PROGRESS TOWARDS MARS ROVER SIMULATIONS IN THE AUSTRALIAN OUTBACK. B. Cairns[1], A. Fenton[2], and *N. Hoffman[3] Email: [1]Project Manager HOP, PO Box 1029, Indooroopilly, QLD 4068 Australia. einre@uq.net.au [2]Department of Mechanical Engineering, The University of Queensland, Brisbane, QLD 4072 Australia. [3]Victorian Institute of Earth and Planetary Science, La Trobe University, Melbourne 3086, Australia.

Introduction: The Australian outback contains extensive tracts of red desert terrain, dry lakes, weathered rock outcrops and some of the world's best preserved impact craters. Specific localities include hot springs with interesting archaeobacteria populations. Apart from the climate, it represents a useful simulation of Mars-like terrain for prototype manned vehicle operations.

As part of the international Mars Society program of experimental stations and field operations, Mars Society Australia is working towards the construction of a prototype Mars vehicle to investigate maneuverability in the desert and the difficulties of space-suited operation, airlocking, and dust management while conducting realistic field programs.

Target: Mars Society Australia is working on a series of vehicle prototypes – dubbed "Marsupials" - to simulate aspects of a field campaign in the ultimate remote desert – the surface of Mars. The current target vehicle is "Wombat", a large 4-Man expeditionary vehicle with large (2 metre) diameter wheels, and optimal terrain clearance. Power is by high-torque wheel-hub electric motors – giving fully redundant independent 4x4 drive - supplied from a central power unit (initially an internal combustion engine but intended to be a fuel cell for the final stage vehicle).

Intelligent suspension allows the vehicle to lean into slopes on traverses, "kneel" or "squat" for access to geological sites, egress from the vehicle, stability on difficult terrain or in storms, and for access to external storage bins or repair of external equipment. The suspension can also be raised beyond normal limits to traverse high or wide obstacles.

The suspension can also be commanded to fold into a minimal packed volume – chosen for terrestrial operations to be the cargo envelope of a standard C-130 transport plane. A working Mars version would travel in packed form and deploy on arrival without any cumbersome or risky assembly requirements.

Inflatable modules are being studied as a low-mass and low volume method for transporting a large deployed-volume habitable space, either as a temporary overnight shelter deployed as an annexe or as a permanent feature carried on the back of the rover.

Intermediate Stage: A conventional 4WD vehicle has been acquired and is being converted with a purpose-built cabin constructed of alloy framing and glassfibre skin. This 2-Man Human Operated Prototype (HOP), will be used as a low-cost entry to the logistics of desert operation and the design of suitable field programs and operating protocols.

After HOP, a smaller 1,500 Kg vehicle will be constructed using the full design principles for Wombat, but named "Numbat" after a smaller marsupial animal. Numbat will be used to scale-up towards the ultimate Wombat design and debug operational procedures and internal design.

Design Criteria: All vehicles are designed to be as modular and simple as possible. Suspension components are fully interchangeable between all four wheels (6-wheel versions are also possible but are beyond the scope of this exercise). Vehicles are designed for full independent operation, with on-board fuel, food, and water supplies for an extended field operation (2 weeks for HOP and up to 2 months for Wombat). Oxygen requirement is simulated by dead load. Washing and toilet facilities are included within the space and load budget.

Vehicles are divided into a forward shirtsleeves environment and clean room where all primary equipment is housed, and an aft chamber which serves as airlock and sample preparation lab. A pressure bulkhead divides the vehicle into these compartments, and pressure doors allow access between compartments and out to the rear of the vehicle.

External stowage is provided for field equipment, sample bins, emergency equipment and spare parts. External manipulators and cameras allow many common tasks to be completed without leaving the vehicle. Interlock chambers allow samples to be brought inside without using the main airlock or depressurising the work area. Equipment load will include coring drills, grab arms, Ground Penetrating Radar, and a variety of E-M and photometric scanners and geophysical sensors.

Individual components and mechanisms in the critical path will be duplicated by two smaller units so that failure of an individual component will not stop functionality of an entire system.

Programme: The HOP precursor is currently under construction and will be completed during 2001 for initial field trials in "bareback" mode with minimal internal fittings. After these trials, design of the internals and installation will be completed.

Numbat is scheduled for outline design during 2001 and construction commencing in 2002, utilising experience from trials with HOP. Wombat will follow on an appropriate timescale. Design and Assembly centres on the School of Engineering at the University of Queensland, Australia.

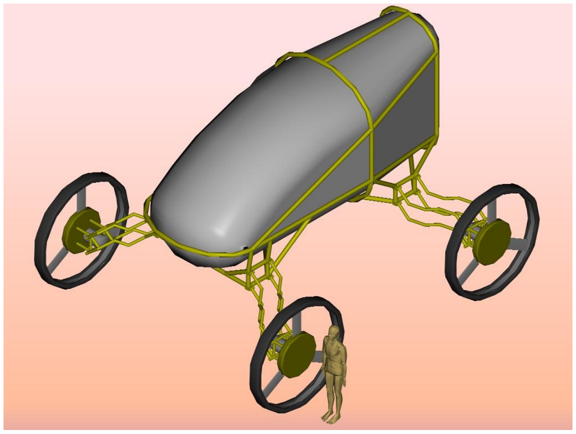

Figure 1: The Wombat Preliminary Design. 6' Human for scale. Note wide wheelbase and large rims.

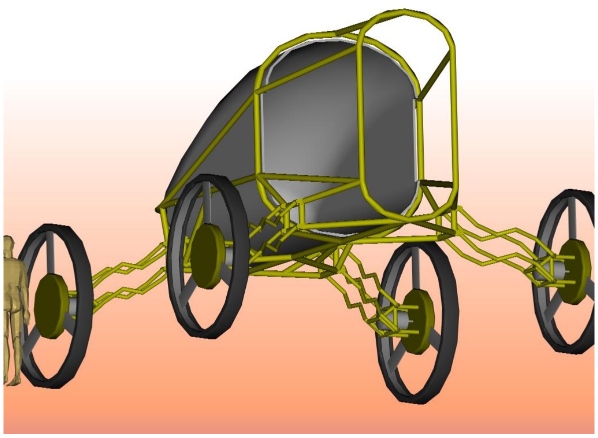

Figure 2: Rear view showing space frame for work area. This may be expanded with an inflatable structure.

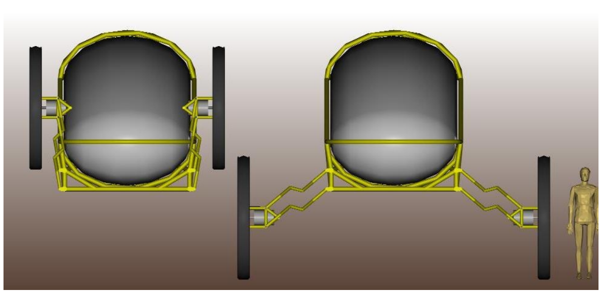

Figure 3: Front view of wheels deployed/stowed.

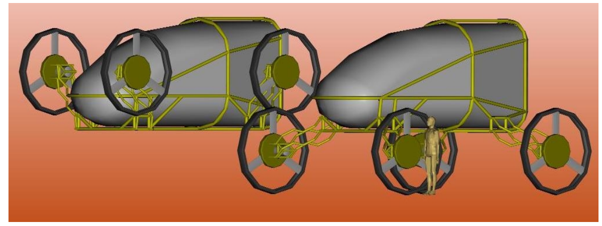

Figure 4: Oblique view

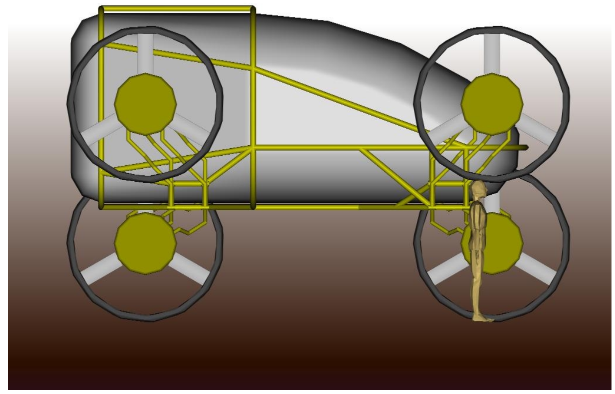

Figure 5: Split view, wheels deployed/folded

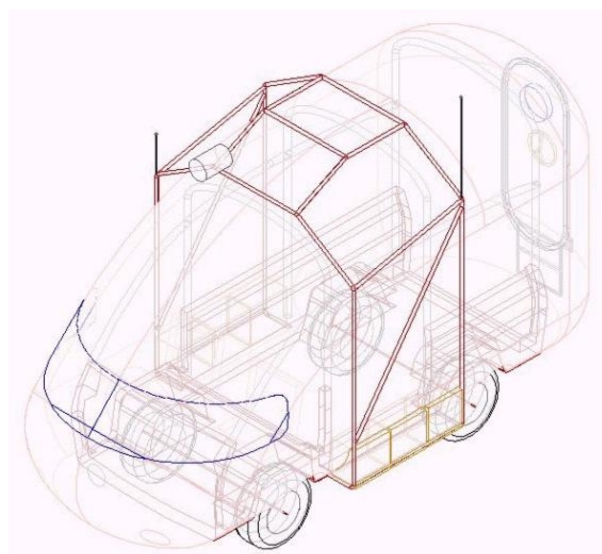

Figure 6: HOP Design schematics