POWERING THE NEXT GENERATION OF LUNAR EXPLORATION

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Image: Argonaut ©ESA https://www.esa.int/

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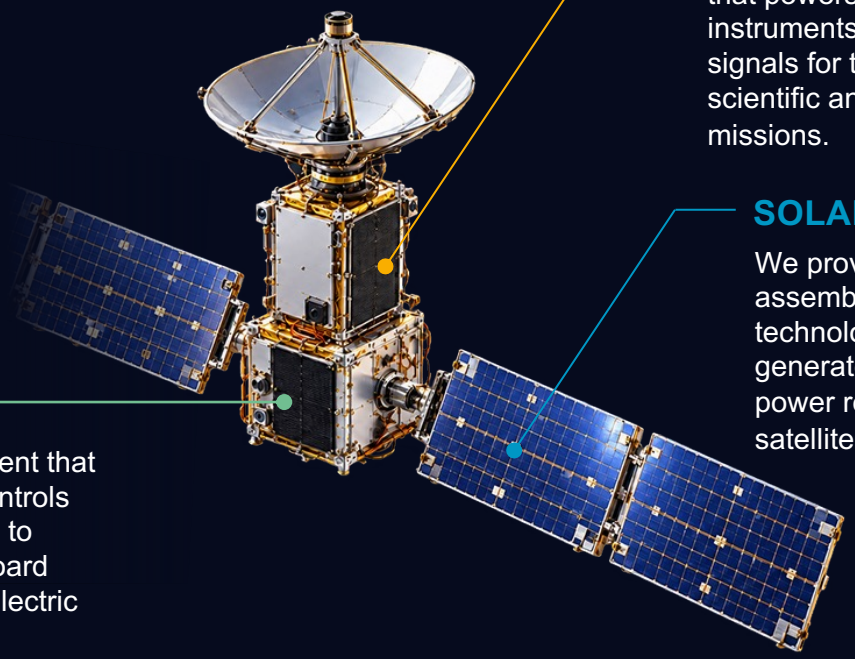
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Since the 1960s **developing**, **manufacturing** and **testing** essential equipment for satellites, both for their **platforms** and their **payloads**.

3 SITES





PAYLOAD

We provide payload equipment that powers onboard instruments and amplifies signals for telecommunications, scientific and Earth observation missions.

SOLAR PANELS

We provide photovoltaic assembly (PVA) technologies that generate the electrical power required to operate satellites.

PLATFORM

We provide platform equipment that manages, distributes and controls the electrical power required to operate the satellite, its onboard systems, mechanisms and electric propulsion.

Satellite: AI-generated illustration



- Launcher safety
- Thruster Steering

Ariane 6 launcher: AI-generated illustration
Reference image: ArianeGroup

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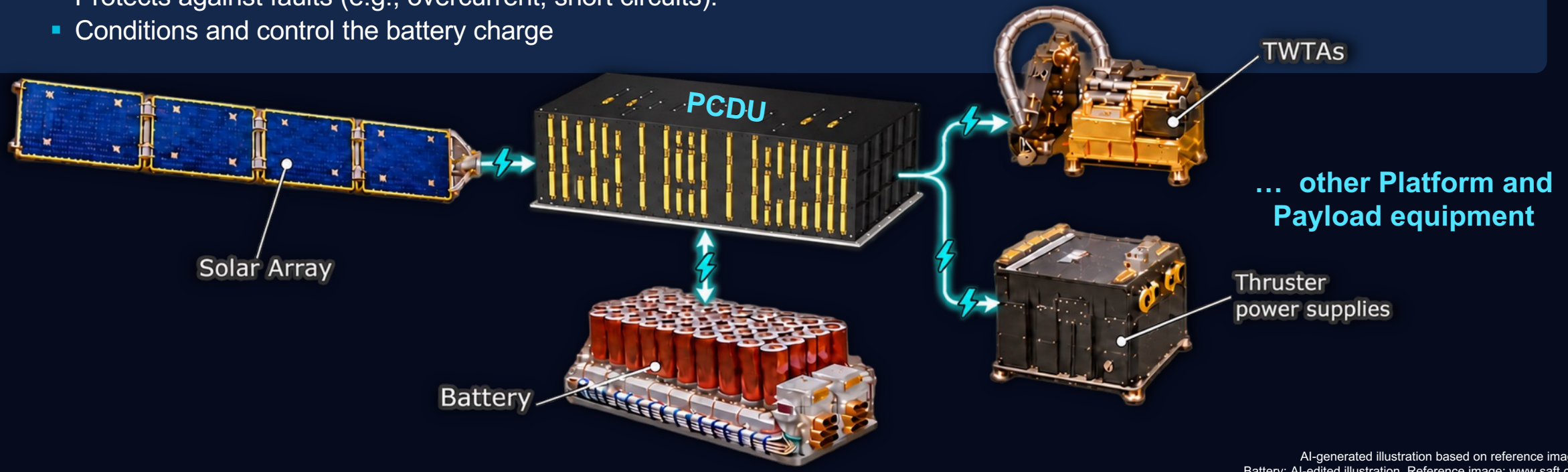
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POWER CONDITIONING AND DISTRIBUTION UNIT

PCDU = Power Conditioning and Distribution Unit

- Electronics system used in spacecraft/satellites to manage, control, and distribute electrical power from sources like solar panels or batteries to various onboard systems
  - Receives power from solar panels (during sunlight periods) and batteries (during eclipse)
  - Regulates voltage & current to specified levels
  - Distributes power to different users (platform and payload equipment)
  - Protects against faults (e.g., overcurrent, short circuits).
  - Conditions and control the battery charge



AI-generated illustration based on reference images
Battery: AI-edited illustration. Reference image: www.saft.com

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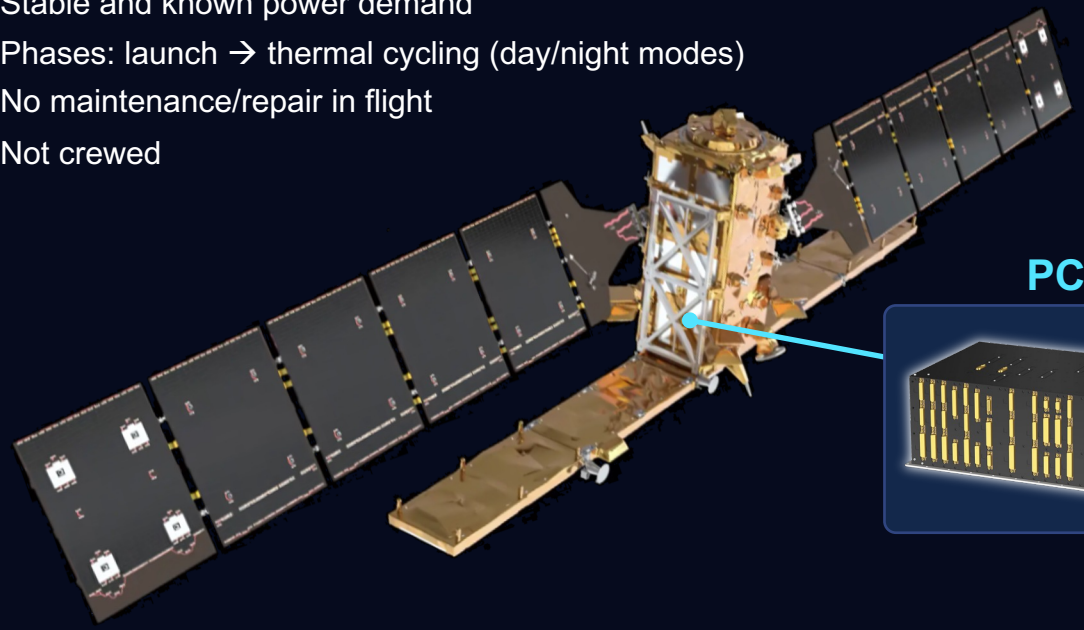
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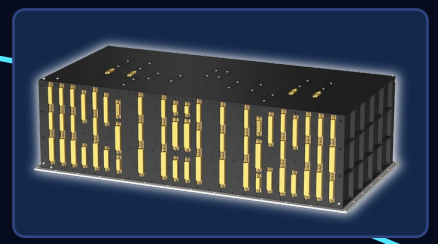
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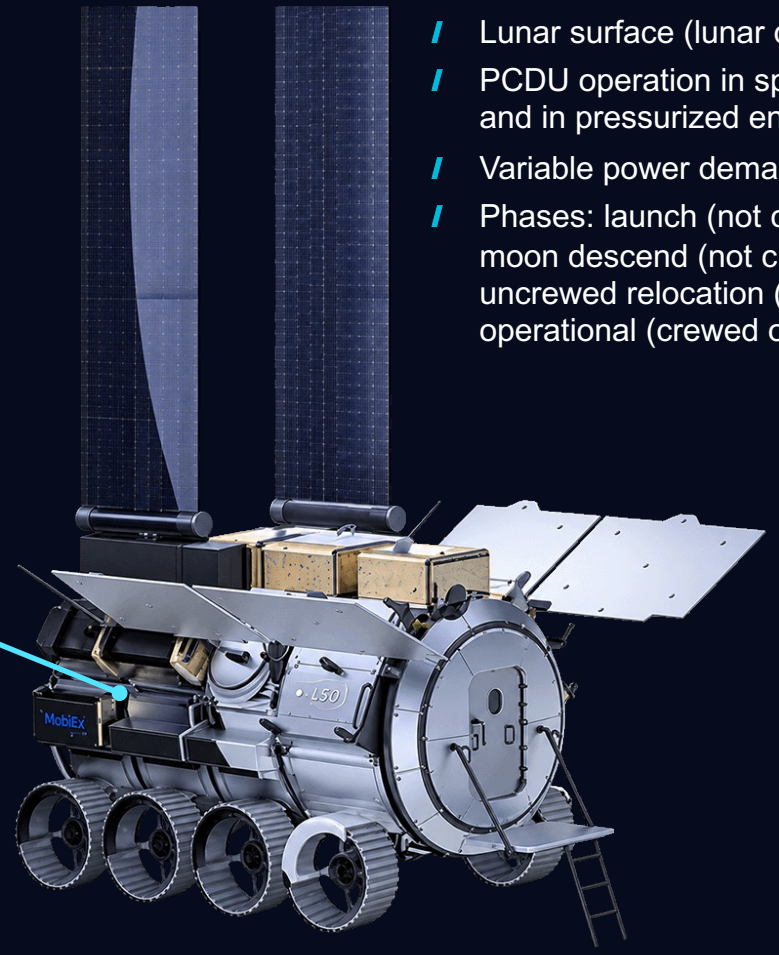
PCDU: STANDARD SATELLITE vs LUNAR MISSION

- Orbit around the earth (LEO / SSO)
- Operation in space vacuum
- Stable and known power demand
- Phases: launch → thermal cycling (day/night modes)
- No maintenance/repair in flight
- Not crewed



PCDU





- Lunar surface (lunar day and night)
- PCDU operation in space vacuum and in pressurized environment
- Variable power demand
- Phases: launch (not crewed) → moon descend (not crewed) → uncrewed relocation (moving) → operational (crewed or not crewed)

DESIGN CHALLENGES

Electrical – Mechanical – Components – Materials

Sentinel-1 satellite: © ESA
MPH: AI-edited illustration. Reference image: Thales Alenia Space.

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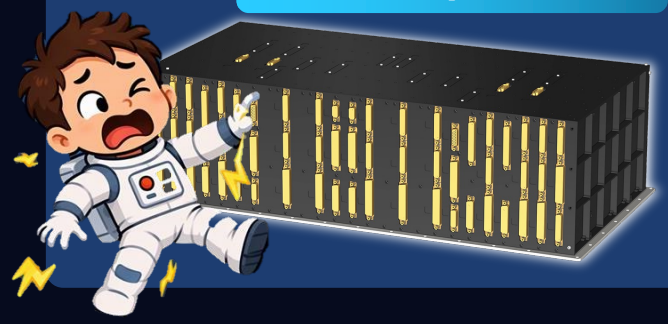
PCDU: STANDARD SATELLITE vs LUNAR MISSION

PCDU for EO satellite

- Bus voltage up to 68V
- Optional 28V secondary bus

- Unidirectional converters →
- Single grounding domain
- Compatible with ESA standards (ECSS)

Power up to 6kW



ELECTRICAL DESIGN NEEDS

Higher voltage levels. Impacts on:

- Components choice → higher rating
- PCB design → traces / layers
- EMC → higher dV/dt

Different power sources or users during lifetime:

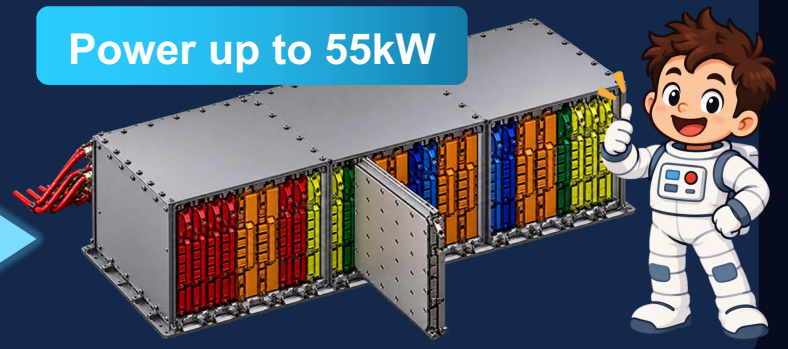
- Galvanic insulation
- Bi-directional converters and switches

High current flow → high dissipation → unit temperature increase. **But shall not pass 35°C!**

PCDU for Lunar Missions

- Several power busses:
  - 1x Unregulated battery-bus 90V-150V
  - 1x 28V regulated
  - External 120V regulated
  - Internal 120V regulated
- Bi-directional isolated converters ↔
- Several grounding domains
- Compatible with ESA (ECSS) and NASA standards.

Power up to 55kW



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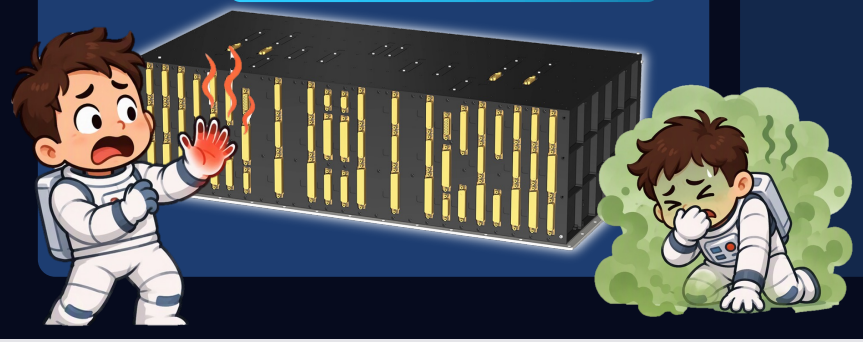
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PCDU: STANDARD SATELLITE vs LUNAR MISSION

PCDU for EO satellite

- Components radiation withstanding up to 7kRad
- Modular unit but not maintainable
- Work in vacuum (mostly) and in a not crewed environment
- Structure temperature can raise up to 65°C

Mass up to 33kg



MECHANICAL DESIGN NEEDS

Maintainability

Be able to repair the unit

Anti-corrosion

Be robust to the humidity of a crewed environment

Interface Temperature

Human safety → Respect the “touch temperature” even in worst-case (high power) dissipation conditions

MATERIALS AND COMPONENTS CONSTRAINTS

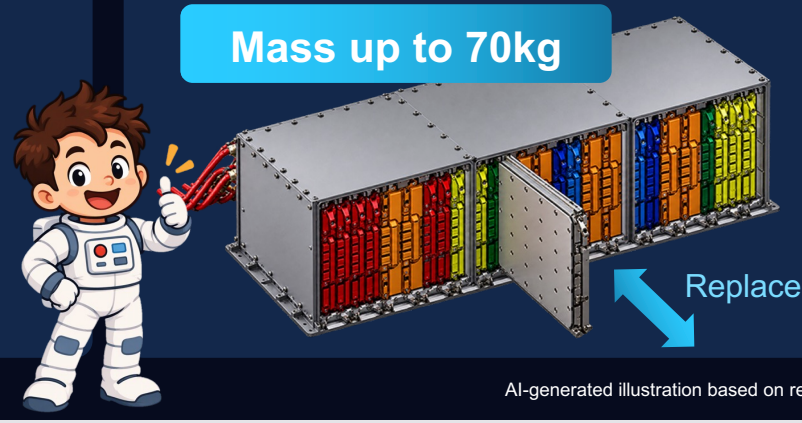
Toxicity

Flammability

PCDU for Lunar Missions

- Components radiation withstanding up to 30kRad
- Modular unit but maintainable
- Work in vacuum and in a pressurized environment
- Structure temperature can raise up to 35°C (when crewed) or up to 65°C (when not crewed)
- High safety standards

Mass up to 70kg



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