LUNAR MISSION ONE

THE LUNAR LANDER

The aim is to drill up to 100m below the surface and analyse rock samples, giving information on the moon and planet formation as well as implant an archive below the surface.

For surviving the eclipse phases of the mission, where the spacecraft will be receiving little or no light the spacecraft makes use of lithium-ion batteries as back-up. The spacecraft will make use of panel-mounted solar arrays which will cover the upper portion of the outer surface of the lander octagon.

THE SOLAR PANELS

Due to the Lunar environment the cells will be running hot, and so an efficiency of 17.75% was calculated for each cell.

Optical surface radiators are to be incorporated into calculated array size and will allow temperature regulation to reduce possible damage to the arrays and create the highest possible efficiency.

When tested the efficiency of the panels at a 45° angle were not greatly decreased from that of a panel normal to the sunlight.

It is expected that there will be a period of 200 days in sunlight with little or no obstructions expected, which will be enough time to complete the primary objectives of the mission. After the 200 days of sunlight, the spacecraft will experience the lunar night, a period of darkness where the nominal mission will shut down completely and the spacecraft's essential functions will be powered by the Li-ion batteries.

Degradation may be caused slowly and steadily by electrons, but high-speed proton from solar flares may also have a degrading effect on the solar arrays, however this was taken into account when determining the size and materials used, and therefore the primary objectives of the mission should not be affected.

SOLAR CELLS On The Lander

The solar panels:

Cell type: triple-junction GaAs cells, AZUR SPACE (TK Solar Cell 3G30C)

Each array size: 0.05mx1.18m, 8 panels

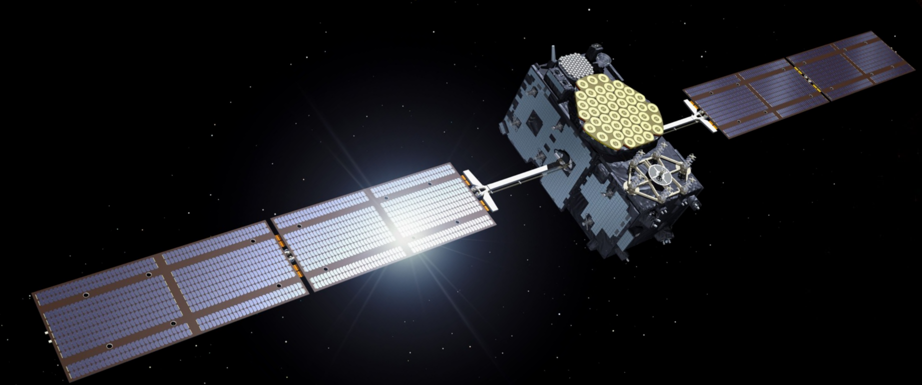
Mass: 16kg

Calculated efficiency: 17.75%

Estimated temperature of the illuminated panels: 63°

Battery Type: Li-ion

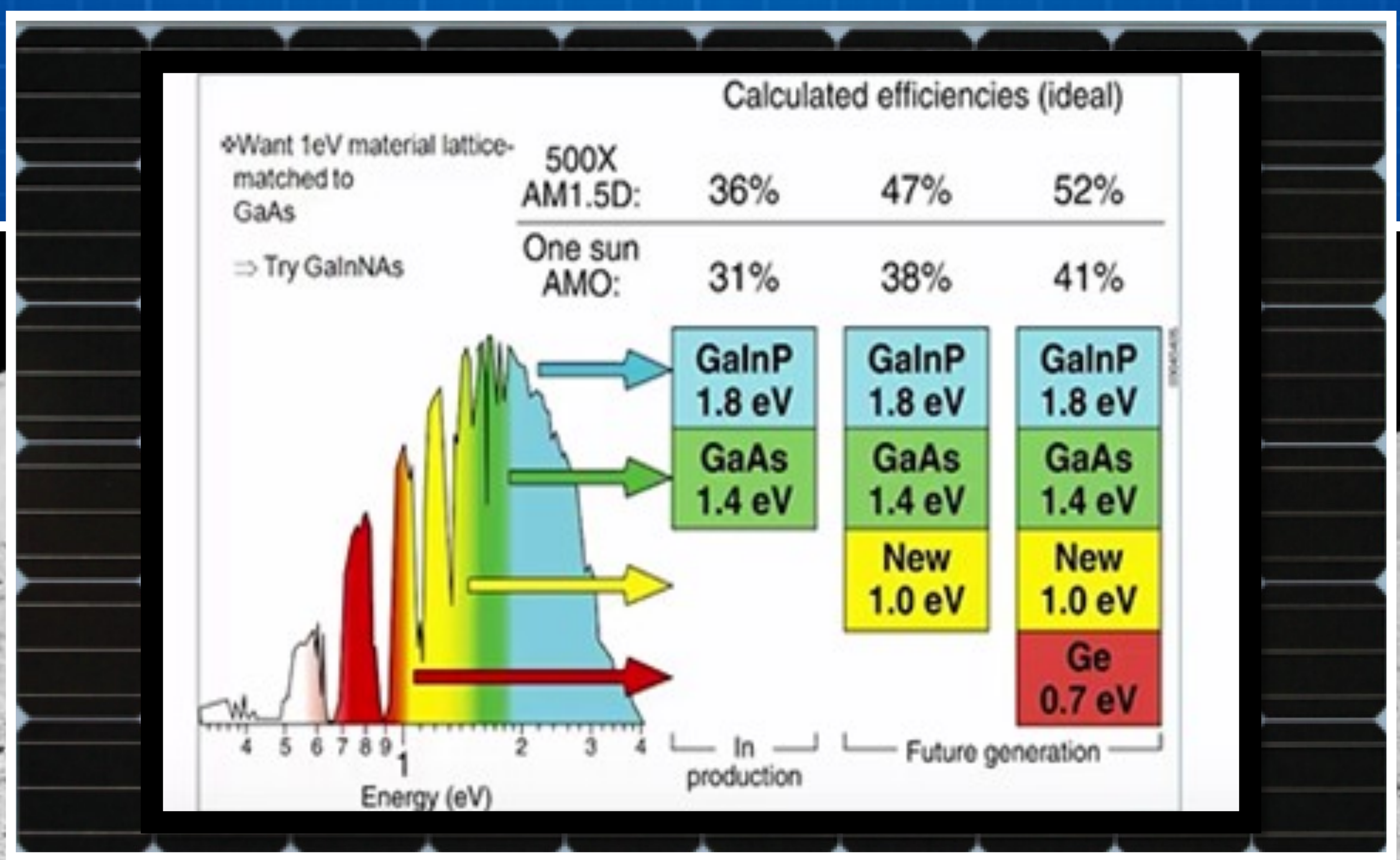
THE LUNAR MISSION ONE SHUTTLE



Triple Junction Solar Cell

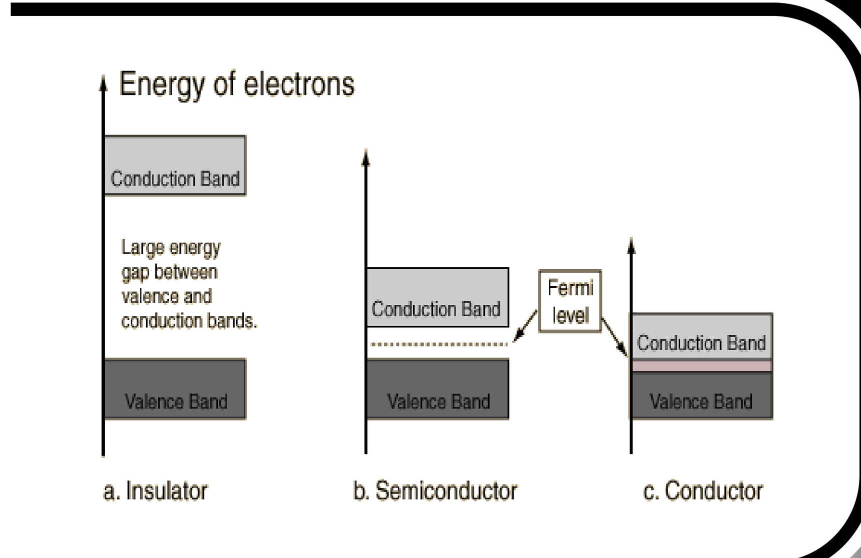
For triple junction solar cells, the use of the different materials aims to absorb a larger range of the light spectrum, overcoming the loss of the solar spectrum that results from using only one material and one band gap.

The largest band gap material, GaInP is placed at the top of the cell, absorbing the shorter wavelengths of light (blue). The middle layer, GaAs has a smaller band gap and absorbs medium wavelengths of light (green). The final layer of the cell, InGaAs layer has the smallest band gap and absorbs the longest wavelengths of light (red).



Band Gap

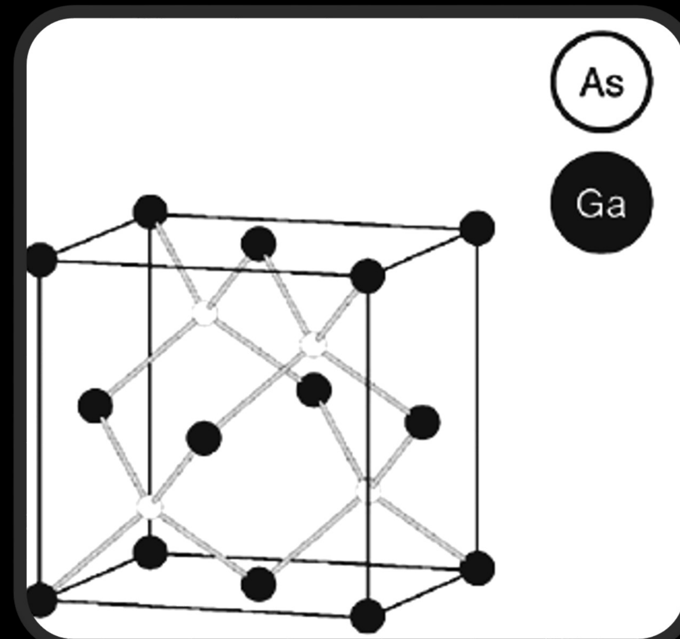
The Band Gap value refers to the amount of energy required to promote a valence electron which is bound to an atom to become a conduction electron which is free to move around the structure. This free electron can act as a charge carrier to conduct an electrical current.

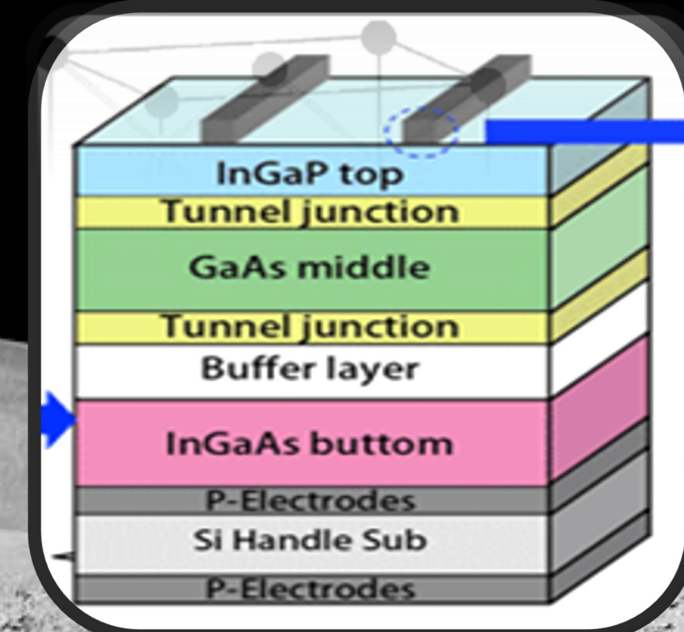


Gallium Arsenide

Gallium Arsenide (GaAs) is an III-V semiconductor with a Zinc blende crystal structure and a wide direct band gap which allows for more efficient photon absorption and high output power density. Electrons can travel six times faster in GaAs than they can in Silicon. It absorbs more energy and therefore allows more electrons to be excited and photons can also be recycled until they interact with an electron.

GaAs is preferred for aerospace because of its greater durability against UV radiation, small size and weight and greater flexibility.





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