AEROO Space AI Competition 2026

Solar-Battery Node AI

Power Health & Vision Anomaly Detection

Team: Beasts (Ayla Badalova, Amir Dilovarov) | **Advisor**: Suleyman Tongut | **Talgar Private Boarding School No. 1**

🎯 Opening Pitch

Power failure is one of the most expensive and underestimated risks in space missions. NASA's InSight mission alone resulted in an estimated **$830 million loss**, primarily due to dust accumulation and undetected degradation in its power system.

Today, more than **78% of maintenance actions** in energy systems are reactive, meaning failures are detected after performance is already lost. In space, where communication delays can exceed 22 hours, reactive maintenance is simply too late.

Solar-Battery Node AI addresses this problem by combining battery health prediction, computer vision–based surface monitoring, and AI-driven decision support into a single, low-cost intelligent node.

Our system predicts battery Remaining Useful Life with up to **92% accuracy** in laboratory conditions, detects solar panel anomalies in under **100 milliseconds**, and provides autonomous maintenance recommendations to operators.

What makes this approach unique is its **space-first validation strategy**. By proving reliability under extreme environments, we unlock technology transfer opportunities where predictive maintenance creates immediate economic value — from large-scale solar farms to remote infrastructure.

Our goal is simple: reduce mission risk, extend system lifetime, and transform power systems from reactive to predictive — first in space, then on Earth.

The Problem

$830M

Mission loss due to power failure

NASA InSight (2018-2022)

30%+

Efficiency loss from dust accumulation

NASA InSight dust accumulation

22.5 hrs

Deep space communication delay

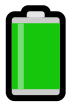
Voyager 1 one-way signal

78%

Reactive maintenance rate

Industry average

Our Solution



Battery Health ML

92%

Remaining Useful Life prediction accuracy

Computer Vision

<100ms

YOLOv8 anomaly detection inference

AI Assistant

GPT-4o

Autonomous maintenance recommendations

💰 Prototype Cost

Component	Price
STM32N6570-DK (NPU Board)	$193
STM32 B-L475E-IOT01A (IoT Board)	$54
IMX335 5MP Camera Module	$65
Total Prototype Cost	**$312**

All prices from DigiKey/Mouser (January 2025). Space certification costs not included.

Impact Comparison

Without Our System

78%
Reactive maintenance

0%
Failure prediction accuracy

22+ hrs
Response time

30%+
Undetected power loss

With Solar-Battery Node AI

15%
Reactive maintenance

92%
Failure prediction accuracy

<100ms
Response time

<5%
Undetected power loss

Development Roadmap

1 Year

Prototype & Testing

Complete prototype, lab testing, competition submission

3 Year

Space Agency Partnership

ISS experiment proposal, NASA/ESA collaboration

5 Year

Commercial Deployment

Satellite integration, solar farm pilots

10 Year

Global Scale

Standard for space missions, renewable energy worldwide

Our Team

Amir Dilovarov

Team Leader

Grade 11

Ayla Badalova

Student Researcher

Grade 11

Süleyman Tongut

Project Advisor

Computer Science Teacher,
B.Sc. EEE