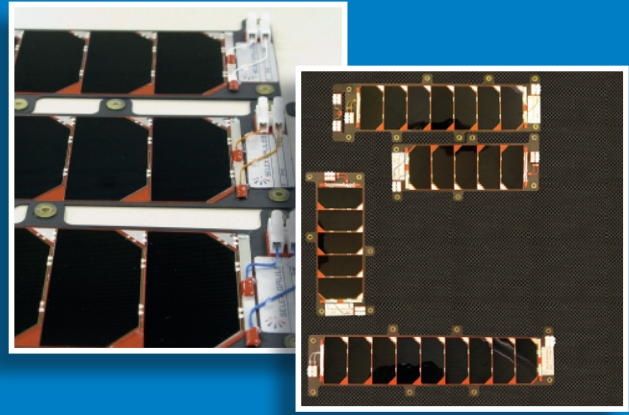
The core of the SPVS™ is the state of the art European triple junction GaAs on Ge solar cell, manufactured by AZUR Space GmbH. This has an average conversion efficiency of more than 28% (AMO, 28°C).

The system is low cost but is still capable of wide Low Earth Orbit (LEO) application scenarios (e.g. atomic Oxygen resistance, demanding vibration and fatigue constraints and very low outgassing) guaranteed by an ad hoc materials and processes selection.

An ongoing qualification campaign allows the solar generator to be suitable for a generic LEO application. The verification includes sine and random vibes, pyro-shock test, thermal vacuum and shock cycles and all the necessary intermediate electrical and mechanical checks. The final product together with qualification data will be available on the market in the second half of 2010.

SELEX Galileo is a key player in Photovoltaic Assembly (PVA) design and production, with a proven capability to supply state-of-the-art fixed solar array.

In 2006, the Company increased its PVA production area to approximately 600sqm, with a manufacturing capability of up to 60,000 / 80,000 solar cells per year. Solar panels are installed on most of the latest ESA, ASI and CCNES programmes: Rosetta, ATV, PROBA, Herschel and Planck, ADM Aeolus, GIOVE A, Lisa Pathfinder, GAIA, Sentinel-3 and the LEO constellations such as Cosmo SkyMed and Pleiades.



TECHNICAL CHARACTERISTICS

Modules' characteristics

Module size (series cells):	5 – 7 – 9.
Mass vs Power ratio:	14 [g/Watt]
Solar cell average efficiency:	28% (27% module efficiency)
Electrical performances:	PMP = 1.1 W/cell
Mission life time:	Up to 10 years (40.000 equivalent LEO fatigue cycles)
Operations:	Low Earth Orbit (400÷1000 Km) ATOX resistant design

Modules' materials and components

Substrate:	Al 6082 alloy 1 mm thickness black hard anodized
Solar cell Assembly (SCA):	AZUR 3G 28% GaInP2/GaAs/Ge TJ solar Cells CMG AR 100 µm Coverglasses Ag plated Invar Interconnectors
Silicon Diode Assembly (SDA):	AZUR BPD external silicon diode CMG 100 µm uncoated glasses Ag plated Invar Interconnectors
Blocking diodes:	1N5811 JANTXV
Wires:	acc. ESCC 3901020-3901012
Terminal box:	high reliable plastic component capable to survive more than +120°C continuous operation and up to +150°C for short duration

Delivery schedule

3 months from acknowledge of receipt of order.

Company heritage:

More than 100.000 solar cell assemblies operating in orbit since mid 90's.

Qualification plan

Insulation, Electrical Performance measurement and Electrical Health Checks.

Vibration Test (Resonance search, Sinusoidal, Random)

Shock Test

Thermal Vacuum Test

20000 Ambient Pressure Cycles

Thermal Vacuum Cycles

Resonance search:

Test frequency range:	from 5 to 2000 Hz
Test time:	1 sweep; 2 octave/minute
Test level:	0.5 g

Sinusoidal Vibration:

Test frequency range:	from 5 to 100 Hz
Test time:	2 sweep UP and DOWN; 2 octave/minute
Test level:	from 5 to 21 Hz: 11mm (0-peak) from 21 to 60 Hz: 20 g from 60 to 100 Hz: 6 g

Random Vibration:

Test frequency range:	from 20 to 2000 Hz
Test duration:	2 minutes
Test level:	20 Hz: 0,013 g ² /Hz from 50 to 800 Hz: 0,08 g ² /Hz 2000 Hz: 0,013 g ² /Hz
Global RMS:	10grms

Shock levels:

100 Hz:	20 g
1500 Hz:	2000 g
10000 Hz:	2000 g