Aeross(Aero Space Society)

Project Aphadras

Mission – Sustaining Future Beyond Earth

A human mission to Mars has been the subject of science fiction, engineering, and scienctific proposals throughout the 20^{th} and into the 21^{st} century. The plans compromise proposals to land on mars, structural operations, designs and technologies used in the framework of the expedition, the basic requirements, eventually settling on and terraforming the planet, while utilizing its moons, Phobos and Deimos. Exploration of Mars to find out the possibility of existence of life in Mars has been a goal of national space programmes for decades. Failure has always raged us due to one or the other defaults in the system of exploration. This time, we come up with our new expedition, the Project Aphadras, involving a group of ten people. As the management, information and efficiency of our new project has shown no defaults yet, it can prove to be very successful in finding out the possibility of life beyond the dimensions of Earth. We are fully equiped with the latest technologies and the newest machines. We have come up with a new Space Shuttle that would reduce the chances of any inconvenience that could come on our way. The success % is 4 which has been the most of all. If we succeed, we could sustain the life of billions that are currently breathing and billions, that are yet to come. I have detailed, one by one, each sections of our department so as to satify, satiate and covince you to accept our proposal.

Basic Requirements:

The expedition is estimated to long for 3 months(180 days). Certainly, A large amount of requirements would have to be fulfilled.

First of all, The most basic requirement to sustain the mission is the requirement of food. According to the averaged estimates, around 1.1 kg of food is required each day. Therefore, for ten members, around 11kgs of food are required each day. For 180 days, 180*11= 1980 kgs of food are required for the whole expedition.

Secondly, The element that sustains life – Water(H20). In average, each astronaut would require 1 litre of water everyday. 10 astronauts would require 10 litres of water everyday. 10 astronauts would thus, require 1800 litres of water for 3 months. Small amounts of water are recycled from cabin air onboard the ISS, but we have to meet up with the major portion of this requirement.

Thirdly, Sanitation is quite an important requirement. Shuttle Space should have proper sanitations to maintain the health of the astronauts.

Fourthly, Thermostabilization is required to be loaded inside the shuttle craft. It's important as it would check for the swelling of food and hence, check whether or not the food is fresh and safe to consume.

Sixth, **Variable Specific Impulse Magnetoplasm Rocket.** The Variable Specific Impulse Magnetoplasma Rocket (VASIMR) is an electromagnetic thruster for spacecraft propulsion. It uses radio waves to ionize and heat a propellant, and magnetic fields to accelerate the resulting plasma to generate thrust. It is one of several types of spacecraft electric propulsion systems.

Seventh, In-built satellites for image-viewing, detecting the presence of harmful radiations, communications and for other purposes. Some of the sattelites are earth observation satellites, communication satellites, navigation satellites, weather satellites, and research satellites

Eight, Radar.

Ninth, Liquid Fuel. Around 21000 gallons of liquid oxygen is required for the whole mission.

Tenth, Nuclear Electric Rocket to run VASIMR(see below)

Structural Design

The Variable Specific Impulse Magnetoplasma Rocket (VASIMR) is an electromagnetic thruster for spacecraft propulsion. It uses radio waves to ionize and heat a propellant, and magnetic fields to accelerate the resulting plasma to generate thrust. It is one of several types of spacecraft electric propulsion systems.

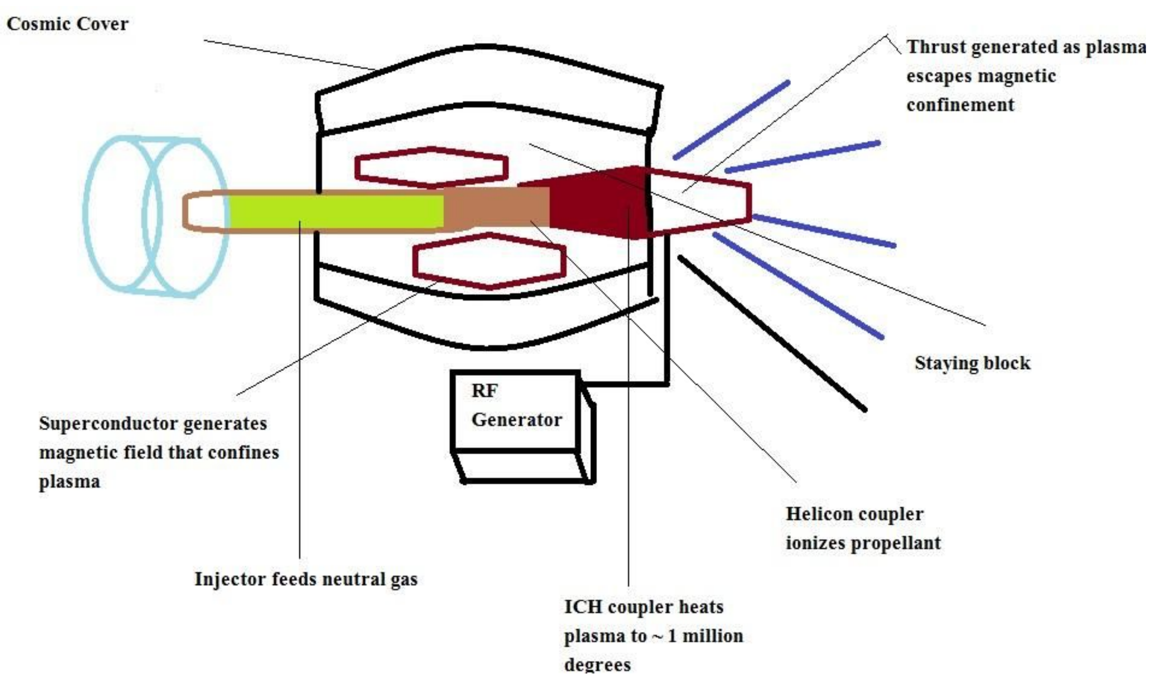
The method of heating plasma used in VASIMR was originally developed as a result of research into nuclear fusion. VASIMR is intended to bridge the gap between high-thrust, low-specific impulse propulsion systems and low-thrust, high-specific impulse systems.

The Variable Specific Impulse Magnetoplasma Rocket, sometimes referred to as the Electro-thermal Plasma Thruster or Electro-thermal Magnetoplasma Rocket, uses radio waves to ionize and heat propellant, which generates plasma that is accelerated using magnetic fields to generate thrust. This type of engine is electrodeless and as such belongs to the same electric propulsion family (while differing in the method of plasma acceleration) as the electrodeless plasma thruster, the microwave arcjet, or the pulsed inductive thruster class. It can also be seen as an electrodeless version of an arcjet, able to reach higher propellant temperature by limiting the heat flux from the plasma to the structure. Neither type of engine has any electrodes. This is advantageous in that it eliminates problems with electrode erosion that cause rival designs of ion thrusters to have relatively shorter life expectancy. Furthermore, since every part of a VASIMR engine is magnetically shielded and does not come into direct contact with plasma, the potential durability of this engine design is greater than other ion/plasma engine designs. Therefore, **It is protected from all types of radiations**

VASIMR can be most basically thought of as a convergent-divergent nozzle for ions and electrons. The propellant (a neutral gas such as argon or xenon) is first injected into a hollow cylinder surfaced with electromagnets. Upon entry into the engine, the gas is first heated to a "cold plasma" by a helicon RF antenna which bombards the gas with electromagnetic waves, stripping electrons off the argon or xenon atoms and leaving plasma consisting of ions and loose electrons to continue down the engine compartment. By varying the amount of energy dedicated to RF heating and the amount of propellant delivered for plasma generation VASIMR is capable of generating either low-thrust, high–specific impulse exhaust or relatively high-thrust, low–specific impulse exhaust. The second phase is a strong electromagnet positioned to compress the ionized plasma in a similar fashion to a convergent-divergent nozzle that compresses gas in traditional rocket engines.

A second coupler, known as the Ion Cyclotron Heating (ICH) section, emits electromagnetic waves in resonance with the orbits of ions and electrons as they travel through the engine. Resonance of the waves and plasma is achieved through a reduction of the magnetic field in this portion of the engine which slows down the orbital motion of the plasma particles. This section further heats the plasma to temperatures upwards of 1,000,000 kelvin—about 173 times the temperature of the Sun's surface.

Motion of ions and electrons through the engine can be approximated by lines parallel to the engine walls; however, the particles actually orbit those lines at the same time that they are traveling linearly through the engine. The final, diverging, section of the engine contains a steadily expanding magnetic field which forces the ions and electrons into steadily lengthening spiral orbits in order to eject from the engine parallel and opposite to the direction of motion at speeds of up to 50,000 m/s, propelling the rocket forward through space.



Force required to move the craft per second = 3E09 N approximately. Thus, It would require a huge quantity of extremely strong magnets to create the margnetic field of the desired magnitude. Hence, There should be a storage of 20000 tons of magnet. Therefore, a separate block for magnets should be there to accommodate them.

This section further heats the plasma to temperatures upwards of 1,000,000 kelvin—about 173 times the temperature of the Sun's surface. There should be a coolant within this system so as to avoid any blasts and over heating. The temperature of this section should be cooled down with large dynamic coolers. Moreover, this section should be coated with elements with relatively high melting point so as to ensure, the craft sustains. It should be coated with compounds of carbon moulded in such a way that it's melting point increases dynamically.

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Benefits:

Firstly, In contrast with usual cyclotron resonance heating processes, in VASIMR ions are immediately ejected through the magnetic nozzle, before they have time to achieve thermalized distribution.

Secondly, VASIMR does not use electrodes, instead, it magnetically shields plasma from most of the hardware parts, thus eliminating electrode erosion—a major source of wear and tear in ion engines.

Compared to traditional rocket engines with very complex plumbing, high performance valves, actuators and turbopumps, VASIMR eliminates practically all moving parts from its design (apart from minor ones, like gas valves), maximizing its long term durability. Hence, it is very suitable for a lond distance expedition. Never ever before did a man ever make it to Mars. This time, in Aphadras, we are gonna move beyond the bonds of humanism. Our programme is totally a new one. This craft can be called, a “next generation” craft.

Limitations:

Some new problems may emerge, like collision with strong magnetic fields and thermal management. The relatively large power at which VASIMR operates generates a lot of waste heat, which needs to be channeled away without creating thermal overload and undue thermal stress on materials used. Powerful superconducting electromagnets, employed to contain hot plasma, generate tesla-range magnetic fields. They can present problems with other on board devices and also can produce unwanted torque by interacting with the magnetosphere.

Solutions:

Therefore, there should be a houseful store house of energy so as to avoid any unwanted situations i.e at anytime, the energy level shouldn’t fall below the bandwith.

To counter the problem of foreign magnetic field’s latter effect, the VF-200 will consist of two 100 kW thruster units packaged together, with the magnetic field of each thruster oriented in opposite directions in order to make a zero-torque magnetic quadrupole.

Other Applications of VASIMR:

VASIMR could function as an upper stage for cargo, reducing the fuel requirements for in-space transportation. The engine is expected to perform the following functions at a fraction of the cost of chemical technologies:

Firstly, Drag compensation for space stations.

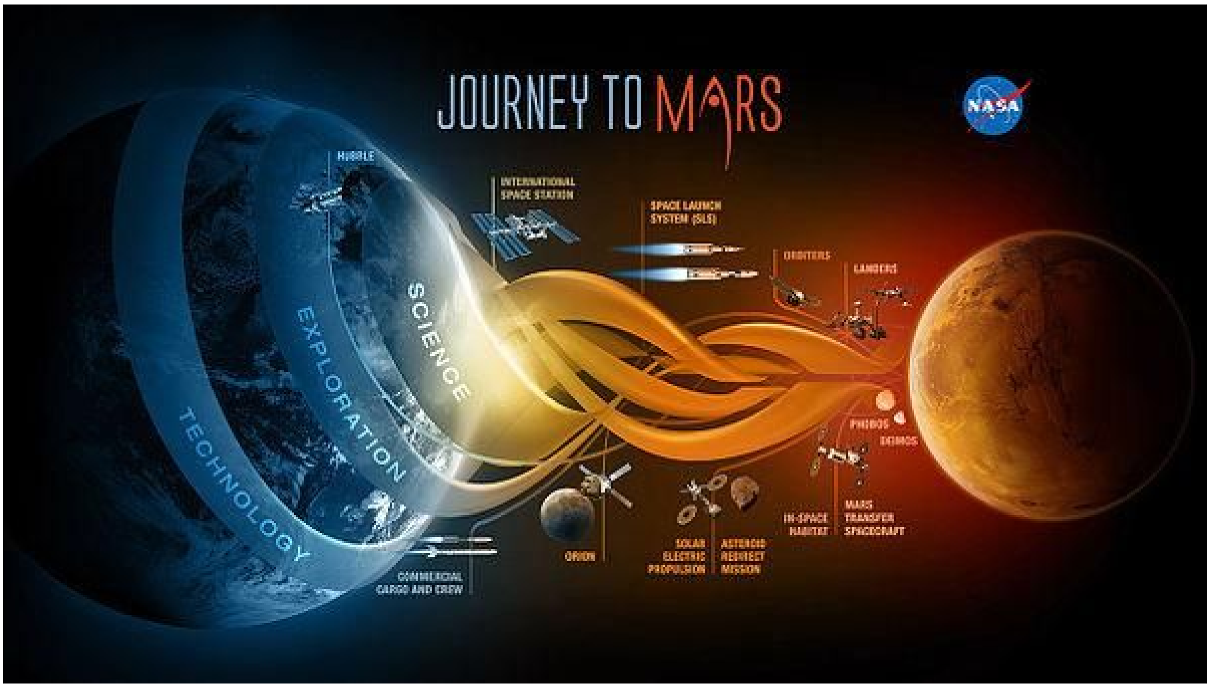
Secondly, Lunar cargo delivery.

Thirdly, Satellite repositioning.

Fourthly, Satellite refueling, maintenance and repair.

Fifth, In space resource recovery.

Sixth, Ultra fast deep space robotic missions.



Operations And Infrastructure

The Mars Exploration Program is a science-driven program that seeks to understand whether Mars was, is, or can be, a habitable world. To find out, we need to understand how geologic, climatic, and other processes have worked to shape Mars and its environment over time, as well as how they interact today.

Mission:

Firstly, to determine if ever life existed in Mars.

Secondly, Characterize the climate of Mars.

Thirdly, Characterize the geology of Mars.

Fourth, Prepare for Human Exploration.

Mars is the focus of much speculation and scientific study about possible human colonization. Its surface conditions and the likely presence of water on Mars make it arguably the most hospitable of the planets, other than Earth. Mars requires less energy per unit mass (delta-v) to reach from Earth than any planet except Venus. However, at minimum energy use, a trip to Mars requires 2-3 months in space using current VASIMR.

Since it is not possible to fly directly to Mars, we would have to create a base somewhere in between. The plan proposed by some of our scientists is that we would create a base station at

Phobos, one of the two satellite in Mars. The base station would be set up with the help of robots. Thus, the journey would start from Earth, next, it would land at Phobos, and the next, to Mars.

The network will provide a convenient, integrated means for transporting robotically constructed bases to Phobos and Mars. All the technology needed for the current plan is expected to be available for use at the projected date of cargo departure from the Earth system. The modular design of the transportation system provides easily implemented contingency plans, so that difficulties with any one vehicle will have a minimal effect on the progress of the total mission. The transportation network proposed consists of orbital vehicles and atmospheric entry vehicles. Initially, only orbital vehicles will participate in the robotic construction phase of the Phobos base. The Interplanetary Transfer Vehicle (ITV) will carry the base and construction equipment to Phobos where the Orbital Maneuvering Vehicles (OMV's) will participate in the initial construction of the base. When the Mars base is ready to be sent, one or more ITV's will be used to transport the atmospheric entry vehicles from Earth. These atmospheric vehicles are the One Way Landers (OWL's) and the Ascent/Descent Vehicles (ADV's). They will be used to carry the base components and/or construction equipment. The OMV's and the Orbital Transfer Vehicles (OTV's) will assist in carrying the atmospheric entry vehicles to low Martian orbit where the OWL's or ADV's will descent to the planet surface. The ADV's were proposed to accommodate expansion of the system. Additionally, a smaller version of the ADV class is capable of transporting personnel between Mars and Phobos.

Operation Plans:

To reach Phobos as early as possible, we need to take up the fastest fly method. On-orbit stagging is considered, by far, to be the best and the fastest operation plans yet. According to this fly method, it would require 85 days to reach Mars through VASIMR.

A single-stage-to-orbit (or SSTO) vehicle reaches orbit from the surface of a body without jettisoning hardware, expending only propellants and fluids. The term usually, but not exclusively, refers to reusable vehicles. No Earth-launched SSTO launch vehicles have ever been constructed. To date, orbital launches have been performed either by multi-stage fully or partially expendable rockets, or by the Space Shuttle, which was multi-stage and partially reusable.

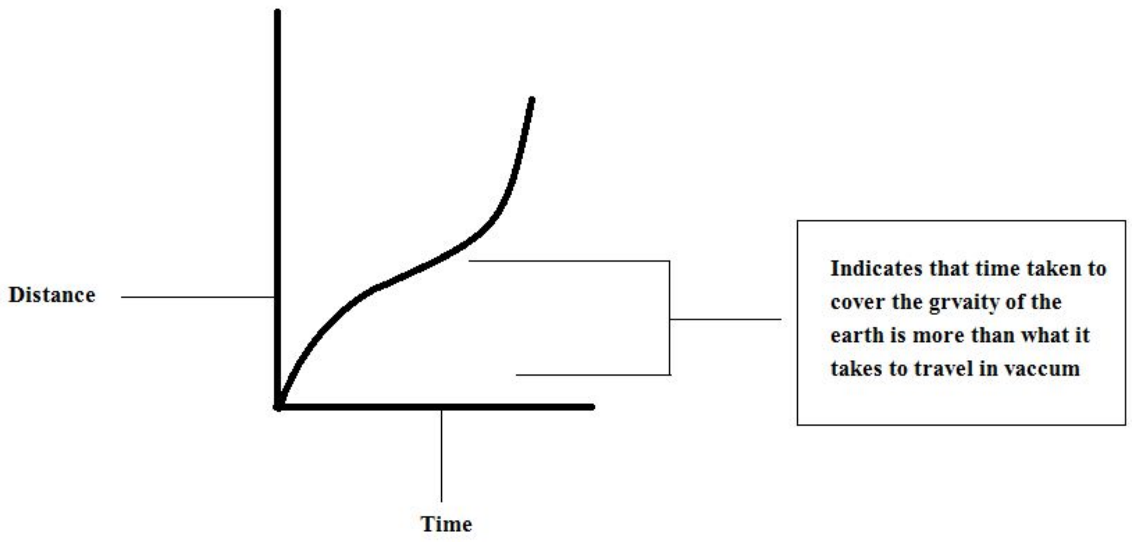
Launch costs for low Earth orbit (LEO) range from $4500 to $8500 per pound of payload ($10,000–$19,000 / kg). Reusable SSTO vehicles offer the promise of reduced launch expenses by eliminating recurring costs associated with hardware replacement inherent in expendable launch systems. However, the nonrecurring costs associated with design, development, research and engineering (DDR&E) of reusable SSTO systems are much higher than expendable systems due to the substantial technical challenges of SSTO.

It is considered to be marginally possible to launch a single stage to orbit spacecraft from Earth. The principal complicating factors for SSTO from Earth are: high orbital velocity of over 7,400 metres per second (27,000 km/h; 17,000 mph); the need to overcome Earth's gravity, especially in the early stages of flight; and flight within Earth's atmosphere, which limits speed in the early stages of flight and influences engine performance. The marginality of SSTO can be seen in the launch of the space shuttle. The orbiter and main tank combination successfully orbits after booster separation from an altitude of 45 kilometres (28 mi) and a speed of 4,828 kilometres per hour (1,341 m/s; 3,000 mph).

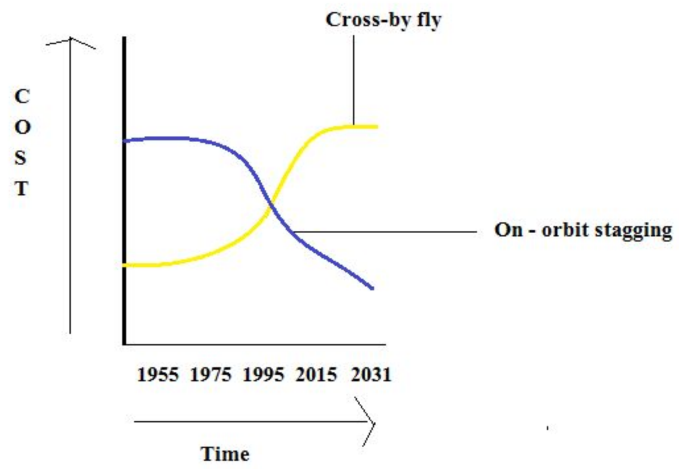
This is approximately 12% of the gravitational potential energy and just 3% of the kinetic energy needed for orbital velocity (4% of total energy required).

Notable single stage to orbit research spacecraft include Skylon, the DC-X, the Lockheed Martin X-33, and the Roton SSTO. However, despite showing some promise, none of them has come close to achieving orbit yet due to problems with finding the most efficient propulsion system.

Single-stage-to-orbit has been achieved from the Moon by both the Apollo program's Lunar Module and several robotic spacecraft of the Soviet Luna program; the lower lunar gravity and absence of any significant atmosphere makes this much easier than from Earth.



Refuelling is essential. Therefore, we plan to refuel our craft in Phobos before landing in Mars. We would robots prior to our departure with fuel and all other requirements.



On-orbit stagging has reduced the cost of transportation to a great extent. The cost of transportation plummeted down from 1995 when the on orbit stagging was introduced. The primary reason why it takes less expenditure is because it covers a lot of distance in a very less amount of time. It approximately save 2-3 months(8640000 seconds), thus saving 9 billions approximately.

Entry into the thin and shallow martian atmosphere will pose significant difficulties the re-entry and for a spacecraft of the weight needed to carry humans, along with life support, supplies and other equipment. Should a heat shield be used it would need to be very large. Retro rockets could be used, but would add significant further weight.

One of the medical supplies that may be needed is intravenous fluid, which is mostly water but contains other things so it can be added directly to the human blood stream. If it can be created on the spot from existing water then it could spare the weight of hauling earth-produced units, whose weight is mostly water. A prototype for this capability was tested on the International Space Station in 2010.

While it is possible for humans to breathe pure oxygen, a pure oxygen atmosphere was implicated in the Apollo 1 fire. As such, Mars habitats may have a need for additional gases. One possibility is to take nitrogen and argon from the atmosphere of Mars; however, they are hard to separate from each other. As a result, a Mars habitat may use 40% argon, 40% nitrogen, and 20% oxygen.

Landing And Launching Sites during the synopsis period.

Earth	NASA, Orlando, U.S.A	
Phobos	South Hemisphere	
Mars	North Hemisphere	

Schedule And Cost

The Schedule for the 2031-32 Space Exdition goes:

Planet/Schedule	**Departure**	**Arrival**
Earth	21st October,2031	1st February,2032
Phobos	1st January, 2032	15th November,2031
Mars	8th January,2032	23rd November, 2031
Total Journey	**99 days approximately**	

Cost:

Genre	Cost
Space Shuttle	10billion$ - Magnets 5billion$ - Cosmic cover 5billion$ - Design 20billion$ - Satellites Total= 40billion$
Fuel	1billion$
Base Stations in Mars, Earth and Phobos	Robotic Assistance-100million$ Infrastructure – 200million$ Design – 2billion$ Total – 2.3billion$
Miscellaneous(Food, Water, Clothing, etc)	1billion$
Technology	2billion$
Researchs and Surveys	200million$
Medicals	10million$
Salaries	20million$ per head. 200million$
Transportation(on-orbit stagging)	500million$

*These are gross estimates.

Total Cost=47210000000$(Rs.3029465700000) or 47.21billion$

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Class XI

Section L

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