THE ARESIAN

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IFT 6 – ANOTHER SUCCESSFUL LAUNCH …

The previous Starship Flight Test no. 5 was a huge success. People are going to remember the stunning capture of a returning Super-Heavy Booster in the embrace of the Chopstick Arms for a very long time indeed. It has excited the popular imagination and really put the Mars colonisation project on the map.

With follow-up Flight 6 on 18 November the Starship and Mars colonisation project has taken another big step forward. Our editorial team take an in-depth look and also give some pointer to other aspects of Starship development.

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NEWS AND ALL YOUR FAVOURITES

We've got lots of news stories for you in this edition of The Aresian including a fascinating item about Musk's proposal to NASA to set up a Marslink internet service, providing an internet link between Mars and Earth. We also have our regular weather report from Gale Crater and our "Pick of the Pics".

MARSWORLD – CHAPTER ANALYSIS

Owen Louis David gives an overview of Chapter 3 in his book *Marsworld* - which is all about the intriguing topic of terraformation. Just how might we make Mars more like Earth? Owen has the answers. The cocktail of ingredients will including applying an aerogel player to the Red Planet, using solar reflectors to heat up the planet, seeding the surface with trillions of cyanobacteria. Your New Earth awaits you!

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In the News...

Marslink announcement

By the Editorial Team

Elon Musk has revealed plans for a new "Marslink" service that will deliver a high-speed WiFi connection with Earth.

The Space X founder presented the concept to Nasa at a meeting of the Mars Exploration Program Analysis Group.

Marslink would be an adaptation of Space X's existing Starlink service already used by over 4 million subscribers worldwide.

We at *The Aresian* have previously speculated about the ability of Starlink to act as a communications receiver for data from Mars. The incredible quality of video from recent Starship flights in the most challenging of circumstances has only reinforced the potential of the Starlink network.

Similar to Earth's Starlink, Marslink would be based on satellites orbiting the Red Planet. It is suggested that the two networks could then be linked by laser communication.

The proposal holds out the promise of regular high quality video updates from Mars (with data transfer speeds of over 4 Mbps), which will be very important in maintaining interest in Mars colonisation.

Doug Loverro, a space industry consultant commented that: *"At a minimum, we're going to get a more realistic Mars plan, you'll see Mars being set as an objective."*

It's interesting to see how Space X and NASA are co-operating at a pretty deep level.

(Source GB News 8th November 2024 and other outlets)

MARSWORLD – CHAPTER BY CHAPTER

By Owen Louis David

***EACH MONTH OWEN LOUIS DAVID IS GOING TO SUMMARISE AND EXPLAIN A CHAPTER IN HIS BOOK,* MARSWORLD**

CHAPTER 3 – TERRAFORMATION

In this Chapter, I deal with the potential terraformation of Mars. Terraformation is of course the theorised process (no confirmed examples as far as we know!) by which a planet is made more Earth-like. This might involve, for example, creating a breathable atmosphere, ensuring better radiation protection, developing insolation levels similar to those on Earth, and inducing precipitation so as to create flowing water on the planet's surface).

It sounds like a super-mega project bigger than anything attempted on Earth. Even the global climate change response being organised through the COP conferences – probably the closest equivalent we can point to (since it does seek to change the planet's atmospheric constituents) - doesn't come close in terms of ambition. In fact it is nowhere near the scale of resource and energy input required for successful terraformation.

But terraformation does not violate any laws of nature or requiring application of some far-off technology. Many of the technologies exist already or are in the course of development. It will be a very long-term project. Perhaps embarking on terraformation will reintroduce us to the virtues of patience. The glorious Medieval Cathedrals of Europe took decades to complete – in some cases over a century. We can surely wait some centuries to see the creation of a second Earth!

In my book I examine potential methods of terraformation. While setting off nuclear bombs on Mars (occasionally referenced by Elon Musk) could certainly melt the ice caps. However, I rule out that possibility as a PR disaster. There are other ways to begin melting the water and CO2 ice. We have already made a start of the technology of solar reflectors in space. That seems eminently doable – creating huge orbital or stationary reflectors that will greatly increase the amount of insolation (solar energy) reaching the planet. Another personal favourite of mine is the idea (proposed by well accredited scientists) of covering huge swathes of the planet in a thin aerogel layer – this will have the effect of trapping heat in the surface. The more you heat up the planet the more CO2 and water vapour is released as CO2 ice and water ice melt. You will also get more outgassing from the regolith layer at the surface.

CO2, as we know, is an excellent "greenhouse" gas that traps heat, rather than letting it escape into space, so getting more that gas into the atmosphere will help warm up the planet. But CO2 I not the only player in town. There are other gases that are *thousands* of times more powerful in their warming effects than CO2. These gases (eg perfluorocarbons or PFCs) could be real game changers, allowing us make some rapid progress in developing the heat-trapping potential of Mars's atmosphere.

Remember, we haven't even begun this project. Precedence teaches that as it gets under way, we will discover thousands of ways of improving outcomes. One very productive method we need to explore is seeding Mars with cyanobacteria, micro-organisms capable of photosynthesis, with free oxygen being created as a "waste product". These micro-organisms are what created our oxygen-rich atmosphere on Earth and they could certainly help do the same on Mars. Their great advantage is that you can simply let them get on with the work – very little human intervention is required, apart from the initial seeding. Mars might also dedicated a large proportion of its GDP, to the production of free oxygen from iron oxides found across the planet. Nuclear power could provide the energy for such a massive processing effort.

Terraformation won't happen at the same pace across all of the planet. The Hellas Basin for instance will be the first to experience atmospheric densities approach those of Earth. We should be able to begin open air farming in Hellas Basin long before the rest of the planet, as the higher atmospheric density will mean that more CO2 is available for plant growth. Then of course, there will be many forms of what goes by the name of "paraterraformation". For instance, we may find ways of covering large areas in aerogel structures in a way that allows us to walk on the surface without breathing equipment. These areas will be much warmer and offer oxygen-rich air, so humans can breathe freely. There will be a rich flora and fauna and natural light. It will be a real boon for humans to get out of the indoor built environment and explore such areas.

My book *Marsworld* examines how as the terrformation process matures, Aresians will look to build create viable ecosystems resembling those back on Earth. It's worth remembering that today there are really no "wildernesses" left on the home planet, in the strictest sense – all land and oceans are "managed" in some way if only to a very limited way e.g. the whaling ban in our oceans and limitations placed on human habitation in nationals parks and so on. On Mars, the level of management will simply be a lot more intense as new ecosystems are developed.

Developing sustainable ecosystems will be something that will need to become part of the Aresian skillset. No doubt a whole new profession of "terraformist" will be created.

Experts will develop programmes for "food chains" with identified apex predators. We may even see some long-extinct species such as mammoths beings revived on Mars (reviving such species in large numbers on Earth would be far more complex).

The ability to explore such ecosystems will be a huge tourist draw for Mars. Aresians will be able to ensure that human observers can get really close to nature, with high level walkways and so on.

STARSHIP FLIGHT NO. 6 – REAL PROGRESS WITH SOME QUESTION MARKS.

By the Editorial Team

Flight no. 6 was another great success in the Starship development programme, albeit it didn't *quite* live up to everyone's expectations. The absence of a repeat of the "chopsticks" capture of the returning booster was certainly a disappointment for most people.

What we did witness, however, was close to flawless. The booster trajectory and return to an ocean landing in the Gulf was impressively smooth and without incident. All the rocket engines worked perfectly.

This flight was particularly notable for a test refiring of one of Starship's engines in the vacuum of space. Again, this was another milestone achieved flawlessly. This is an excellent omen for orbital flight – suggesting that the Starship can manouevre as required , making any necessary adjustments once in space. Can an orbital flight be that far off now? Flights 7 or 8 would seem good candidates. However, the main aim enunciated by Musk seems to be another controlled ocean landing for the Ship followed by a Chopsticks capture for the Ship as part of Flight 8. Flight 7 will see a Version 2 Starship being launched and put through its paces. The Version 2 will have much larger propellant tanks.

The Space X presentation of Flight 6 was interesting for some side information on Starship development. A render of a lunar Starship was including. This offered some tantalising clues as to what might emerge in reality. Key features included fold-back solar panel

strips that can be extended during transit. These might be helpful on a lunar flight (though perhaps not essential) but would likely be a necessity for the long flight to Mars. The Starship would have tripod legs for stability following landing. We also saw that a lift would operate from the crew levels, near the top of the Starship, down to the surface.

There was also a fascinating glimpse into Space X's Mars-landing development programme where heat-resistant material appropriate for the Mars atmosphere was being tested. The CO2 atmosphere on Mars can easily break down during vehicle entry owing to the high temperatures. The resulting plasma is highly reactive and so heat-resistant materials need to account for that.

Musk's prediction of robot Starships being ready to head for Mars in 2026 might appear crazily ambitious but I don't think we can rule it out. Space X are said to be targeting 25 launches in 2025. When you look back to the Apollo programme and see the amount of progress mad from 1966 to 1968 (when humans first circumnavigated the Moon), then an early Mars landing cannot be ruled out.

THE LATEST WEATHER ON MARS

Here's your update for the weather on Mars provided by the Curiosity Rover in Gale Crater.

For the nearest Sol to 14 November **2024** we have a *high* of **minus 9 degrees Celsius** (16 degrees Fahrenheit) – one degree warmer than last month. Still extremely cold of course but, nevertheless, something we can relate to. In the UK we currently have forecasts of minus 11 degrees for parts of Scotland.

The low for the same date, at **minus 73 Celsius** (or minus 99 degrees Fahrenheit), is also warmer than the measurement last month. The record low on Earth (minus 89.2 Celsius) was registered at Vostok on Antarctica in 1983. We haven't got down to that temperature yet at Gale Crater!

In the News…

Mars Landing Comes Into Focus

By Owen Louis David

The Angry Astronaut (You Tube Channel) reports that Space X and NASA have been working for years on a new

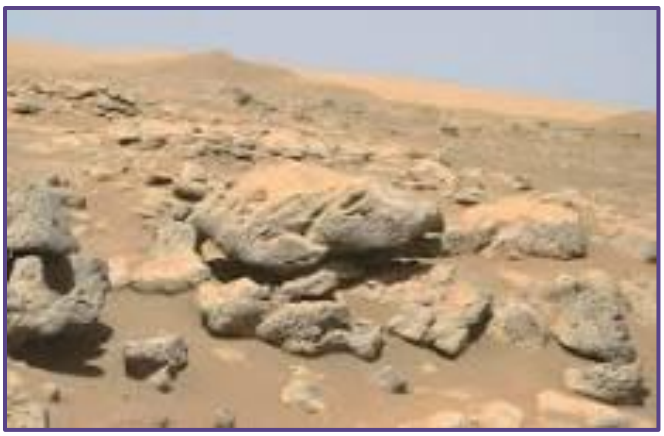
technique for landing heavy loads on Mars. It's encouraging to hear about this discreet co-operation. NASA/JPL engineers have been working with Space X in putting together a detailed analysis of the feasibility of a supersonic retropropulsive approach as a Mars landing technique. Of course Space X pioneered this approach to landing on Earth, with the Falcon 9 orbital rocket. The conclusion of the study was that this approach could also be applied to Mars.

Landing on Mars is certainly a challenge compared with Moon and Earth. On the Moon the absence of an atmosphere makes a retropulsive landing much more straightforward. When it comes to Earth, our thick atmosphere means it is possible to bleed out a lot of velocity during the landing process (as long as your craft has built-in heat resistance). That help is not available to the same extent on Mars where the atmosphere is extremely thin.

However, NASA seem to have come round to the idea of supersonic retropropulsion being the way forward. For me personally I think this is a sign of just how slowly NASA moves. They seemed to disregard. I remember that back in the 2000s I was arguing retropulsive landings on Mars. There was a lot of resistance to the idea in the Mars colonisation community.

However there is now a strong consensus that this is the way forward.

PICK OF THE PICS



Credit: NASA

So many great images from Mars! And remember, this is just the beginning. Once Space X establish a base on Mars we are going to inundated with fascinating photos showing all sorts of intriguing stuff.

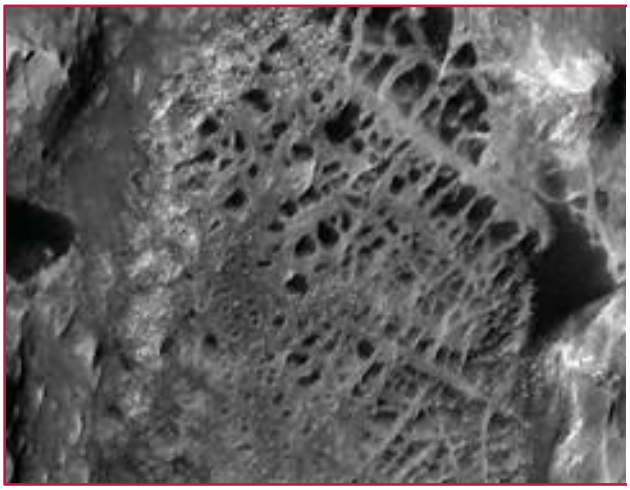
This image from NASA certainly has something about it. Thanks to Dougie H. for sending this in. Who wouldn't want to explore those rock formations. What secrets do they keep?

Geology may not be everyone's favourite science but it surely does have some great pics!

THE ARESIAN HAS THE ANSWERS

SPIDERS ON MARS?

OR JUST SPIDER WEBS?



Credit: NASA

By Victor Samuels

We all remember – *well some of us do!* – that Ziggy Stardust's band (the product of David Bowie vivid and boundless imagination) were called *"The Spiders from Mars"*. Spiders and Mars have always gone together ever since the days, back in the 1960s when scientists would speculate that the only sort of organism of any size that might be able to live on the surface of Mars would be spiders. I think that idea in turn came to the fore because spiders had been found to survive nuclear bomb explosions rather better than many other life forms (not least because there were probably a lot of toasted dead flies going for free after such an explosion!).

Anyway, there you have it, we are always looking for a spider connection to Mars and now we have a surface feature that reminds people of spiders webs…kind of.

The structures shown in the image are also being referred to as "boxwork".

NASA's wonderful, doughty and intrepid, Curiosity Rover is now being lined up to take a close up look at these surface formations though it won't get there till 2025. Rovers aren't noted for their speed – more their caution (or rather the caution of their controllers back on Earth).

By the way this "spider-web" feature is not to be confused with the "spiders on Mars" feature, found at many locations across the Red Planet – which is formed when carbon dioxide ice at the surface sublimates. But this just shows you how keen people are to make the spiders and Mars link!

The boxwork structure appear similar to those found in some caves on Earth. They are believed to be caused by water-rich minerals filling up cracks in rock which, following erosion, ae exposed as a startling network of delicate crystalline veins. Earth-based examples of such formations are rare and tiny in comparison. The huge formations on Mars suggest they are a key feature the planet's geological history, and are connected to the planet's ancient hydrology, when water ran freely on the surface. It is thought that Curiosity's latest research mission may shed light on that early part of Mars's history. The environment then – warm and watery – could have been conducive to microbial life, the sort of organisms we see thriving in hot springs and hot oceanic vents on Earth.