

# Payload Design of RHOK-SAT, a 1U CubeSat to Characterize Perovskites in Low Earth Orbit



Olivia Kaufmann  
Benjamin Wilson

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# Introduction

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- 1U CubeSat projected for March 2024 launch
- Being done with no engineering department
- Launching new photovoltaic (PV) technology into space
- Custom electromechanical assembly to test the PV cells



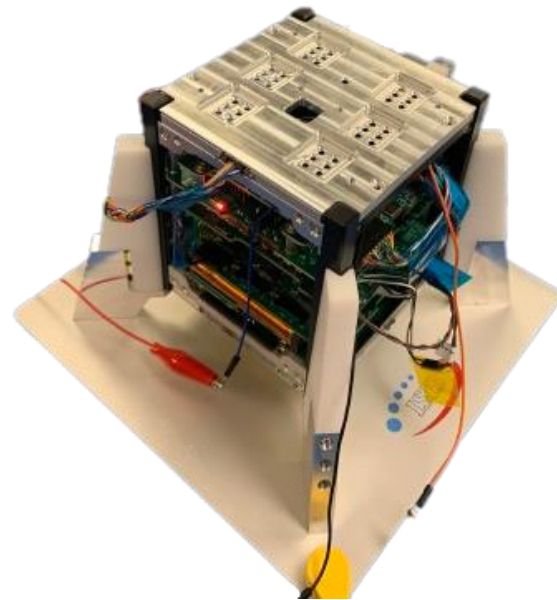


# Mission Description

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## Two Missions

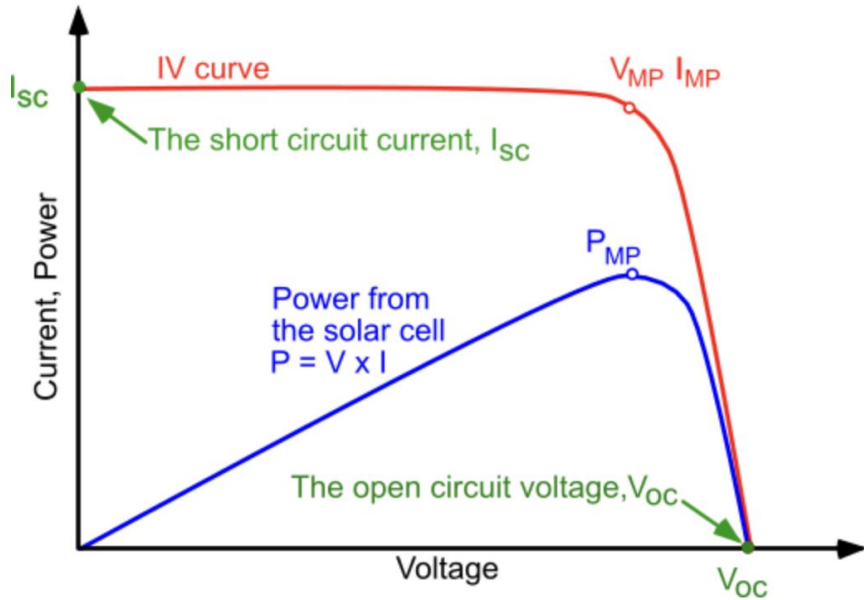
1. Educational
  2. Scientific
    - 36 perovskites
    - 1 control CIGS
- ISS Orbit (400-700 km altitude)
    - 9 – 18-month mission





# Characterizing a Solar Cell

- Assess performance under illumination
- Sweep from  $V_{OC}$  to  $I_{SC}$
- Important parameters:
  - $V_{OC}$
  - $I_{SC}$
  - $P_{MP}$
  - Efficiency

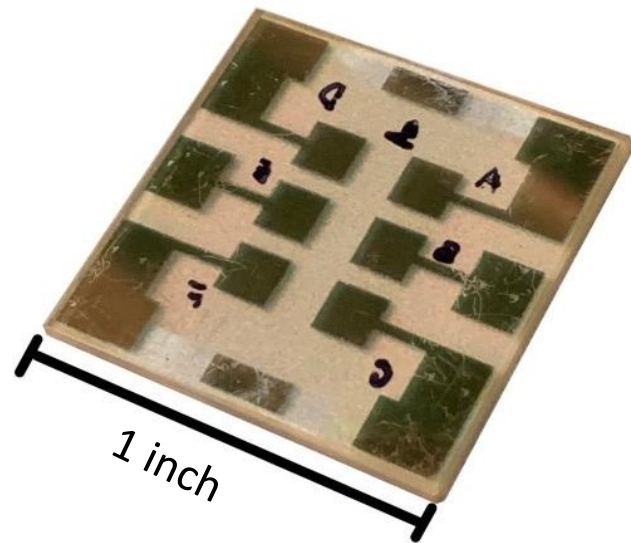


<https://www.pveducation.org/pvcdrom/solar-cell-operation/iv-curve>



# Experimental PV Cells - Perovskites

- 6 distinct pixels per slide
- Potential deep space applications
- Performance can be recovered when cells are stored in a dark location
- Sensitive to moisture
- Premature degradation occurs when illuminated but not measured





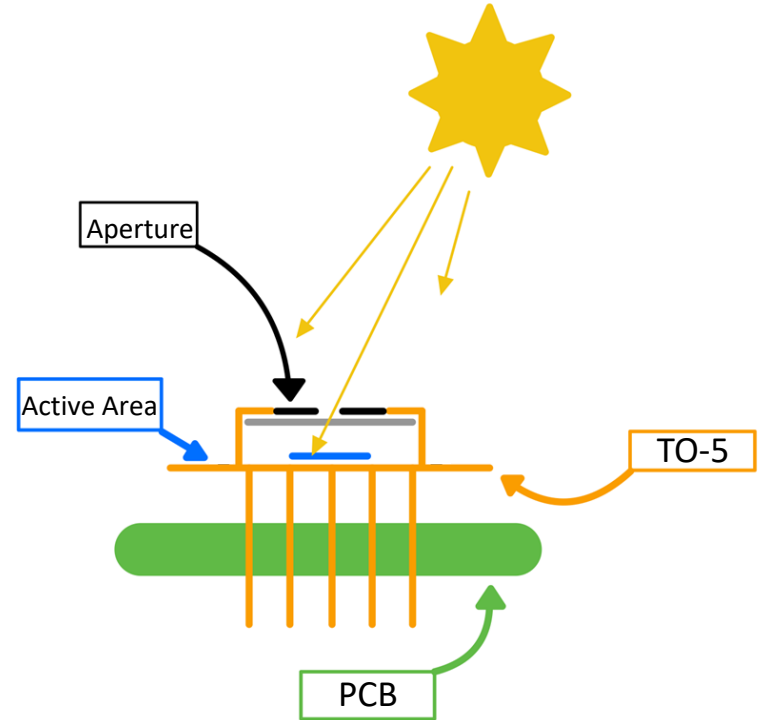
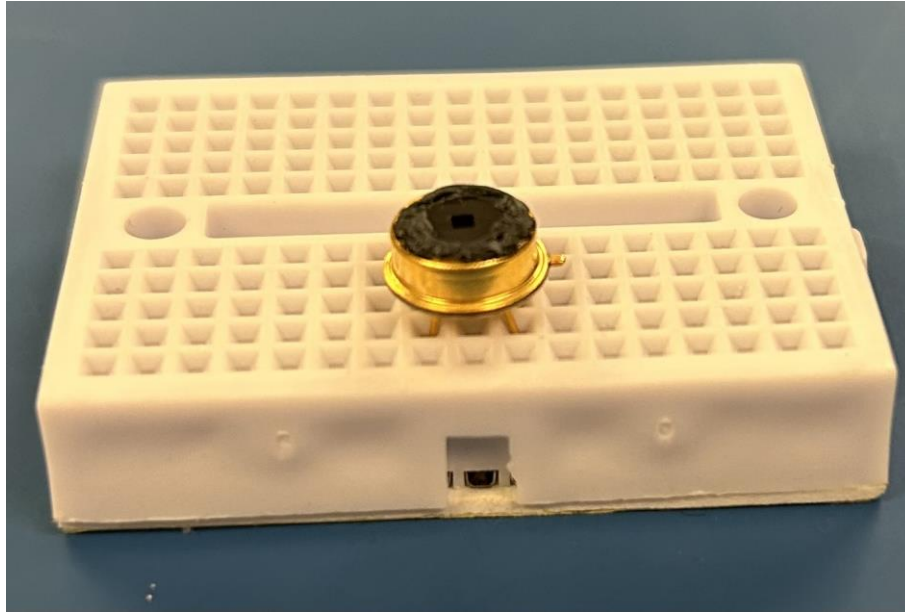
# Aerospace Measurement Unit (AMU)

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- Passive measurement device that
  - uses a variable resistive
  - resistance starts at a maximum to measure  $V_{OC}$  and is decreased toward  $I_{SC}$  .
- AMU relies on the voltage generated by the cell
  - Sweeps can only occur when the cell is illuminated.



# Sun Sensor





# On-Orbit Procedure

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Sun angle measurement determines threshold is met

Temperature measurements of all cells

IV sweeps of all pixels and CIGS

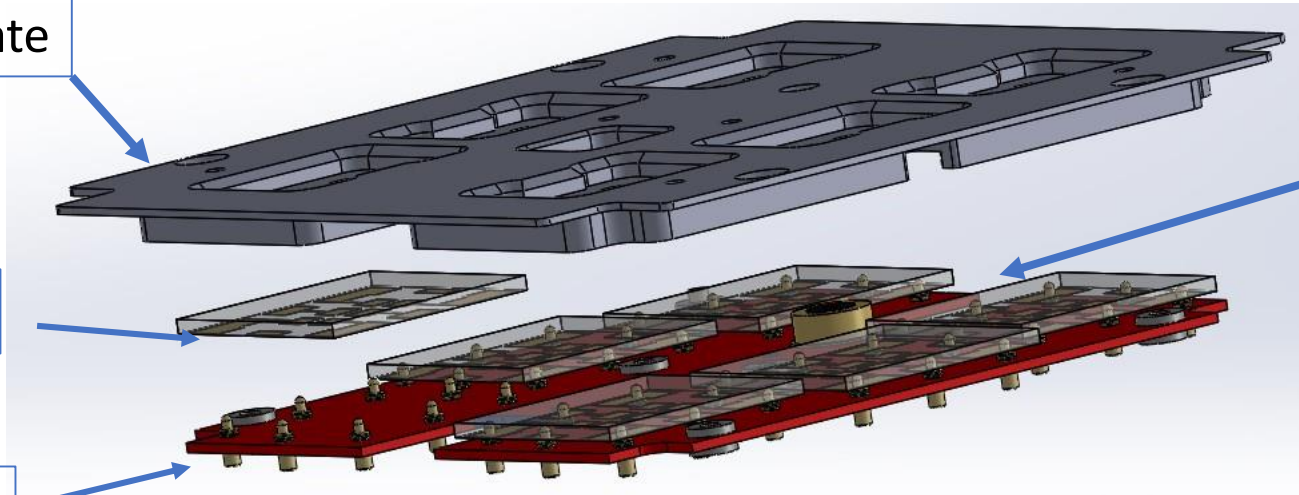
Temperature measurements of all cells

Sun angle measurement





# Payload Mechanical Structure



Top Plate

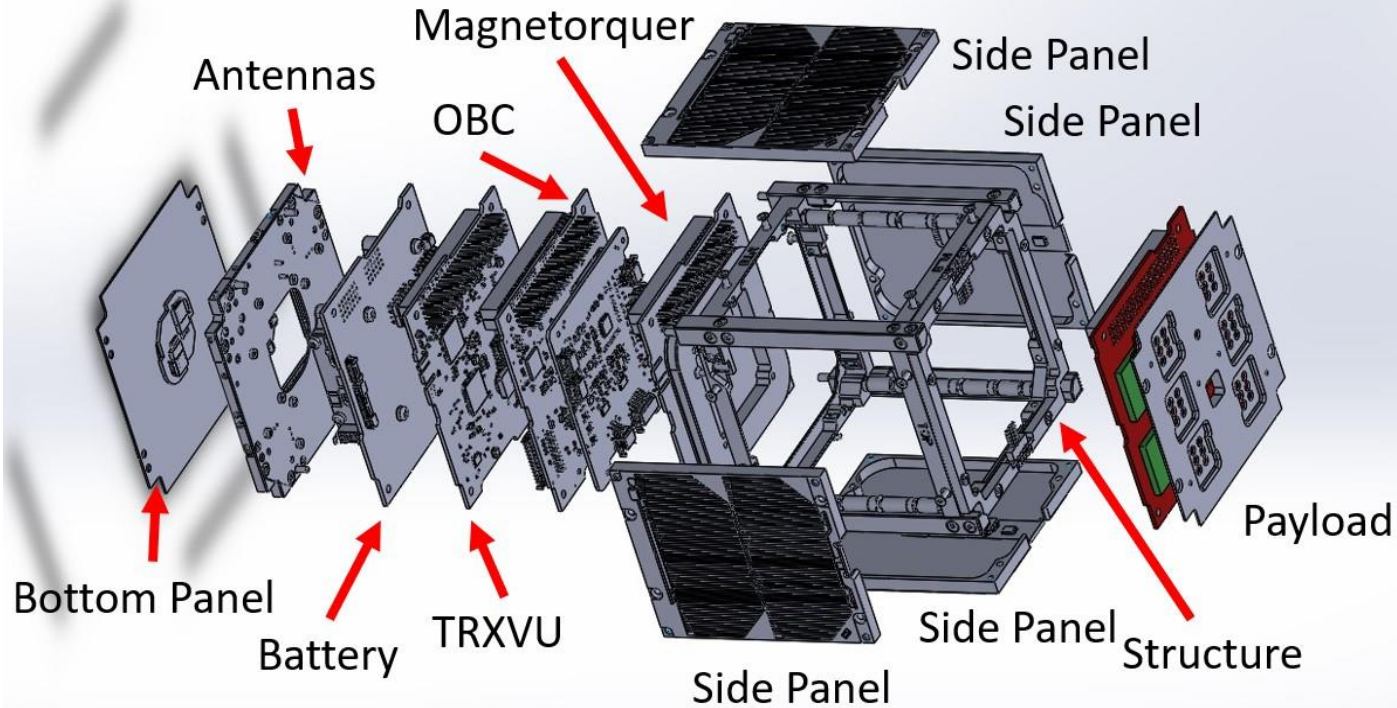
Perovskite

Pogo Board

Sun  
Sensor



# Exploded View





# Electrical Design

## Circuit 1:

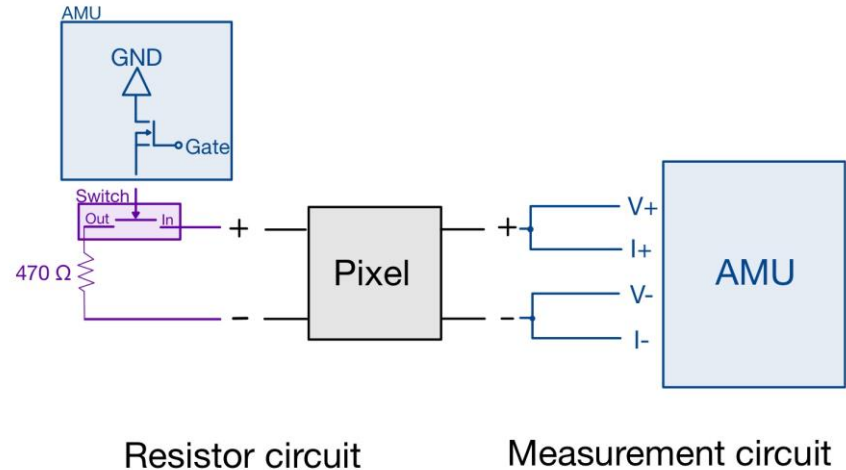
### Measurement circuit

- perovskites, AMUs

## Circuit 2:

### Resistor circuit

- resistor, analog switch

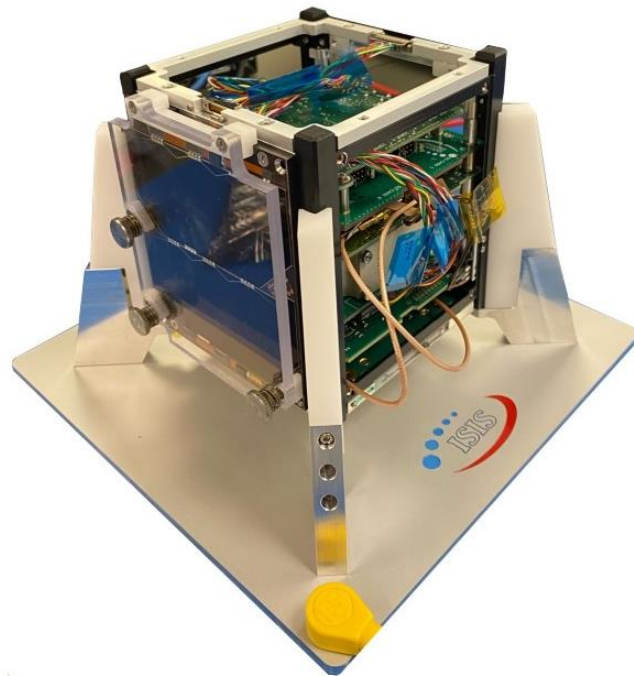




# Conclusion

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- Currently in late stages of design
- Scientific mission: testing novel PV cell technology
- All being done without an engineering department





# Acknowledgements

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