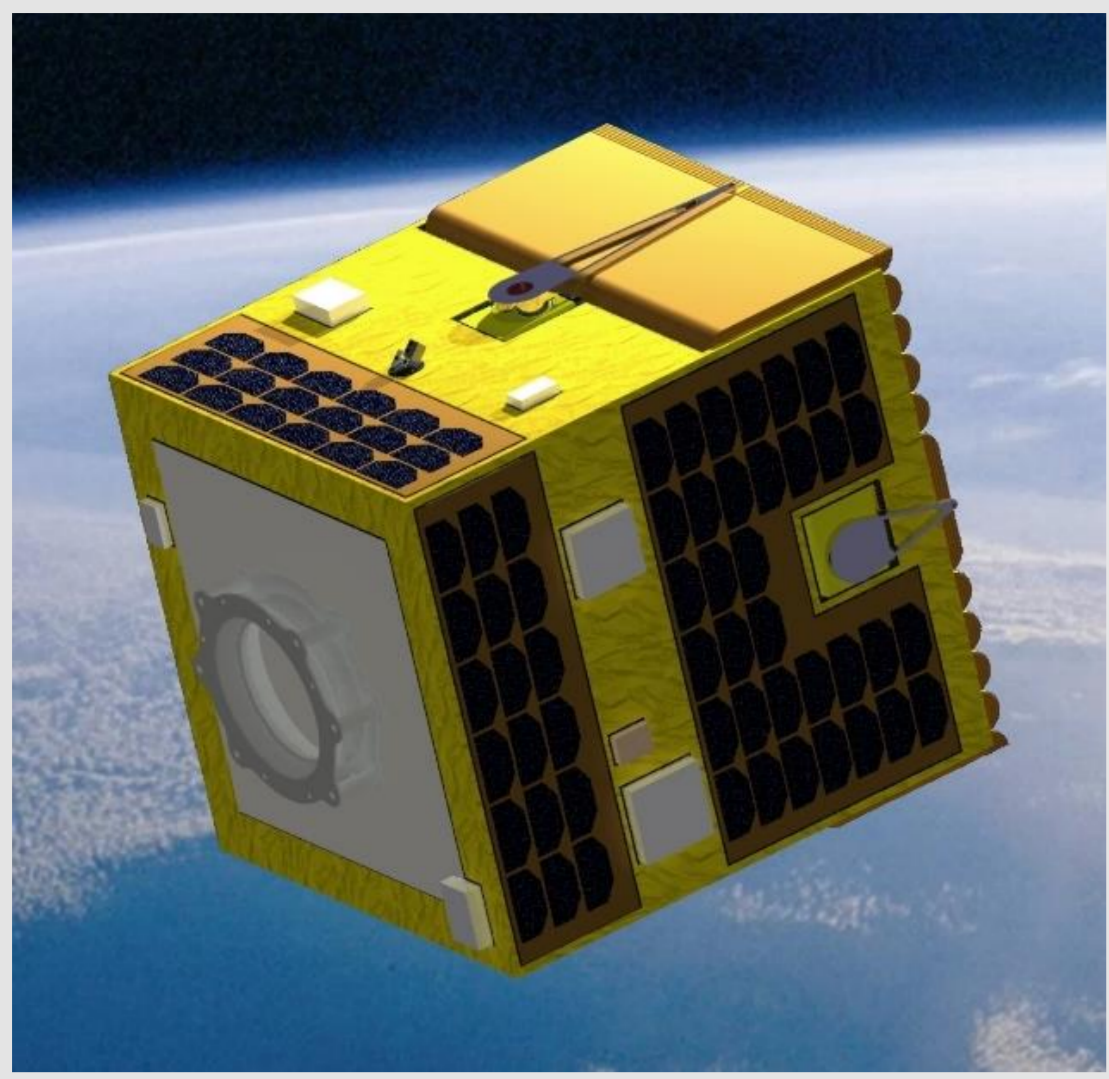


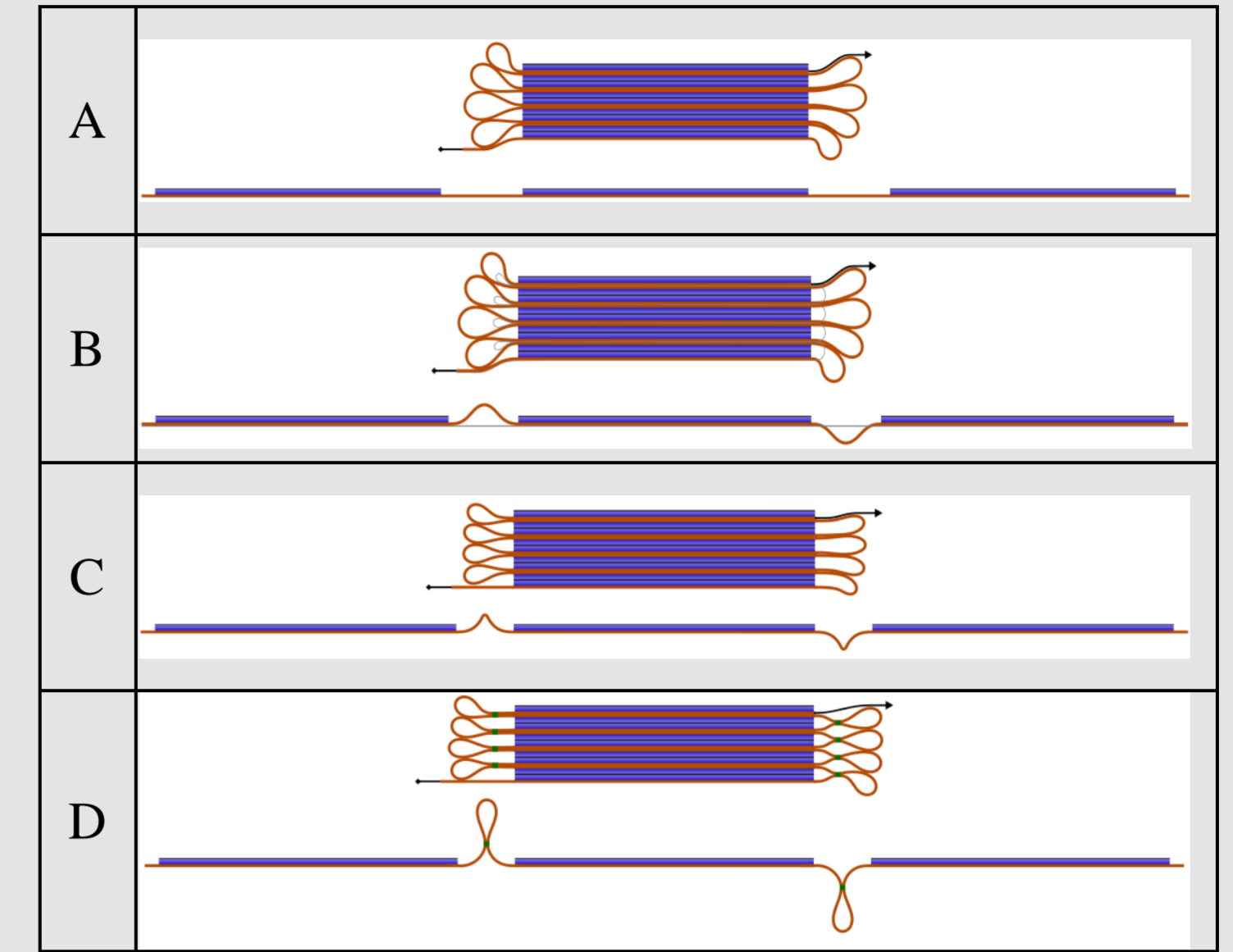
# GoSolar – Gossamer Solar Array based on CIGS Photovoltaics



Artists view of the Gossamer Solar Array (GoSolar) on the Small Satellite Bus (S2TEP) undeployed (left), deployed (mid) and a large application (right)

## Blanket Design

- Flexible blanket consist of:
  - PV generators ca. 200mm x 200mm
  - Harness to connect generators to power unit and characterization electronics
  - Base membrane to mechanically connect PV generators and harness



Harness Loop Geometries

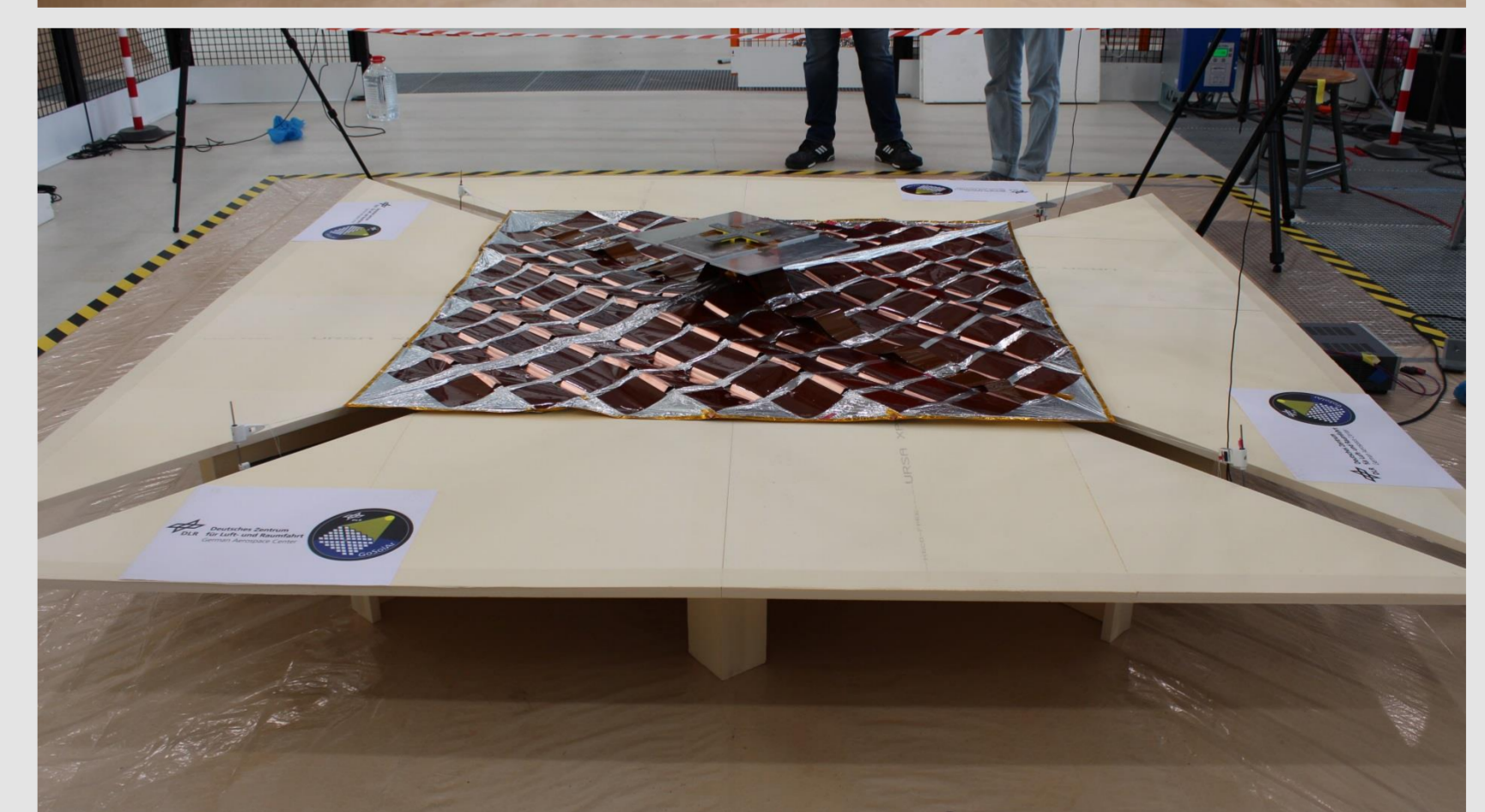
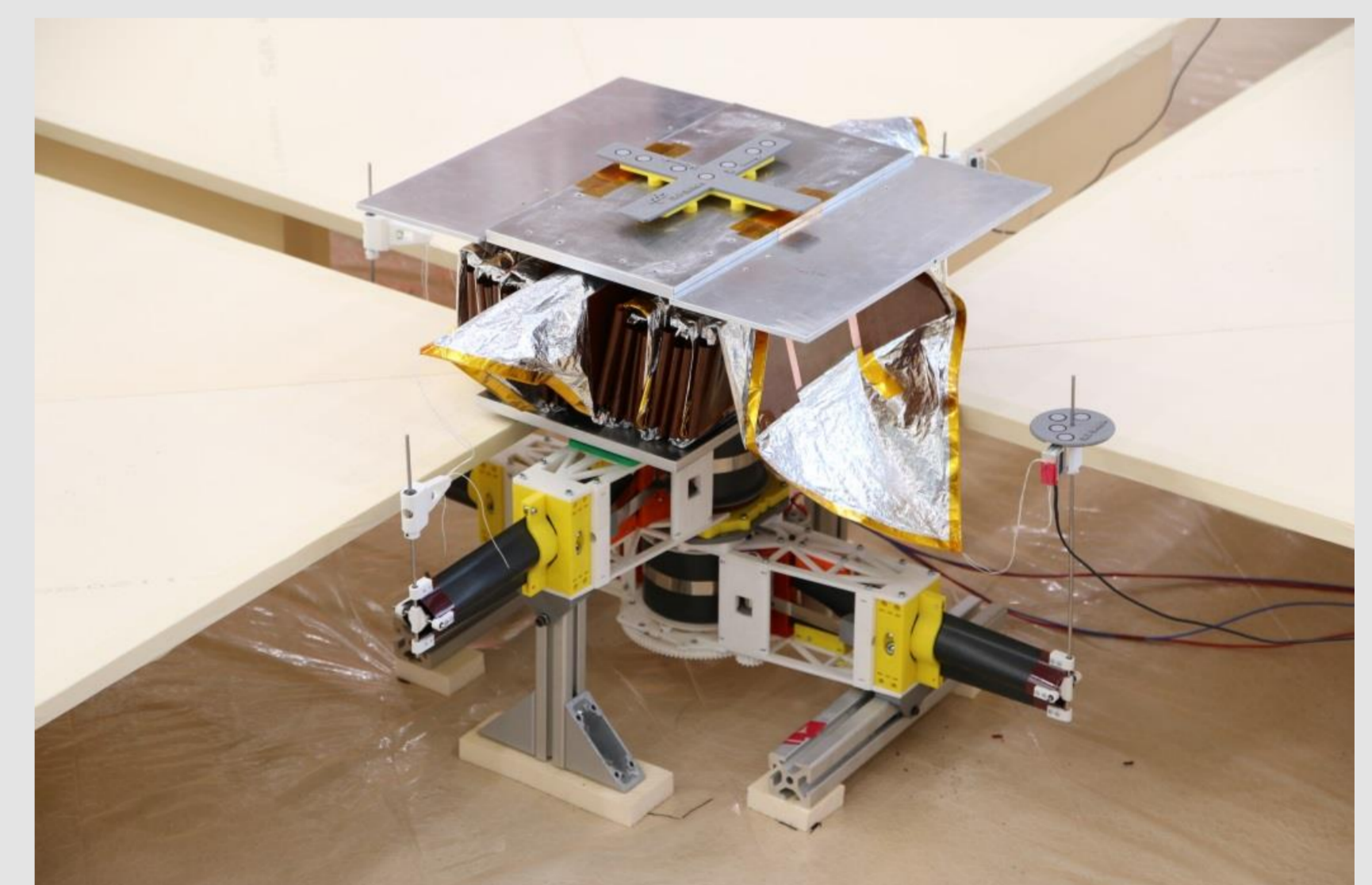
- Design parameters
  - total mass 8 kg for the 25 m<sup>2</sup> blanket
  - small stowing volume (approximately 500mm x 500mm x 250mm)

## Blanket Thermal Design

- Maximum temperature not more than 90°C due to efficiency loss
- High- $\epsilon$  SiO<sub>2</sub> coating on the front side
  - 2.2 $\mu$ m thickness
  - Dip coating using Polysilazane
  - Significant Increase of emmissivity
  - Small influence on absorbance
  - protection against atomic oxygen
  - shielding against low energy protons
- High- $\epsilon$  back side (black Polyimide)

## Breadboard Tests

- 1m x 1m breadboard with photovoltaic mass dummies of different accommodation and loop geometry
- Smaller breadboard booms
- Deployment with force measurement showed peaks during deployment of around 5N

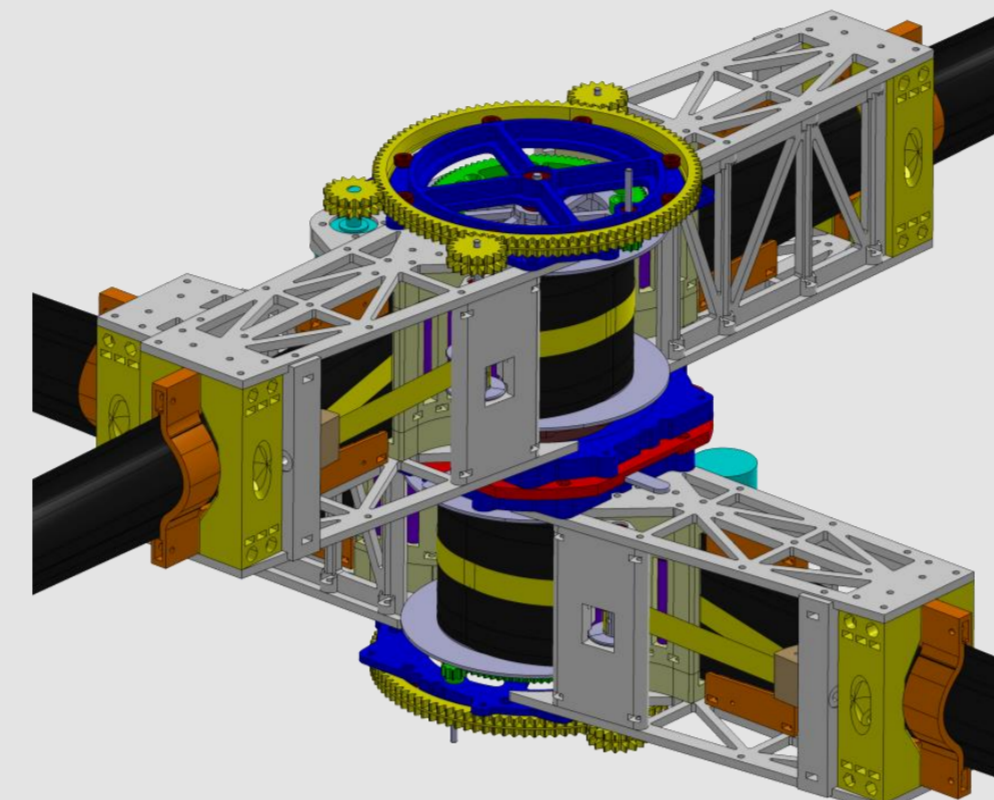


Breadboard Deployment Tests

## The GoSolar Mission

- 5m x 5m for technology demonstration
  - Size depends on required power and efficiency of photovoltaic technology
  - Scalability to 20m x 20m taken into account
- GoSolar shall produce two times 140W as experiment
  - remaining area has mechanically and thermally representative dummies
- Flexible blanket can be folded for stowing in launch configuration,
- Available Volume (600 x 600 x 480)mm<sup>3</sup>
- Coilable CFRP booms as support structure
- Full on-ground qualification test campaign but also in-orbit verification considered

- Backing structure made of deployable, double-omega CFRP booms with deployers

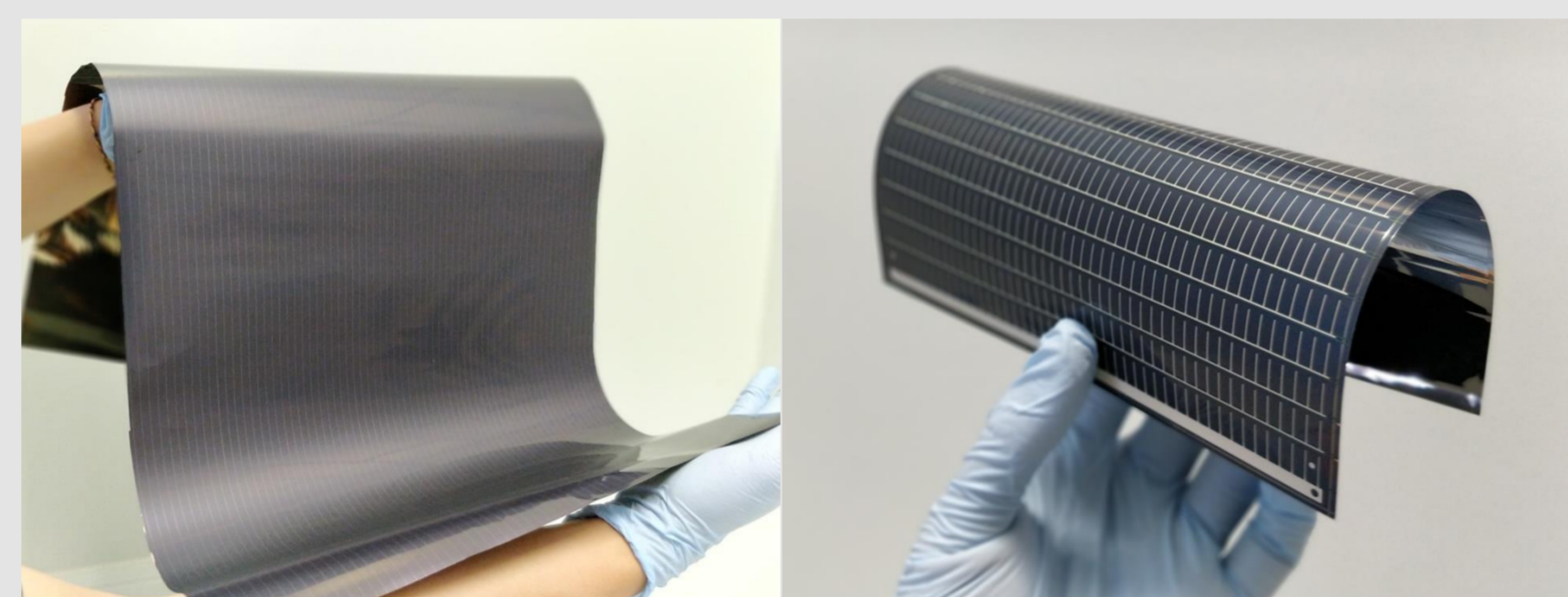


Boom Deployment Units

## CIGS PV Technology

Explore the potential of CIGS PV

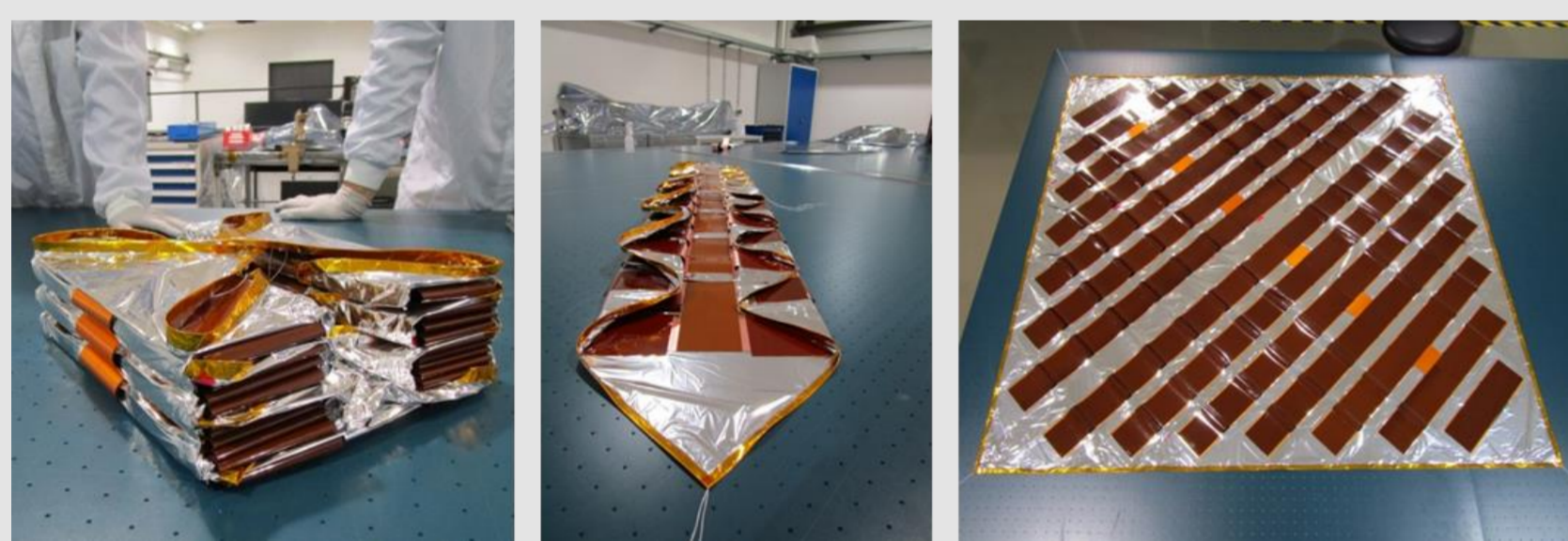
- 1-20 €/W
- ≈15% efficiency, in laboratory >20%
- 0.8-1.3 g/W and 30  $\mu$ m thickness (without coverglass + backing structure)
- Truly flexible and low sensitivity to mechanical loads
- Radiation resistant



CIGS PV Modules: Flisom (left), Ascent Solar (right)

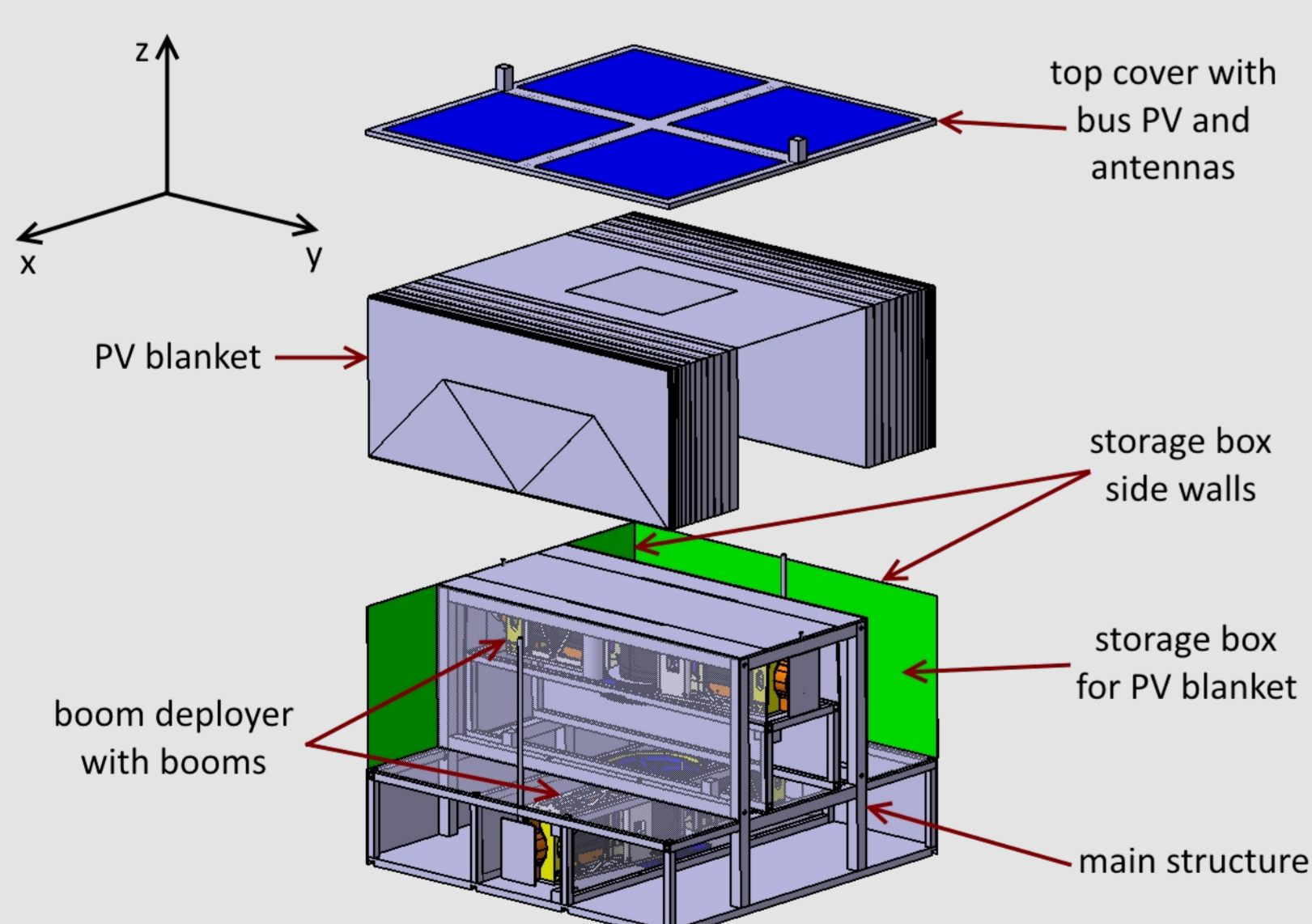
## Overall Accommodation

- Sequential unfolding of the two dimensions of the membrane



PV Blanket Sequential Unfolding Sequence

- Sidewalls with hinges that fold the walls out of the sail plane
- Top cover can be lifted and is equipped with operational PV
- Harness is routed through the centre from the flexible blanket to the bus

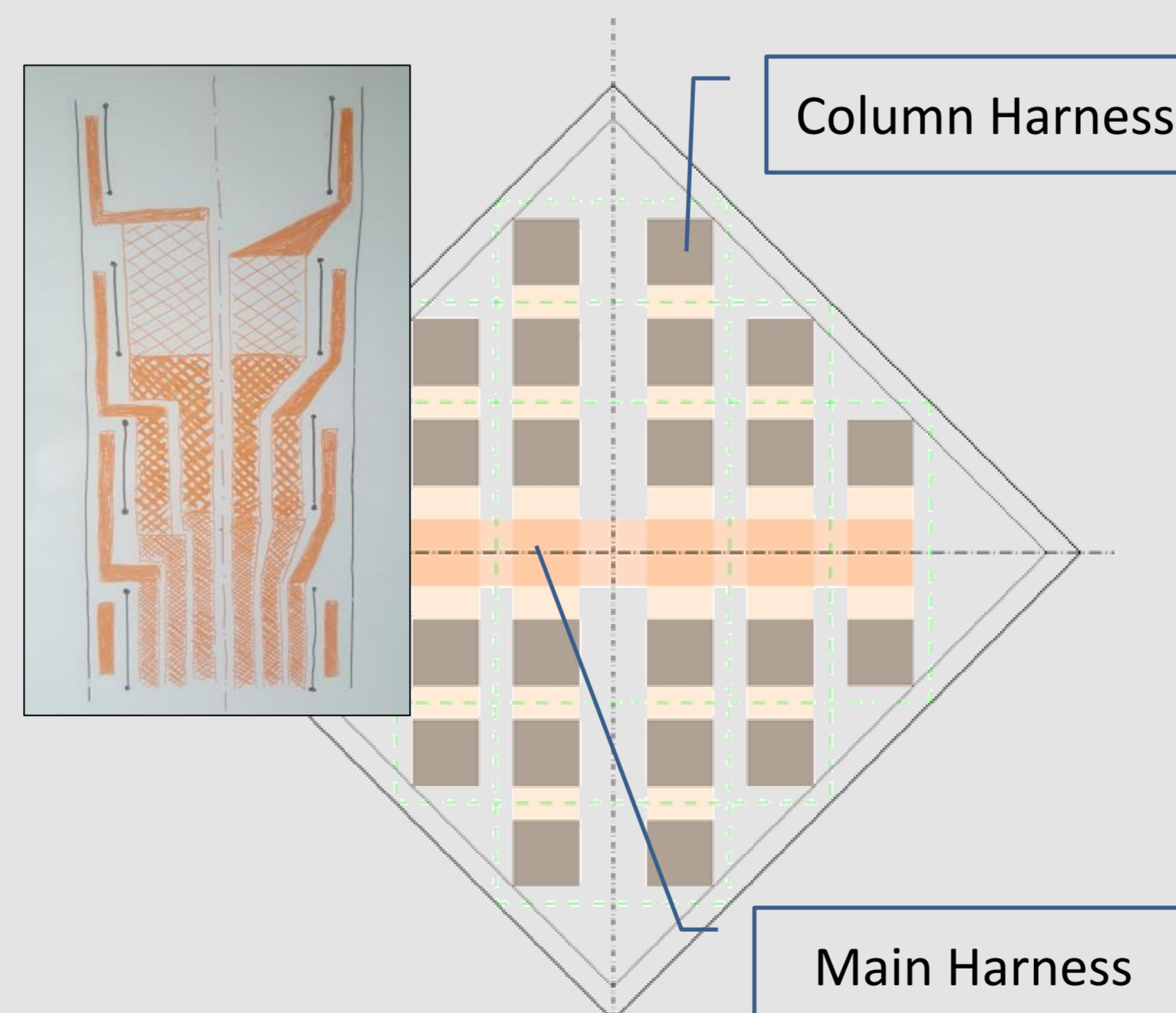


GoSolar Accommodation

- Computer, power distribution, interface boards and PV-characterization electronics of Payload are in E-Box outside GoSolar

## Overall Electrical Layout

- Column harness connects all generators
- Main harness leads to the centre where the power system is located
- For a future system with two photovoltaic wings, the main harness would transfer the power to the edge of the array where the bus system would be located
- Harness based on flexible PCB material.
- Printed circuits as mesh for homogenous mechanical and thermal behaviour



Harness Concept