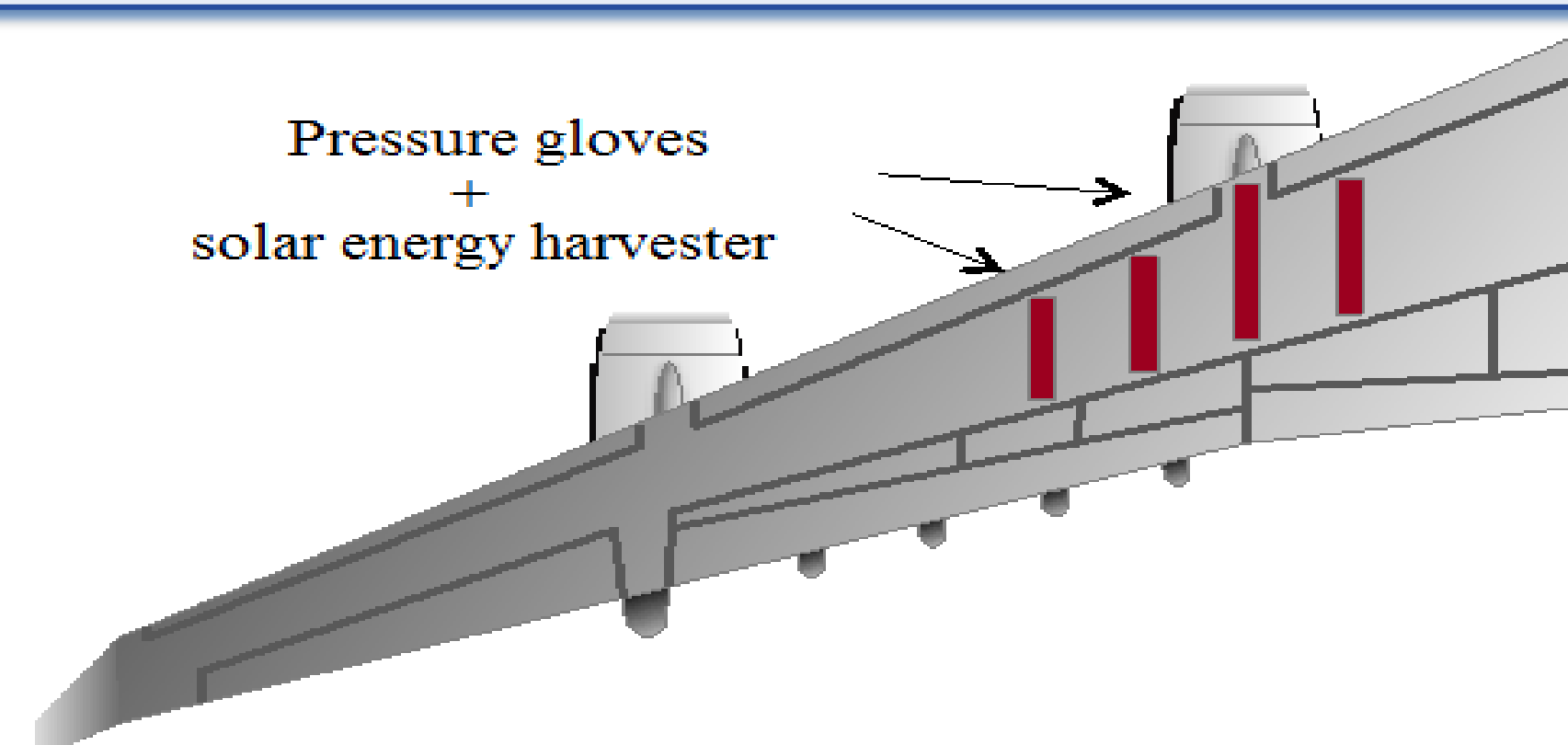


Photovoltaic Power Supply for an Airliner Wireless Sensor Network

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General description: An **autonomous, battery-free** power supply which captures, manages and stores energy using **photovoltaic** cells and **supercapacitors** to supply pressure sensors belt on top of an **airliner's wing**.

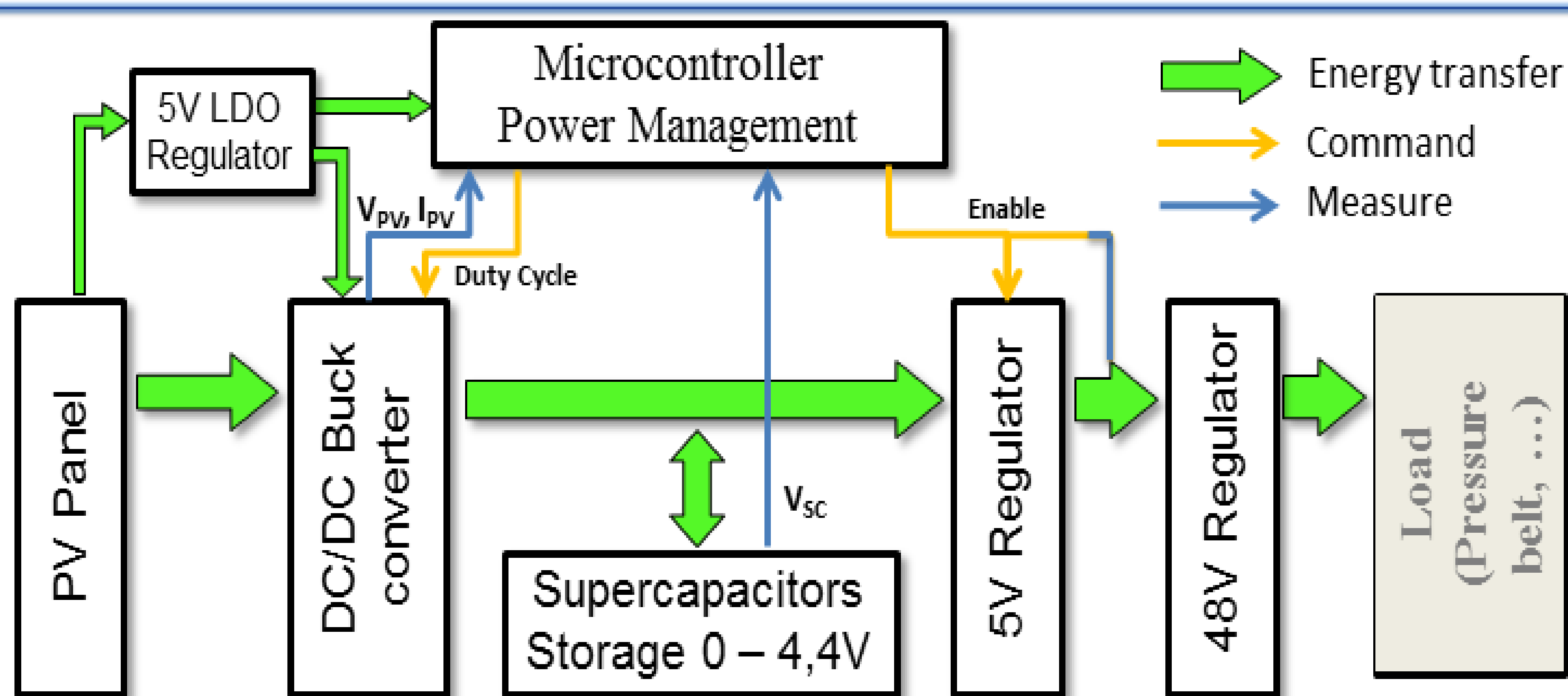


Requirements: - **Few millimeters** in thickness

- Mean electrical power of at least **2W under 48V**
- Operate at **low light** (cloudy weather)
- Operate between **-50°C and 85°C**, down to **200hPa**
- Autonomous start-up** with storage empty

Architecture:

- Thin-film photovoltaic** panel
- MPPT** achieved by DC/DC buck converter with **fractional Voc algorithm** optimized at low light
- 2 stacks of 2 **Maxwell PC10 supercapacitors (SC)** in series as buffer storage
- Output stage activated by μC** when SC are charged enough.
- Current sensing** for protection



PV generator:

DATASHEET

PHYSICAL CHARACTERISTICS	
Length	1110 mm
Height	285 mm
Thickness	1,5 mm
Weight	0,79 kg
ELECTRICAL CHARACTERISTICS	
Vmp (max power voltage)	9,20 V
Imp (Max power current)	5,51 A
Wp (peak power at stc)	50,70 W
Voc (Open circuit voltage)	10,88 V
Isc (short circuit current)	5,85 I
Efficiency (module)	17,14%
Max bending	25%

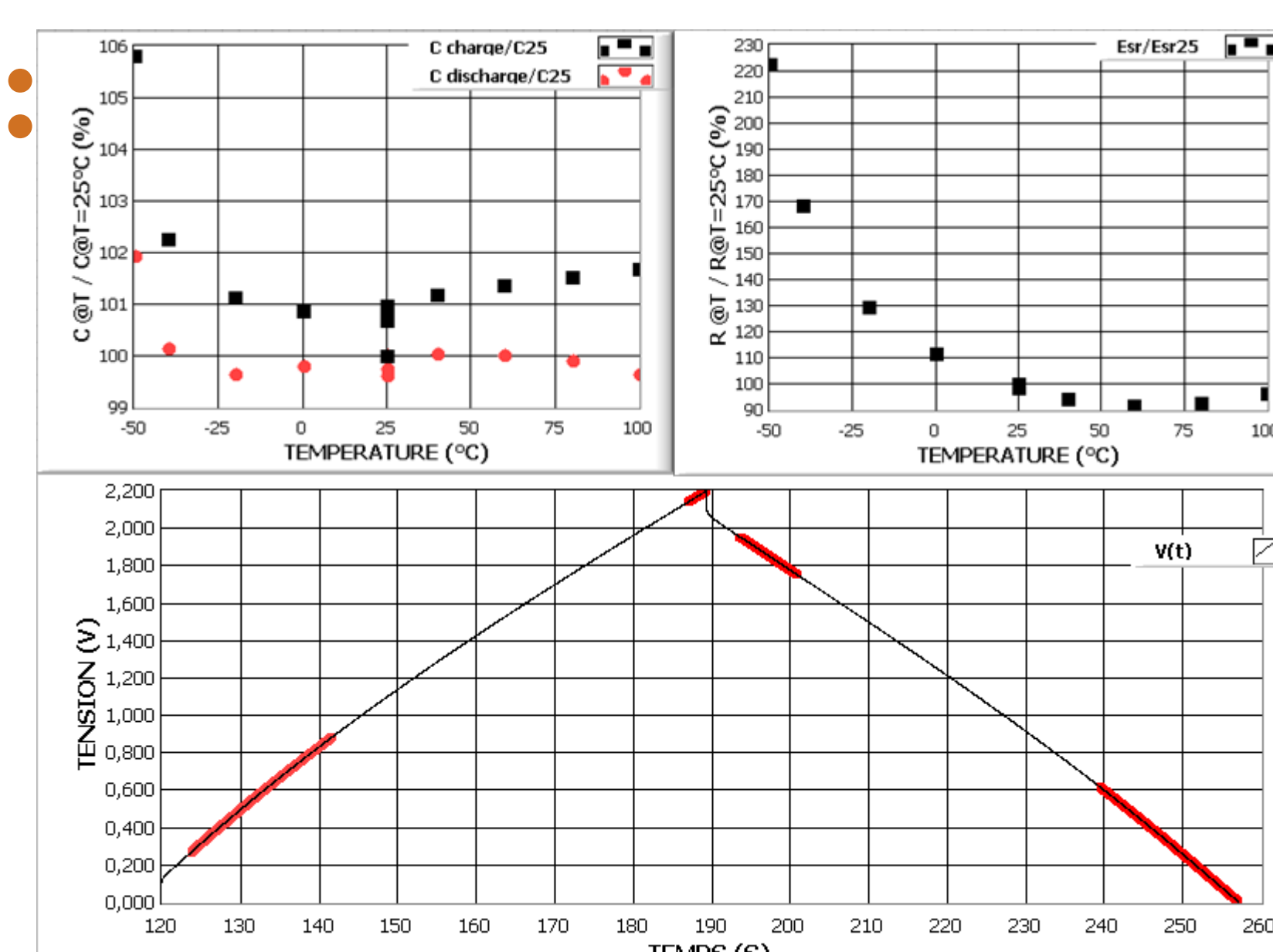


- SolbianFlex SP50L, with SunPower "Back contact" cells.
- 9% efficiency at 72W/m²**
- 0,32m²** to have enough power at low light

Supercapacitors:

- 8 SC types tested
- Charge/discharge - from **-50°C to 100°C**
- at **-50°C and 200hPa** (pressure at 10000m)
- Self-discharge tests**

➡ **Maxwell PC10 HT**



Operational prototype:

- Supply 2W** from solar irradiance as low as **80W/m²**
- Current limitation** to prevent high current during high irradiance operation, **sampling current every 13ms**
- Current regulation** to full-charge SC in spite of ESR voltage variations
- Load powered by SC only** in case of transient absence of sunlight

