



#### Specs



Power Consumption: 62 W

- End to End Efficiency: 3.7%
- Efficiency Potential: 10-12%
- Weight: 14.83 kg

Dimensions: 95 cm x 28 cm x 23 cm

Laser

A 975nm high-powered fibercoupled direct diode laser to power assets in PSR

Near the Lunar south pole, there are craters that never receive sunlight. These regions, called the permanently shadowed regions (PSRs), remain at average temperatures of 100 K and contain water ice and other volatiles due to the low temperatures. This ice is so important because it can be used to support lunar habitation or for electrolysis into liquid oxygen fuel. This habitation and refueling capability is a key component to space exploration. However, due to the lack of sunlight, incredibly cold temperatures (<100 K), and large crater diameter (~20 km), traditional power systems cannot be used for exploratory equipment.

BELLE is a power-beaming solution to address the future power generation needs for scientific exploration and habitation of the lunar permanently shadowed regions. Wireless power transmission is of particular interest for PSR missions because it can avoid the harsh PSR environment that hinders traditional powering solutions. With BELLE, power can be beamed from the continually sunlight illuminated rim of the crater using a high-efficiency, high-power laser to a distant asset in the interior of the permanently shadowed region. A beam scanning system and a quadrant arrangement of photodetectors are used to locate and track the fixed or moving asset. An automated gimbal orients the solar cell to face the beam, allowing the laser power to be converted back into electrical energy for use by the equipment.

A high efficiency solar cell converts the laser energy back into electrical energy for use by the rover







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## The Problem

# Our Solution

### **Photovoltaics**

## Subsystems Gimbal

A dual axis gimbal to center laser on photovoltaic receiver.

> Beaming of energy is ideal for **distributing power** over large distances. It also could provide reliable energy when **natural disasters** cut regions off the traditional power grid.

Power beaming proves an ideal solution for powering assets in the harsh **PSR** environment, eliminating the need for an asset to visit a charging station or be dependent on battery life.



#### **Quadrant Detector**

Silicon Photodiodes with high responsivity at NIR wavelengths to process reflected laser beam

## Applications

The U.S. Military is exploring the use of lasers and optical tracking in military and defense systems.





#### Galvanometer

A dual-axis mirror scanning system with resolution of 12 µrad, and repeatability of 8 µrad to direct high powered laser



