

Quacr's Expedition to Mars

Quacr is a collaborative problem solving system that harnesses the power of competition. It operates online at www.quacr.com.

Quacr has developed a Mars Expedition concept to test its problem solving ability.



We assume that humans will travel to Mars one day. This may be for extinction insurance, resources, adventure, fame or just that we are inquisitive.

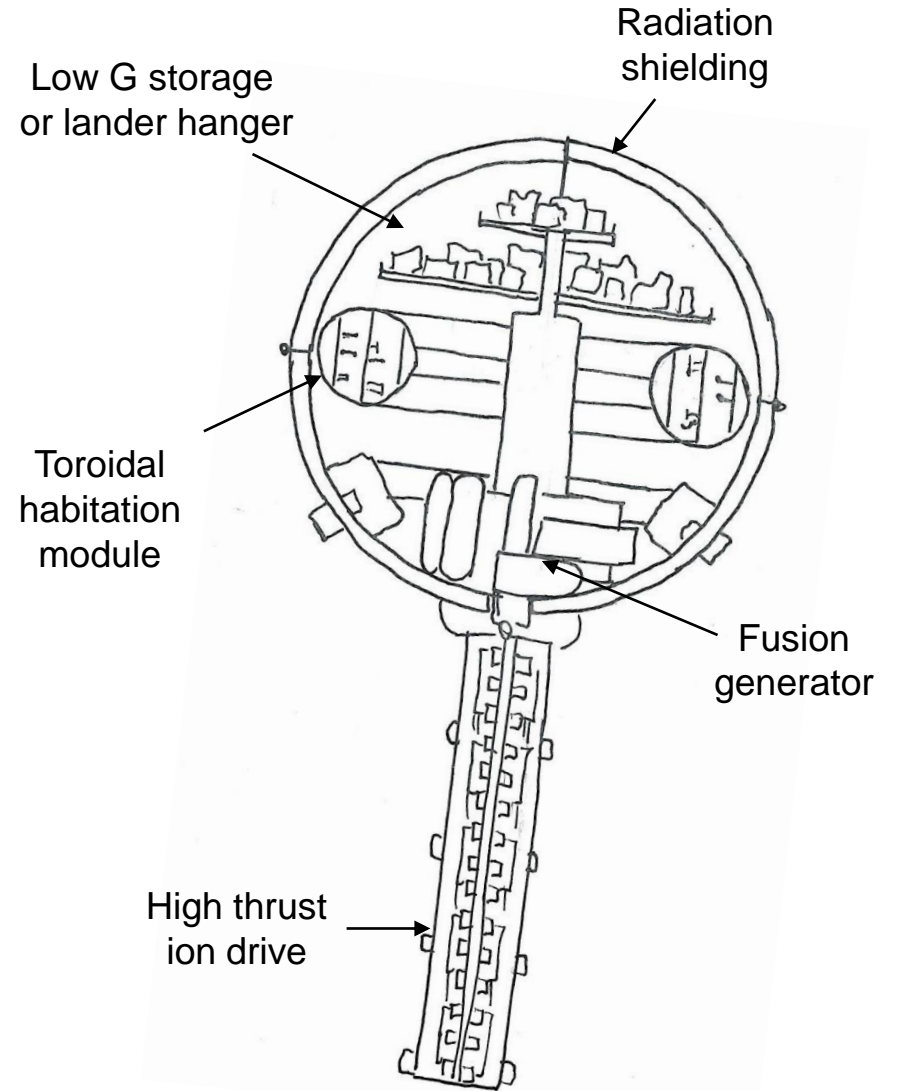
We also assume that :-

- Fusion power is available
- High thrust ion drive engines are available
- Humans need to be shielded from space radiation and micro-meteorites by passive shielding
- Humans can tolerate Mars gravity long term

The third point means that a space traveller's spaceship is surrounded by tons of radiation absorbing material. The spaceship is very slow to accelerate. It is not usable in the normal science fiction concept of a rocket trip to Mars. Instead it is used in a different concept that we call the Quacr Ship.

The core of the Quacr Ship is a 130 m diameter sphere that is coated with nearly half a millions tons of shielding material. The shielding material has the same mass per surface area as the Earth's atmosphere.

Within the unpressurised shell there is a pressurised toroidal habitation module. The habitation module rotates at about 4 revolutions per minute to generate 1 g of artificial gravity.



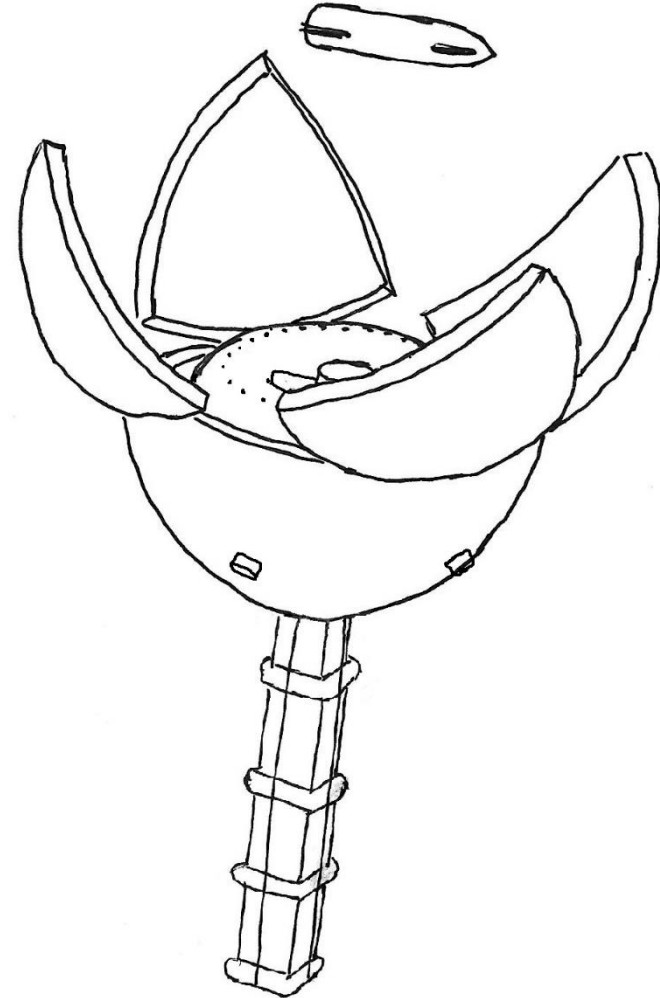


The Quacr Ship has artificial gravity, air pressure and radiation shielding. It is a safe and comfortable place for dozens, or even hundreds of people to live, work and cultivate their own food long term in space.

The shielding material is sand and dust that is loosely held in place. If the Quacr Ship were accidentally to enter the Earth's atmosphere the sand and dust would blow off and most of the ship would burn up in the atmosphere. There would be little effect on the ground.

The Quacr Ship has a fusion powered ion drive engine that can provide 2.5 tons of thrust. That gives it an acceleration of about $5 \times 10^{-5} \text{ ms}^{-2}$. That's not enough thrust to lift off but it is enough to manoeuvre – given enough time.

The Quacr Ship is built in low Earth orbit with parts brought up from the surface. It then flies higher and gets its sand and dust shielding from a crushed asteroid. It then takes several years to work itself into a useful orbit.





The Quacr Ship takes up an orbit swinging between Earth and Mars. It uses the gravity of Earth and Mars to adjust its orbit to remain in synch with the planets.

The Quacr Ship's orbit is unstable. The Quacr Ship needs to continuously monitor its trajectory and make regular adjustments. However all the hard accelerating is done by the gravity of Earth, Mars and the Sun.

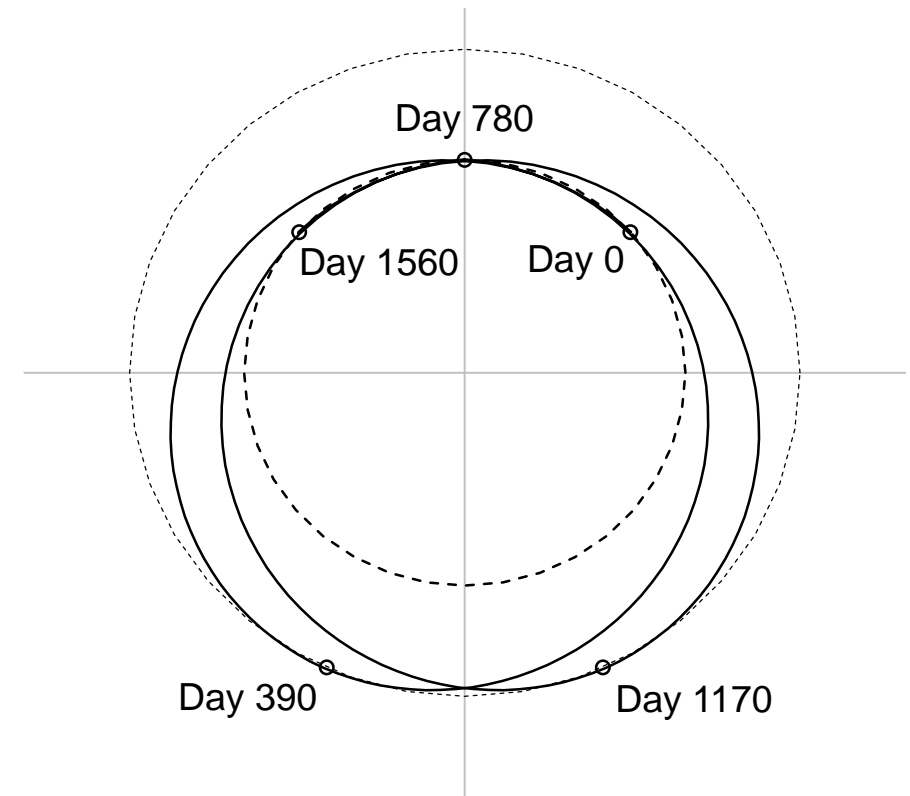
The closest approach to Earth is about 10^8 meters (100,000 km or about 62,000 miles). It passes inside the orbit of the Moon but well outside the orbit of Earth's geostationary satellites.

To get to the surface of Mars from the surface of Earth a traveller must:-

1. Lift off from Earth in a conventional rocket, get into Earth orbit and wait for the Quacr Ship to pass.
2. Boost out of Earth orbit to meet the Quacr Ship
3. Enter and live in the Quacr Ship for the journey – about 390 days.
4. Boost away from the Quacr Ship and use Mar's atmosphere to slow and descend to the surface.

The traveller is exposed to space radiation while outside the Quacr Ship during the changes but these are relatively short periods of time.

Quacr Ship Earth Mars Orbit





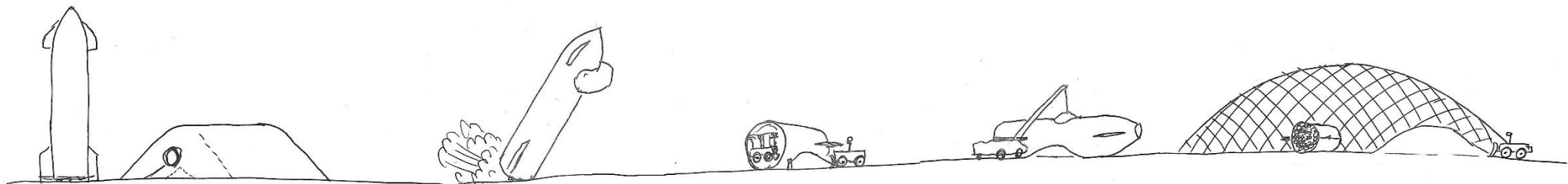
The objective of the Mars Expedition is to build a self-sufficient community – a community that could survive indefinitely if it was cut off. The number of people required depends on the supporting technology. With 2021 technology it would probably need thousands. With sophisticated separators, 3D printers and automation the number could be much smaller. The expedition proceeds over several phases with many arrival flights.

Phase 1: A spaceship travels to Mars. It is unmanned so doesn't need the Quacr Ship. After landing it fires one engine, tips over and falls onto an airbag. It unloads a variety of exploration drones. They survey and search for water and minerals.

Phase 2 : Several unmanned spaceships travel to Mars also without the Quacr Ship. Most of them also tip over and unload equipment including a fusion power generator. Machines set to work covering the spaceship bodies with Mars soil and rock. Some of the arrivals are escape ships. They do not tip over. They unload fuel generators which are plugged into the power supply and start to create and store fuel.

Phase 3: The first colonists make the journey to Mars in the Quacr Ship. More spaceships deliver more equipment and supplies. The colonists take up residence in the converted spaceship bodies where they are protected from radiation. They start to grow their own food. They control soil moving and building equipment remotely. They erect more complex pre-packed buildings. They make concrete from local water and crushed rock.

Phase 4: Every 780 days another group of colonists arrives having travelled in the Quacr Ship. They continue to build, explore, work and cultivate. Mars and Earth trade information - entertainment, design, software, research products etc.





The Mars Expedition is enormously expensive. Funding only flows in if the population of Earth is interested. Generating and retaining interest around the world is therefore one of the key goals of the expedition. The implications of this are:-

- On Earth expedition management is heavily influenced by the need to present interesting stories to the global population. Senior managers have skills and track record in showmanship and entertainment.
- Regular episodes are broadcast presenting the activities of the colonists including their successes, failures, complaints, interpersonal relationships and problems as they try to survive together. These include personal interviews to camera and personal challenges to the colonists. (Revenue generated is useful but small compared to the cost of the expedition)
- Colonists are selected to represent every region, outlook, background, religion, sexual orientation, age, body type, and ability. They are selected for their strong personalities. The objective is to represent all the social problems we have on Earth in microcosm. This is the opposite of the normal selection criteria for space projects.
- In 2021 there is not yet sufficient global interest to begin this expedition. More action is required to generate more global interest. This might include a repeat of the Earth based social isolation simulations like Biosphere 2, MARS-500 and HI-SEAS, but with global entertainment as the objective. This might be self-funding.
- The expedition is not under the control of any single national government.



Technologies we need to develop:-

- Fusion Power
- High thrust ion drive engine
- Robotic construction of space vehicles in space
- Asteroid crushing and handling in space
- Radiation shielding
- Planetary collision safety
- Tipping over Mars lander
- Fuel generation and storage machines
- Closed ecology life support systems
- Robotic soil moving
- Construction of pre-packed surface buildings
- Dealing with health effects of Mars gravity
- Separators – machines that convert rocks into raw materials
- Replicators / 3D printers
- Expedition based global entertainment formats and networks
- Advanced collaborative problem solving techniques – like Quacr



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