Seven two-metre-long retractable landing struts enable the *Sigrun* to lower its *Valkyrie* to the surface. The floor of *Sigrun's* hold can be opened laterally allowing the *Valkyrie* within the hold to be lowered down through the open floor. Six magnetic claws attached to the ceiling of the hold clamp onto the *Valkyrie's* outer shell before the hold's floor collapses. The *Valkyrie* is then lowered to the ground beneath the landing craft. After lowering its *Valkyrie* cargo down to the Martian surface, five of the six engines propel the *Sigrun* up off the ground. The *Sigrun's* landing struts are retracted once the landing craft has reached a constant altitude of six metres. The central rear engine activates, providing thrust to propel the hovering craft forward. When the velocity of the *Sigrun* reaches $10ms^{-1}$, the front three engines deactivate, and the other rear engines reposition themselves on the horizontal plane. The *Valkyrie* is able to move from its landing zone once the *Sigrun's* central engine ignites.

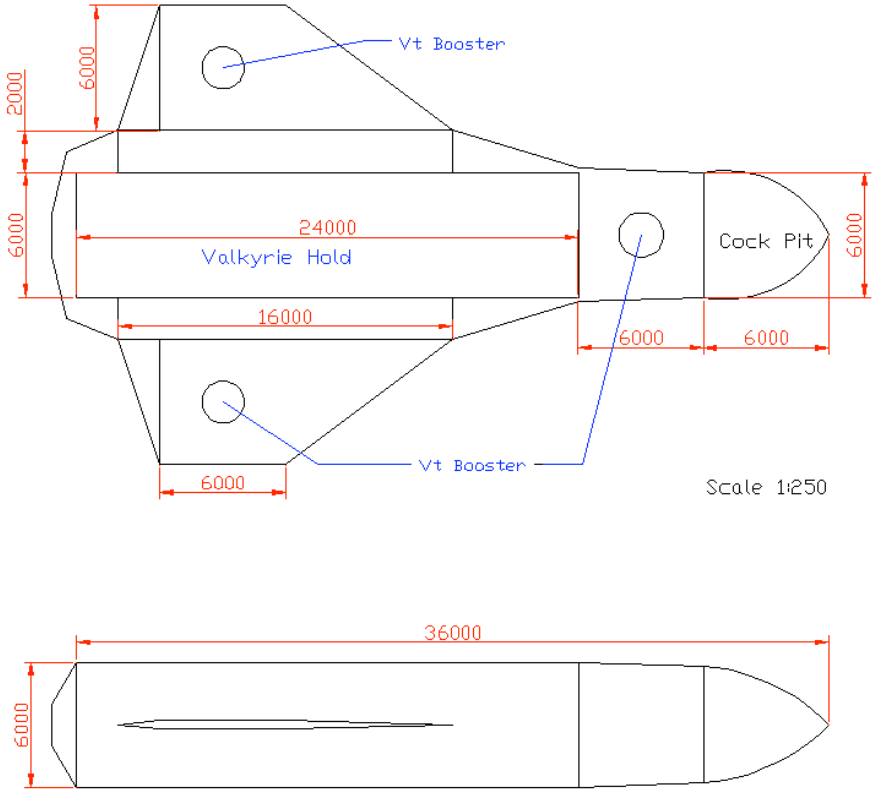

Figure 3.6: Artist's Impression of Sigrun Landing Craft

3.4 Mars Areological Research Surface Utility Vehicle

Please find attached the Marsotronix Inc. Proposal response to the Foundation Society's Design Request for a MARSUV. NDH has worked with Marsotronix Inc. over the past decades, and have selected their tender submission from several expert tenders. Renamed *Valkyrie*, the MARSUV project will truly open up Mars to the Foundation Society.

Valkyrie Rover Vehicle

Prepared by Marsotronix Inc for Northdonning Heedwell Aerospace, on behalf of the Foundation Society

The Mars Areological Research Surface Utility Vehicle, aptly renamed *Valkyrie*, will be a perfect balance between comfort, research and liveability. The *Valkyrie* will ultimately serve the purpose of surveying the geological features of Mars whilst determining possible sites for future settlements on the red planet. Marsotronix Inc. believes that this design of the *Valkyrie* will satisfy the Foundation Society's own ambitious global survey of the unique Martian environment.

The *Valkyrie* will be comprised of several compartments linearly connected by ductile corridors; this innovative design makes use of amorphous metals and carbon nano-fibres, which will allow for sufficient manoeuvrability and adequate protection. The combined properties of the carbon nano-fibres and amorphous metals will allow the *Valkyrie* to survive the abrasive Martian dust storms. The internal compartments will be wrapped in gold-plated aluminium tin alloy. This thermal blanket will maintain internal SUV temperature regardless of the extreme external conditions. The major external components and instruments such as satellites, beacons, and cameras will be exposed to drastic and wide temperature fluctuations, and as such these components will be built from composite materials that will not deteriorate. More sensitive instrumentation will be separately insulated from the rest of the vehicle.

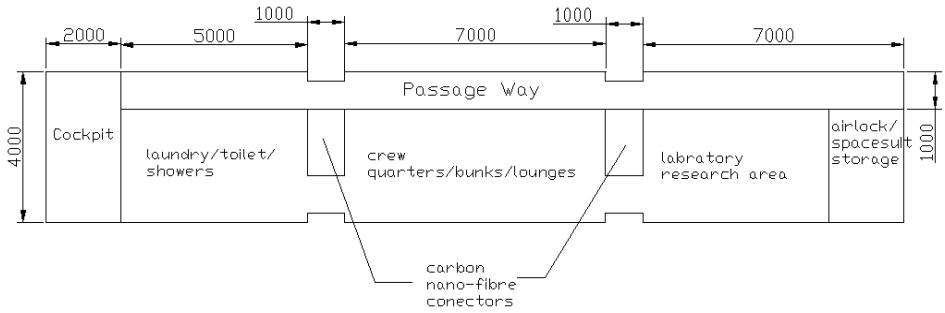

Figure 3.7: Valkyrie Schematics

The *Valkyrie* will use the latest variation of the Tweel-type tyres, originally developed by Michelin in the earlier 21st Century. The advantage of this wheel is that it will be able to deform and absorb shock, and also has increased lateral and vertical stiffness. The MARSUV will have six pairs of Tweels with computer synchronisation ensuring precision steering.

The *Valkyrie* will communicate with Earth via 1.5 m wide high gain antennae and will be able to receive and send radio signals; this will provide long range communication. Short range communication will be via a 50 cm low gain aerial that will be used when the *Valkyrie* is in its early phases of its mission. It will also be equipped with a computer that will control all aspects of the vehicle's instrument controls and switching them off and on.

The *Valkyrie* is compiled of three 7 metre-long carriages and two, metre-long traversable connectors. The compartments boast a 4 metres wide wing span and spacious height of 3.2 metres, excluding suspension and wheel stature, and employ the wide range of the SUV's functions. The forward compartment houses the *Valkyrie*'s cockpit and piloting instruments, galley, laundry, toilet and shower, and will transpire to become the most frequently used area for the *Valkyrie* for the Martian Exploration Team. The cockpit will stretch the entire front width of the *Valkyrie*, offering technicians and crew unparalleled driving views, and will be coupled by remote cameras around the vehicle for driver assistance.

The second compartment accommodates crew bunks, personnel quarters and a lounge/relaxation area. This compartment accumulates most of the Team's rest or relaxation time. Adjoining this, the third compartment features the complex lab equipment and the airlock for Astronaut transition between the SUV and the Martian environment.

The electrical power for the *Valkyrie* will be sourced from hydrogen and carbon dioxide. An idea developed by Robert Zubrin that involves flammable methane and water being produced from the combination of hydrogen and Martian carbon dioxide in the presence of a nickel catalyst. The methane will then be used as a power source for the *Valkyrie*. Back-up power will be supplied by three solar panels providing 1200 kilo-Watt hours of power a day. The energy will then run into carbon-nanotube flywheels and stored for later use (See 3.2.4 Power Generation). These solar panels will fold into recesses to be protected from dust storms. An efficient high powered engine will be used, and its fuel will be sourced from the electrical power being produced by the hydrogen and carbon dioxide mixture.

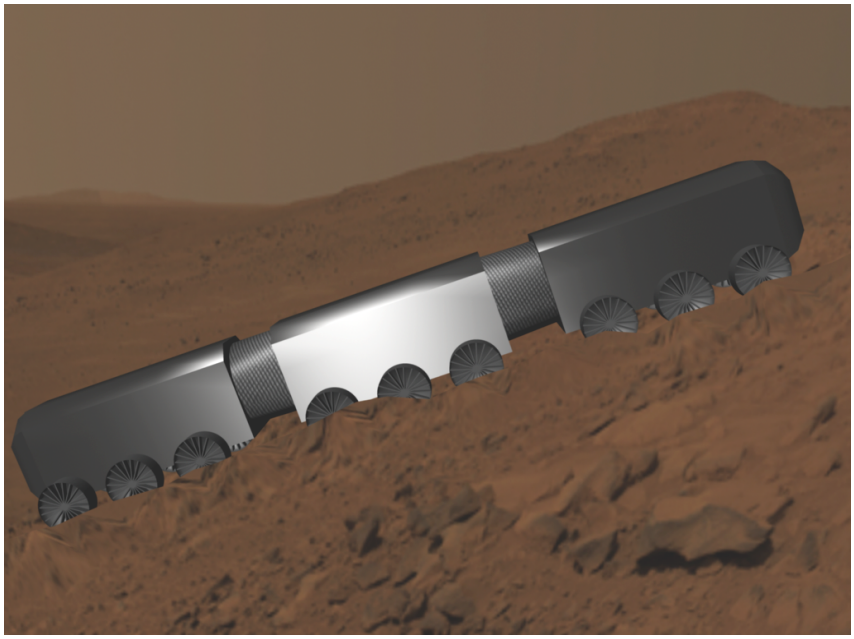

Figure 3.7: Artist's Impression of MARSUV, the Valkyrie.

The *Valkyrie* will use a dehumidifier to control the humidity levels in the vehicle, and as such water from exhalation will be recycled and reused. The air inside the vehicle will be circulated and drawn into filters for repurification. This will rid the air from microbes and particles such as fungi spores and bacteria. The excess carbon dioxide will be removed from the atmosphere and diverted into electrical power generation. These systems will be controlled by the on board computer and will be monitored by one of the two technicians. Automated alarm systems will alert technicians to all faults. The recycling systems have a back up system for failure that will last for seven days, allowing for enough time for an *Asgardam* ship to rescue or repair the MARSUV.

A landing craft has been designed to transport the *Valkyrie* between the Martian surface and *Asgardam*. This craft, named *Sigrun*, is designed to carry the *Valkyrie* as well as cargo and passengers (See 7.2.3 Landing Craft).