

Space Governance Options for Reconciling the Hazards, Hype & Hope of Humans on Mars

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Mars is unchartered, unknown and unearthly and yet attracts all of humanity. The hazards of the endeavour are overwhelmed by the hype and hope surrounding the enterprise. A variety of private individuals, commercial organisations and national space agencies are engrossed in efforts at landing and inhabiting Mars. However, these efforts are disjoint and there exists little or no coordination. The aspirations as also hazards are immense, the resources scarce and costly. Consequently, left ungoverned the potential for conflict in space exploration is high. There exists a critical need to regulate and coordinate affairs in this area right now when the technologies and legislation are yet immature. This calls for a credible, institutionalised governance structure. This paper proposes an expansion of the existing United Nations Office of Outer Space Affairs (UNOOSA) to take on the mantle of space exploration governance and to continue with incremental progressions later.

1. The Allure of a Mars Adventure

Amongst the planets, Mars is the God of war; wild, brash and filled to the brim with adventure. Little wonder then that the planet appeals so strongly to adventurers. The buzz of the unknown and unexplored fires their imagination. Apparently, a one-way ticket to an unknown, unearthly and unchartered destination like Mars fits the bill. The endeavour is especially adventurous when one considers that most national space agencies ranging from the U.S.' National Aeronautics and Space Administration (NASA) to Russia's ROSCOMOS as also the China National Space Administration (CNSA) believe that neither has technology nor legislation matured to support such an endeavour. The closest date NASA places for a human Mars mission is 2030¹. Other space agencies don't even dare hazard a guesstimate.

On the other hand, regardless of the feasibility or availability of technology, private parties plan Mars landing and habitations by as early as 2018². Such propositions are a great draw. For instance, more than 200,000 people from 140-odd countries have applied for one-way tickets to Mars from Holland's Mars One television project³. Interestingly, the largest applicants are from the world's leading space faring nation – the U.S. These are followed by applicants from other formidable space faring entities like Russia, China, India and Europe, all of whom are known to have their own independent Mars missions.

Perhaps, these are people with little or no faith in the promise of Mars missions pursued by their own countries. They may also be extraordinarily brave or unaware of what they are getting themselves into. The popular image of the intrepid explorer

¹ Ref site of NASA and statement of NASA Administrator in Charles Bolden, "Why did we choose to go to Mars? Because it is hard", *Orlando Sentinel*, 05 Aug 2012.

² Ref Philip Keane, "Dennis Tito Reveals 2018 Mars Mission Details", *Space Safety Magazine*, 27 Feb 2013 and Adam Mann, "Private Plan to Send Humans to Mars in 2018 Might Not be so Crazy", *Wired Magazine*, 27 Feb 2013.

³ Ref site of Mars One, "705 Potential Mars Settlers Remain in Mars One's Astronaut Selection Process", *Mars One News*, Amersfoort, The Netherlands, 5 Mar 2014 at <http://www.mars-one.com/news/press-releases/705-potential-mars-settlers-remain-in-mars-ones-astronaut-selection-process>

discovering new vistas to harvest and make fortunes, most certainly drives their aspirations. These are aspirations built upon assumption, myth, movies and popular literature. However, divested of the associated romance, a more prosaic picture is evident when one looks at the inhibiting factors like the interplanetary distances, the physiological and psychological issues related to the Martian atmosphere, radiation, surface temperatures, the gravitational effects etc. The hazards are many and varied.

2. The Hazards of the Adventure

To begin with, at present levels of rocket technology, the interplanetary trip to Mars takes around 270-300 days, far more than any conceivable road, rail or air trip on earth. A suitable 'launch window' opens every two years for a chemical rocket trip of the above duration. After three to four months, a return launch window opens that involves as much time to return. The return is subject to reaching Mars orbit and landing. The prevailing dismal rate of successes in Mars missions inspires little confidence in both of the above. The statistics are revealing; of the 45 Mars attempts since the first Mars mission in 1960 more than half failed. In fact, until the year 2000, a failure rate of over 70% precluded any notion of success in the endeavour. The failures rates have stabilised to around 50% since then due to a string of NASA successes⁴. The same cannot be said for other nations. Russian success continues to be dismal at over 70%, Japan's lone mission (*Nozomi*) after five years went off target missing Mars orbit altogether⁵, China's *Yinghuo* fell back to earth⁶ and Europe's lander *Beagle* failed. Put briefly, reaching Mars is a hard and unforgiving endeavour, with little room for error. More than two-thirds of the Mars missions have been lost due to launch failures, component malfunctions, communication losses and other errors that sent spacecraft crashing into the Martian surface or missing the planet altogether. Going by the statistics, no country has made it to Mars in the first try, before India, spectacularly, last month with *Magalyaan*. These statistics, in the context of air, rail or road travel are unimaginable. They would inspire no confidence and no reasonable person would hazard travel by

such means. Even the hardy adventurer would harbour second thoughts.

Cruising interplanetary distances appears formidable; landing and habitation are equally so in many more ways than one. Landing in the thin atmosphere of Mars is particularly an issue with spacecraft entering the Martian atmosphere at a tearing speed of 24,000 kmph. Even after slowing down with a parachute or inflatable, the descent would be well above the speed of sound. Pretty obviously, one of the main issues with landing humans on Mars is figuring out how to slow down so as to not smash into smithereens. Dropping a lightweight robotic crawler like the rover is a separate issue; it may or may not survive the crash. A human being needs to survive the landing and also live well thereafter.

After the landing comes the shock of the cold, barren, lifeless surface of Mars that is too inhospitable to harbour life as understood on earth. It has temperatures ranging from 20 degrees Celsius to minus 150 degrees. More importantly, because of the low atmospheric pressure, if left unprotected, the skin and organs within minutes would rupture, outgas and produce a quick, painful death. As of date, no agency is known to have designed, tested and certified protective suits to guard against such issues. Apart from temperatures and low pressure are the ultra-tiny dust storms flying around the planet for billions of years. These are not quite like anything on Earth. The particles are known to be toxic, carcinogenic, and full of perchlorates that cause problems in the thyroid gland. The atmospheric composition is different and one would also have to contend with the lack of oxygen (0.1% as opposed to earth's 20%). And last but not the least, the usual colours, sights, sounds, birds and trees, etc. of earth's biosphere are absent in the lifeless expanse of Mars.

However, the spirit of adventure is hardy and may hazard the perils of space flight. One may get lucky and be amongst the few to make the trip. Returning from the trip would be an even greater exercise. The human body evolved over thousands of years to earth's gravity and is yet to evolve or adapt to the

⁴ Figures sourced from NASA Mars Timelines at http://nssdc.gsfc.nasa.gov/planetary/chronology_mars.html accessed on 07 July 2014.

⁵ Ref Govert Schilling, "Japan's Lost Hope", *Science Mag*, 17 Nov 2003, and *NBC News*, "Japan abandons its Mars Probe", 12 Sep 2003.

⁶ Ref David Cyranoski, "China forges ahead in space despite Yinghuo-1 setback", *Scientific American*, 15 Nov 2011 & Morris Jones, "Yinghuo was worth it" *Space Daily* 17 Nov 2011.

zero gravity of space flight or one third gravity of Mars. Depending on the duration of space flight, a variety of debilitating changes occur in the human body ranging from loss of muscle mass and strength up to 50%, bone demineralisation, cardiac arrhythmias, kidney stones, cancer, loss of immunity etc. Weightlessness and floating in zero gravity appears fun in movies and TV shows. In real life, they are painful and harmful to the body in many more ways than one. The support structure of the skeletal system, the muscular system, metabolism, blood pressure etc. is for the near term genetically unchangeable and deeply attuned to earth's gravity. The aspect of what happens to these evolved systems when they are removed from earth's gravity and placed into zero or one-third gravity over long periods of time are yet to be fully understood. What, however is fully understood is the prospect of returning from Mars at 50% of original size, with kidney stones, reduced immunity and perhaps cancer⁷.

3. The Cost of the Adventure

Apart from complexities there is the aspect that human space exploration endeavours are inherently costly. For instance, way back in the year 1991, a U.S. Government Office of Technology Assessment (OTA) study "Exploring the Moon and Mars: Choices for the Nation" estimated cost of one-way human Mars missions at \$ 550 Billion over a 35 year period, depending on capabilities desired and the exploration schedule. It also emphasised that the need to support human life in the extremely harsh environment of Mars would drive the costs to as much as 10 to 100 times the cost of robotic exploration⁸. By 2011, with billions of dollars already being spent by the U.S. on Mars missions, prudence finally arrived with the Congressional Budget Office recommending elimination of the human space programme altogether⁹. In summation, the sombre reality is that human Mars missions are inherently complex, costly and risky. National space agencies like NASA, ROSCOSMOS etc. for decades have been engrossed in the endeavour. They are constricted by the earthly realities of the endeavour at every

stage. Enormous resources have been devoted with little in sight apart from a few robotic contraptions crawling on Mars. Crewed landings on Mars are altogether different, complex activities with considerable risks to human lives. There exists no scope for mistakes. The associated responsibilities and liabilities of their enterprise fetter their flights of fancy. Decades of experience have enabled them to reconcile to reality and consequently they remain reticent in airing their ambitions. The above is evident in the fact that NASA's earliest date for a Mars landing is a distant 2030 compared to 2018/2020 advertised by commercial firms. However, the sombre realities are yet to percolate down to the public at large.

4. Analysing Why Hype and Hope Prevail Over Ordinary Prudence

The general public displays little interest in understanding and appreciating the nuances and related issues in any detail. For instance, the highly informative and credible site of NASA has a lot fewer visitors as compared to those hosted by commercial firms. Googling "NASA Mars Mission" returns barely 15.5 Million hits compared to over 134 Million hits of "Mars One". On the other hand, earthly issues like 'food' and 'movies' return over a thousand million hits¹⁰. Perhaps, the complexity of the subject and the vast panoply of technicalities surrounding the issues related to the means and ends of space exploration, travel, habitation etc. do not make the subject immediately appealing to the lay person. At the same time, hyping up sites with graphics, catch lines, gloss and promises apparently go a long way in increasing the appeal. The hype apparently has its desired effect. In the recent past, up to half a dozen commercial firms have come up with proposals enabling faster, cheaper human settlements on Mars. The fact that they lack the massive resources, finances, competencies inherent to such an endeavour are glossed over by the hype surrounding the hope of colonising Mars. Commercial firms may or may not succeed. However, the general public is drawn to them because national space agencies appear restrained in sharing information, they are perceived to be slow, and also demand exacting

⁷ For a brief overview, see Lt Col Curtis D. Cochran, Lt Col Dennis M. Gorman, Maj Joseph D. Dumoulin, "Space handbook", Chap-11, *Air University Press*, Alabama 1985 and Susanne Churchill, "Introduction to Human Space Life Sciences", Chap 18.2, Part IV, Space Sciences in A. Houston & M. Rycroft, "Keys to Space: An Interdisciplinary approach to Space Studies", *International Space University* Publication, New York, 1999.

⁸ Ref U.S. Congress, Office of Technology Assessment, "Exploring the Moon and Mars: choices for the Nation", OTA-ISC-502, Washington DC: *US Government Printing Office*, July 1991.

⁹ Ref Congressional Budget Office, "Discretionary Spending-Option 11: Eliminate Human Space Exploration programs", *Congressional Budget Office Report*, 13 Nov 2013.

¹⁰ Returns as accessed on 14 July 2014.

standards to qualify as space travellers or astronauts. Commercial firms, contrarily promise fast results, much less efforts and no exacting standards or qualifications. This enhances their mass appeal. The claims of certain commercial firms of enabling Mars settlements by the next decade serve to give vent to the hopes and aspirations of the general public, they have captured public imagination as never before and huge lists of aspirants queue up for the Mars trip. Hope drives them to sign up for a one-way trip and risk the prospect of never coming back. They are drawn together by the appeal of space travel and space settlements and if state agencies are not open enough to share, publicise or make their efforts and limitations known to the general public or open up avenues to give vent to their aspirations, they have but little option. The ordinary prudence of reasonable human beings can only be expected to give way to the heady mix of hype and hope in such circumstances. Attributing the loss of prudence to ignorance, gullibility, cultural conditioning etc. is the easier recourse. However, the list of volunteers is vast and diverse. It also includes professionals and well educated individuals who are normally less susceptible to gullibility. Consequently, it would be safe to assume that a myriad combination of factors go into promoting such beliefs.

Amongst the many factors promoting this belief in the feasibility of much faster, cheaper and easier space settlements is a lack of real knowledge on the subject, cynicism regarding governmental efforts and most significantly the heady concoction of human imagination and popular literature. Little can be done about the latter, but the first two issues can be addressed to a certain extent by increased interaction amongst governments and private parties. The fact that the general public turns to commercial providers rather than their national space agencies indicates an obvious disconnect between state endeavours and aspirations of private parties. The disconnect is further evidenced by the fact that the largest number of Mars applicants are from the world's leading space faring nation – the U.S., followed by citizens from other prime space players like Russia, China, Europe, India etc.

5. The Need for Space Governance to Consolidate Energies, Efforts & Resources

Thus, there exists a requirement to take cognisance of aspirations and balance them with

the inherent complications, to temper hype and hope with reality and streamline efforts to attain aspirations. There exists an apparent groundswell of human will, resolve and aspiration. It makes better sense to harness these energies and resources rather than quell them with complexities and challenges. Dismissing the aspirations on grounds of gullibility would be the easier, though not prudent recourse. Amongst the plethora of fantasies and imagination would lie that one odd extraordinary thought of a “Clarke’s Orbit” that makes geostationary satellite communications a reality. The development of the human race over the ages has been attributed in a larger measure to hope, imagination and abstract thinking. Commercial firms have now ignited the above three aspects as never before. Taking the idea beyond state closets onto the general public has led to an influx of thoughts and ideas dedicated on the subject. These would only rise in the foreseeable future.

Harnessing the disparate thoughts from across the world is an eminently better option than dismissing them and hence it makes sense to provide an institutional mechanism for including and developing them. The existing situation calls for increased involvement and intermingling of nation-states, commercial firms, and other organisations involved as well as individuals interested. A single cooperative effort coinciding with the 50th anniversary of the Moon landing makes eminent sense, in the present. This is especially so since Neil Armstrong’s famous ‘small step for man’ on the Moon’s surface is yet to be converted into a ‘giant leap for mankind’. As opposed to the colourful fantasies, the banal reality is that there have been no crewed landings on the Moon since the last Apollo landing of 1972. Isolated efforts by nations have their limitations and are demonstratively manifest. Equally manifest is duplication of efforts by nations and the attendant wastage of precious national resources. Most new entrants in the interplanetary race are busy re-inventing the wheel and attempting to ‘fly-by’ Mars. Resources of nations across the world could certainly be put to better use by consolidating efforts under a single governing agency.

In legislative terms, space is the common heritage of all mankind and it makes eminent sense to pool in resources for a common cause that would tomorrow affect all of humanity. Secondly, the non-appropriation principle in Article II of the Outer Space Treaty, 1967 to a certain extent limits the

potential for conflict over celestial resources. By any means, the conflict could begin only after human landings and habitation that is some time away. However, the time to nip the possibility of mankind fighting over Mars or carrying forward the conflict to Mars is right now. The need to comprehensively address the multitude of issues, existing and potential, is most critical at present. Putting a space governance system in place in the present when the endeavour is yet immature and the opportunities rife would be a much better option than attempting to react to crises.

An institutionalised structure does exist in the form of the United Nations Office of Outer Space Affairs (UNOOSA) which is responsible for promoting international cooperation in the peaceful uses of outer space. However, it is not known to impact space exploration activities significantly. At any rate, it is not known to have any great success in leading nations to cooperate and pool resources for space exploration. This perhaps leads to the formation of other institutions like the International Space Exploration Coordination Group (ISECG) comprising of fourteen national space agencies that aims to coordinate national efforts and resources for space exploration. However, the group is restricted to national space agencies and individuals, commercial firms do not qualify for membership. Thus, a huge chunk of humanity is again left out.

6. Recommended First Step: Expand UNOOSA to Govern Interplanetary Exploration

The need to reconcile the hazards, hype and hope associated with landing humans on Mars is now critical as never before. Space is the common heritage of mankind open to all for peaceful use and exploration regardless of entities being space faring or non-faring nations, governmental, non-governmental, commercial or individuals. Leaving aspirations of the mass of humanity unaddressed draws in the complications of deprivation and unhealthy competition that later snowball into conflict. The conflict on earth could spill over onto Mars. The need to prevent conflict in the future

demands action in the present. The most obvious action would be to obtain an institutionalised governance structure which is aimed at addressing the issue comprehensively. Creating an institutionalised structure that can accommodate the varying demands and aspirations of nations, commercial organisations and individuals would be a challenge by itself. Hence, the more prudent recourse would be to draw on existing institutionalised international structures like the United Nations. As of now, the UN as per Article 1 (IV) of the UN charter is duty bound to be the central body for harmonising actions of nations to attain common ends. Further to be considered is the aspect that 193 UN member nations of the total 196 nations of the world, by consent, agree to be bound by UN decisions. Consequently, the prudent recourse would be to expand existing organisations of the UN to enable governance of space exploration activities and comprehensively address related issues. Governance would include all the related aspects of coordination, cooperation, conflict prevention, etc. some of which are already being undertaken by the UN in some manner or other. It would at least provide a common platform for progressing the endeavour. One of the options for governance would be considering an expansion of the existing United Nations Office of Outer Space Affairs (UNOOSA) to additionally deal with the specific issue of space exploration. The UNOOSA as of now has two sections; the Space Applications Section (SAS) that deals with satellites for navigation, disaster management, communication etc. and the Committee Services and Research Section (CSRS) that deals with secretariat services and research. Amongst these, the SAS became increasingly involved in satellites 'due to the shift in emphasis from scientific exploration'. Now that scientific exploration is back in the forefront and likely to stay there, it may be prudent to create a third section dedicated to space exploration. Once a common platform for dealing with the issue is created, incremental progressions could continue over a period of time. A small step at reconciliation and coordination today may enable mankind's giant leap to Mars tomorrow.



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