Opinion: Mars Mission Planning is Premature, Expensive, and likely Short-Sighted

By: Sf. Ramon Careaga, MSTOM, BSEE

Synopsis:

In the Age of Exploration, conquering men had realistic expectations about the logistical difficulties and terrors which awaited them across the veil of the unexplored. Still, they triumphed. But in today's soft willed world of specialists, scientists and contracting companies make insinuations of ridiculous early stage planning for the most dangerous mission mankind has yet dared to fathom: colonizing another planet. Yet we have not conquered colonizing our own moon, nor mastered long term living in space. We rely on explosions for propulsion, burning fuel for energy, and have no contingencies for making renewable space flight industries, nor rescue missions. Foreign scientists from underdeveloped nations make wild, speculative claims of abilities which frankly do not exist, and will cost the developed countries, especially the United States untold trillions of dollars to launch even early stage developing missions.

Countries which are not prepared to shoulder the burden of the incredible expenses of a luxury space program, should be willing to do more development, both of their capital and finance economies, and population infrastructure, so as to provide more expertise and industrial logistics. The industry of developed countries simply cannot be wholly devoted to space industry, and often scientists and academics alike forget just how involved and detailed engineering is. In a race to be first, many companies will go bankrupt, and some countries will have ruinous programs, like the Russian space shuttle program. Things must be allowed to naturally progress, and all insinuations with crude drawings that going to Mars with a large colonial force can be done for around $100 billion must be soundly rebutted. The orders of magnitude of distance and difficulty indicate that actual costs should be in the hundreds of trillions, counting all development stages and safety protocols.

Fantasy Vs. Reality

In the movies space battles between space-ships, human or alien, often involve a form of Space Opera gallantry. The Pirate Age has come back to life, and demonstrated now against the romantic backdrop of never-ending, but colorful space. Gone from these ‘simulations’ are any of the stark realities thrust upon audiences by the slow but meticulous 2001: A Space Odyssey. But, believe it or not, even that movie is fairly fantastical. After all, it was projecting that by 1990 we would have already conquered and perfected Artificial Intelligence (AI), something which we are frankly far from doing, and likely will remain so unless we conquer quantum and bio-computing.

Nevertheless, the minds of eager novelists, scientists, and astrophysicists insist upon making crude guesses and themes which involve sending what amounts to a fledgling society, into the most hostile environment imaginable. In the movies, the space battles tear ships asunder, and people get sucked out of holes in the hulls. To some degree the show “The Expanse” demonstrated this reality in its horrifying and stark harshness. The hull in a ship is not leading to immediate death, but in a spaceship, it is the literal seal between life and certain death! In reality a space battle would be thus: a rail gun pinpoints the enemy spaceship’s radiation shielding generator, and knocks it out, and then targets the oxygen tank, and that’s all. It’s a rail gun… no metal known will withstand the pressure of a shape charge projectile launched at several times the speed of sound!

Imagine how useless the entire investment then becomes. Just hundreds of billions of dollars floating around, full of rotting half-preserved corpses, mostly functioning systems, and doing nothing. What a pointless goal it is to aim for a spaceship warfare era! Rather real spaceship warfare, if it comes, will be full of hacking and delicate maneuvers, and trying to avoid collisions at 20,000+ kmh!

No, the reality of space is stark, hostile, and full of terrible danger. The idea, therefore, of adding to the terror by launching thousands of people upon a giant explosives laden thruster/missile is absolutely absurd. Everything that can go wrong, will go wrong. And it must be assumed to be so. Putting out twenty or thirty, or even two hundred page papers that outline the details is simply not going to do it. This cannot be planned like a telescope mission. A telescope is not a life, and it is replaceable! No: to go to Mars, we must go sequentially. We must establish bases in space, then the Moon, then between the Moon and Mars, and finally, yes to Mars. We will need relay systems, and build electromagnetic launching stations. The cost of the supplies, and the engineering will be unimaginably precise in detail. To this point I would like to spend some time giving scientists and novelists a small idea of the task.

Engineering Cars is Actually Really Hard

Before we can pretend space travel will be a matter of strapping some expensive buses and a shopping list of supplies upon the back of a magically calm rocket, and just trucking on over to Mars for a mere $90 billion (probably it’d be 10-20x that number, or upwards of $2 trillion), let’s consider the difficulties involved in engineering cars.

Cars are a couple orders of magnitude easier to engineer than the Space Shuttle: let’s say three orders. Certainly there are varying degrees of cars, so we must assume the supercar design is the top. But in terms of

space travel, we need repeatable missions, so we cannot consider hand-made supercars but production line supercars, such as a Ferrari or Porsche. Now, what does it take to engineer the top line-production supercars? Nobody would fault Ferrari or Porsche for being somewhat below the top of the line because they aren't selling them, usually, for the $1-2 million price tag but more like hundreds of thousands, and yet even still the typical supercar from these mid-top shelf companies will take five to ten years from conceptualization to production. Consider the art, the design, the marketing value, the inspiration, then the consideration of what's possible, and practical, legal, and safe. Consider the cost influence, and all of the factors that detract from the product to reach the artist and engineering teams' initial conceptions. Think of the roadblocks in technology which must be overcome to enable the car to reach even the prototypical stage. By this time, millions have been spent! Now, if this is true of a car, the next order of magnitude is an airliner. For airlines the next order up means another 5-10 years of pre-production, and design, debugging and labor. The very creation of the robots and manufacturing facilities to build and house these systems is its own engineering feat. By the end: the production of these is in the order of hundreds of millions in order to simply start testing and hoping to sell the first ones to airline companies.
Consider then the next order of magnitude up from this: the modern fighter plane. Modern fighter jets, such as the F-35 are 10-20 year projects, **minimum**, with years of debugging, testing, and all sorts of political maneuvering for aerospace funding, etc.. just to make them possible to hit the skies and be used in an environment that is generally predictable, well understood, and most importantly: not immediately harsh to the pilot if the hull is breached and they are ejected. If the radar system fails, the pilot is not about to die of radiation exposure induced liver failure. However, if the onboard Operating System of a futurized Space Shuttle fails, or goes down, and an end line of code hangs in the DRAM, seizing up the rebreathers or circulators, anyone who is not attached to a manually switched oxygen tank, and floating inside a heavy water container til the system reboots, is bound to fry up inside within minutes in many pockets within the solar system (such as Jupiter's magnetosphere). Now consider the fact that certain CME and solar flares can approach the speed of light, and how these could reach the craft in mere minutes after the warning from Earth and GOES-like satellites is launched! How can you even hope in a rocket-based craft to have enough safety tanks? Without on board plasma shield generators that are fool-proof tested, people will absolutely die. And the F-35 production comes in at the billions to trillions of dollars mark.[1]

So far: the general consensus is the F-35 is a failure.[2] The space program must be allowed to make dozens of such failures before they would ever consider sending someone to Mars.

The problem is that the Space Shuttle program was so generally successful that it has been perceived as somehow easy. But the shuttles could not land on a space body, nor could they possibly compare to the ambitions listed in even the least rose-colored, castle-in-the-sky type research papers regarding landing on Mars. They were simple trinkets in comparison to the types of logistical nightmares that come with rock-propelled landing of manned missions beyond the Earth's atmosphere and magnetosphere. That's the key problems. The moon isn't even past the Earth's atmosphere, and certainly within the protective influence of the magnetosphere. Mars has little to no magnetospheric protection to speak of, and certainly between Earth and Mars there is none. The Space Shuttle and SpaceX missions, and the International Space Station itself, cannot really be compared to the dangers which lurk beyond Earth's protections. Those programs are in the hundreds of billions to trillions of dollars range. Therefore we should expect the mission which enables us to colonize the

[1] It takes 41,500 man hours to build an F-35 and the total program cost is expected to be $1.5 trillion https://en.wikipedia.org/wiki/Lockheed_Martin_F-35_Lightning_II
[2] https://nationalinterest.org/blog/the-buzz/f-35-americas-most-expensive-weapon-war-the-ultimate-failure-24984

Moon to cost tens of trillions to hundreds of trillions. A reasonable expectation then, of succeeding at terraforming Mars would then need to be adjusted to hundreds of trillions of dollars set aside just to do so. Right now, the nations of the world are too weak, and waste too much money on non-essential budget items which do not grow their financial sectors, and the USA remains the only country which can commit to laying the foundation. However, it literally cannot afford to build the Space equivalent of the Great Pyramid of Giza, without a coalition of willing participants who pay their fair share. Europe and other NATO parties do not even pay their NATO dues and most nations do not pay the UN dues. How can it be said that mankind is ready to go? The reality is that foreign scientists are expecting it to be easy because they have little experience in industrial success of highly evolved engineered projects, and are too used to spending American dollars for their own infrastructure. India, for example, still has over half the population admitting to defecating in the public streets. How can they possibly afford a robust NASA/ESA like space program? Will China even participate without being underhanded?[3] [4] How can Russia hope to justify such a cost, when their own space shuttle program collapsed (literally) under its own undermanaged weight?[5]

The Delorean Lesson

In 1985 a movie, “Back to the Future,” debuted for the world a highly advanced time machine based around a car’s chassis. It was a Delorean. In the sequel it received hoverlift and fusion generator upgrades, almost *at a whim*…. as if it were ‘that easy.’ And yet, in reality, from 1989 - 2011 this highly engineered car-prop sat degrading away in the Universal backlot, right under the nose of employees and management. This was one of the most iconic inventions of the automobile era, symbolic of all hope for 2015 and beyond. But it simply fell apart, or was stripped of its former prototypical glory. In 2011, as documented in “Outatime,” Universal hired some Delorean/Back to the future enthusiast experts, one of which had background in electronics on the Mars rover missions, to fully and completely restore the car. It was a one year, multi thousand hour logistical nightmare to simply renovate this prop/car into a piece of art (functioning and preserved at Universal Hollywood, where it remains on display). It cost Universal millions of dollars to fully curate this project.

Now, imagine the amount of sketching, documentation, planning, pre-planning, re-planning, scrutinizing, and effort it took to make this simple *non-functioning* car/prop to work, as it did, in a movie where the rest of the science fiction was added by movie magic. Untold thousands of man-hours that weren’t even documented went into this one project. It was a labor of love, obsession, and a strong motivation behind it, as well as ample funding - the funding worthy of a super car pre-production.

Using our schema above, then, imagine the upkeep aspect to all the equipment, manufacturing equipment, supplies, warehousing, storage, and of course launched inventory, supply, etc… which would be put into orbit, as part of an endless supply chain to space assembly. It is nothing short of awe-inspiring. This is not a project that one launches from the ground. This is a project (going to Mars) which must be launched from space itself. It must involve millions of man-hours of all the above, just to get it to the point where you need space-repairment, space-janitors, space-mechanics, space-plumbers, etc. The current model of air force pilot meets programmer meets engineer meets electrician is simply not going to cut it at such a scale. One will have

[3] https://www.youtube.com/watch?v=0vfXYCVCE60
[4] https://www.youtube.com/watch?v=KQ4qlPUm6OE
[5] https://www.youtube.com/watch?v=XLOCQw5s9Uw

to find **actual experts** at those subjects and then train them for space. And that involves even the building of communities, even cities, to house all of this;. all of which, of course, will increase the budget drastically.

(1) The Delorean Time Machine, Restored over 1 year by Joe Walser and team

What the author is hinting at, of course, is that it must be done piecemeal. A 20 page propositional paper[6] is a joke compared to what is needed: there would be 20 page Introduction to the manuals for the **toilets** aboard the spacecraft just leaving Earth to get to the docking station where the assemblage plant is!

The amount of technical drawings (therefore requiring draft engineers and mechanical engineers) just to hand to systems, electrical, and project engineers is absolutely astounding. It might compare on the order of magnitude with the amount of paper contained in a middle sized library. It cannot be a job rushed through, or thrown together from previous missions. It must be a mission that is approached in modules that are, from the start, operating from an agreed upon modern set of standards. So standards from the Saturn, Shuttle, Voyager, and Rover missions etc… will no longer be applicable. They will need to be scalable, modular, and revisable. Forward looking engineering is always hardest to accomplish and takes the most man-hours to develop. Think of all the most miniscule standards to determine: when to use screws, bolts, nuts, lock-nuts, washers, rivets, torx drive, phillips' drive, star-nute drive, glue, hot glue, rubber, plastic, or caulking, etc. The amount of forward-driven standards that must be considered is staggering, because one cannot simply design anything (even a horn antenna), without thinking about how a small change in its metric dimensions might affect the spatial considerations for plumbing, or payload capacity for viable living systems for plants and animals, etc. In movies they go to a panel and push some buttons and move a bar, or adjust something floating. In reality to go

[6] https://arxiv.org/ftp/arxiv/papers/1904/1904.01389.pdf

from a mechanical button to a digital screen to a holographic button is itself another order of magnitude increase at each stage of engineering. Also, artistically more hours are typically spent on the latter than the former. So aside from paying engineers to do this, you have to pay the graphic designers and concept artists just to make switch panels. So now consider the design cost to maximum benefit ratio. Will it be worth it? Do the toilets need to be IR flush or will an old fashioned handle do? What will be the payload cost of the replacement handles? What if you choose a standard which later proves to be excessive in weight or budget cost. Therefore, one must consider the forward engineering ramifications of such choices and not simply “apply” what is currently standard. One must consider the difference between smartphone market engineering, and aerospace. In smartphone design and engineering, waste is expected, and the market pays you back. In aerospace engineering, until space mining is feasible, there **is no return on capital**. This is a key point which cannot be overstated. As fun and enjoyable research on Mars would be, (and the benefit to our learning experience as a whole in designed bio-compatible living systems for space and off-world… ,) there currently is no actual proof-of-concept benefit to the expenses. There are only profits to be made for military contractors receiving subsidies. But those subsidies themselves could drive rampant inflation, and as mentioned before, few nations, if any, can handle such a ramp up in inflationary spending without justifiable asset returns. Literally the assets (commodities) are leaving Earth, and becoming immediately high-risk, **uninsurable** liabilities.

The way around that is, again, slow, methodical, modular design, that awaits the arrival of the developing world to offset costs worldwide, and as world education standards increase, and computing/AI enhances, some of the problems too become offset. Realistically, however, this doesn’t appear to be in the immediate future of mankind.For example pre- -planning just for the separate market and industry economy necessary - finding one able to handle trillions of dollars in infusion from mining operations without bottoming out the current rare earth metal and jewel markets - should take about 10-20 years all by itself.

By doing things in stages and steps, not only are lives and resources spared, but development stages are not missed which necessitate the scrapping of years or even decades of work as we move towards the production of terraformation planets. Naturally there is no point in going to Mars if we do not plan to heal and fix the planet over a thousand year period. Therefore, it seems like it would be a good idea to make planning for this eventuality a priority in all forward thinking engineering, when it comes to space exploration.

Procedural Colonization

The idea of single jumping to Mars has become a sort of scientific obsession. Of course everyone wants to be a part of, or responsible partly for, the first pioneering journey. But what frightens me more than that first journey, and how much different it is than Columbus’ or Magellan’s or even Neil’s journey, is what will happen when we fail. Not only the catastrophe of the death of hundreds to thousands of colonialists, but also the economic impact of failure, and to the spirit of adventure. Such an early jump at a premature date, if a large enough disaster happens,it could actually result in a setback of decades to hundreds of years.

Sometimes one needs a black eye in order to know the difficulties, and to reorient themselves to realities that have come to bear. However, there is a taste of desperation in the air both in our current politics and the world/globalist scene. For example, the irrational fear of climate change, and the belief in a coming end of the world scenario caused (mysteriously) by warmer climates. Obviously these are as irrational as believing the end of the Ice Age would end the world, or fearing temperatures which only serve to increase rain, and the velocity of evolution, especially in the tropics. The reality is that it isn’t as much as the climate change that is to fear, but the fear itself. We should fear fear, and be wary of it all the more because it creates a cycle of freezing one in inaction.

It isn't that we should do nothing. Not at all. But we should consider all these efforts thus far - those which are not merely grant grabs - to be baby steps and water-testing. It isn't that they were cheap baby steps, but after all, they are chump change compared to the costs that should be expected, and the profits to be made in recompense (eventually) when colonization of the moon (to establish a base,) and of the satellites, and finally of Mars should commence.

Consider the previously proposed sub-surface deep mining the author has discussed, with respect to the development of automated armies of mining robots and robotic bipedal miners[7]. The provision of minerals, metals, and rare elements will be of invaluable import to the expansion of the aerospace industry, space-military divisions, electronics, and ultimately spaceship industry.

But simultaneous to this procedural development must be the creation of safe, explosion-less, launch facilities. Primarily they need to be electromagnetic maglev launchers, with onboard nuclear drives for space travel. The idea that we will be using rockets reliably seems rather short-sighted. It isn't so much that we cannot get to Mars with rockets, but if a follow-up (rescue) mission needs to be sent and in a hurry, how should such a mission be launched? If the system is a renewable system, it can be arranged almost immediately. If, however, fuel has to be gathered, and new ships built (on account of the current paradigm of one-and-done engineering), it will be a hopeless endeavor to actually rescue anyone. Additionally, the chances of rescue probably do not decrease linearly with distance, but by an exponential decrease. Supposing rescue probability would normally decrease by the r^2 we should therefore assume conservatively it would decrease by the r3, just to be safe. Remember the difficulties of Apollo 13? That was merely the moon. Now, consider the difficulties of saving the lives of hundreds to thousands if they are minutes away in transpondence, or on the other side of the sun, and moving at a highly differential rate to other stations. It is something that needs to be prepared for by the establishment of satellite relay stations.

The subsurface mining, AI robotics, satellite relays, and maglev launching systems, combined with a production aerospace industry are just some of the considerations that **must** be seriously pondered upon, before a maturity approaching "safe colonization efforts" will be assured. That is, if it ever can be assured.

Summary

There are not conclusions here, only a summary of the facts. It is a fact that interplanetary space is the most hostile environment mankind has ever faced or has considered facing. It is considerably more so beyond the Earth's magnetosphere regarding ease of rescue. It is also a fact that colonization efforts would be exponentially more expensive than even the space shuttle missions. Furthermore, the efforts may be difficult to undertake for any single nation, and considering the weakness of nations not fully engaging in capitalistic and financial sector growth similar to the United States, it may simply be impractical at this juncture. Finally, it is a fact that the one-and-done engineering is lacking in the forward thinking of standards, and procedural design and manufacturing. All of these will be necessary to continue colonization efforts in space assembly, as well as establish a strong aerospace industry which does not harm or threaten Earth industry or economics, but rather aids it to grow, in an isolated fashion.

[7] https://www.academia.edu/38560727/Birkeland_Polyphase_Superweb_A_Proposition_for_the_Future_Betterment_of_Mankind_global_defense_interconnection_and_unlimited_power

Citations

1. Wiki, “Lockheed Martin F-35 Lightning II,” https://en.wikipedia.org/wiki/Lockheed_Martin_F-35_Lightning_II
2. The National Interest, “F-35: Is America's Most Expensive Weapon of War the Ultimate Failure?” D. Grazier, 2018, https://nationalinterest.org/blog/the-buzz/f-35-americas-most-expensive-weapon-war-the-ultimate-failure-24984
3. “Human Mars Mission Architecture Plan to Settle the Red Planet with 1000 People,” M. Kumar et al., 2019, https://arxiv.org/ftp/arxiv/papers/1904/1904.01389.pdf
4. Academia “Birkeland Polyphase Superweb A Proposition for the Future Betterment of Mankind, global defense, interconnection, and unlimited power,” Sf. R. Careaga, 2019, https://www.academia.edu/38560727/Birkeland_Polyphase_Superweb_A_Proposition_for_the_Future_Betterment_of_Mankind_global_defense_interconnection_and_unlimited_power