THE ARESIAN

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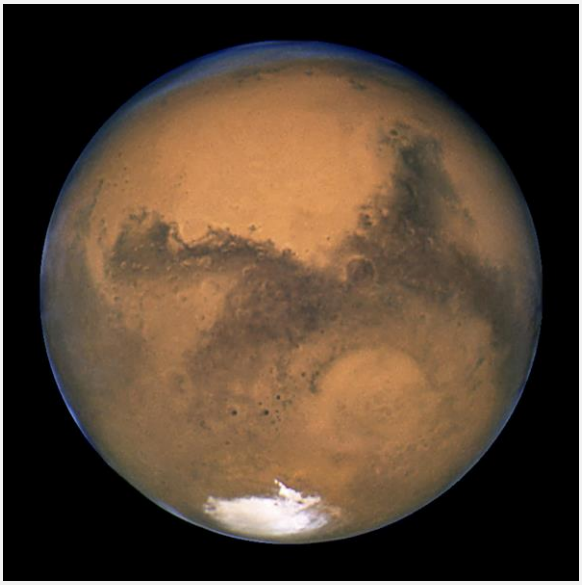
Editor: Owen Louis David **Assistant Editor:** Mary Khan **Contributors:** Peter Roberts, Katherine Hall and Mario Pinto. *Published by Mars Futures Forum*

WELCOME TO THIS MONTH'S EDITION

In this month's edition of *The Aresian* as ever we keep to our laser focus on the prospects for colonisation of Mars. We have a special feature on the oceans of Mars and of course we speculate on the impact of Space X's second launch of its Starship rocket. Do continue to send in your views. Please respond via *Mars Futures Forum* with any views and suggestions. We are very much on the look-out for contributors. So, if you have any ideas for articles about any aspect of Mars colonisation please get in contact with us via *Mars Futures Forum*.

Get to know Mars. Read *The Aresian*.



Credit: NASA

The Aresian makes Mars accessible.

MARS OPINION

The second Starship sub-orbital flight attempt shows that Space X is on the right track.

This time the vehicle achieved successful separation and reached space. Its trajectory and performance were as they like to say in the control room "nominal".

It seems a lot of commentators are still falling short of understanding just how important this development programme is. They seem locked in some NASA-approved "Apollo paradigm" of glorious but ultimately inconsequential *"space exploration"*.

We know however that Musk and Space X are super-focussed on the ultimate goal of Mars colonisation, meaning the establishment of human civilisation on another planet. For Musk we can assume it is the one thing he knows will put his name in the firmament along with the likes of Galileo, Darwin, and Einstein - for all time.

For Space X, it might be a question of *"one more heave"* to get Starship over the line and into the rank of orbital spacecraft, a worthy successor to Saturn V.

We do think that colonisation of Mars will follow a successful orbital flight much more quickly than people expect.

WHAT ARE THE MAIN CHALLENGES OF MARS COLONISATION?

By Owen Louis David

People often ask me: what are the main stumbling blocks or challenges to establishing humanity on Mars?

It's sometimes difficult to see the wood for the trees, so it's a useful exercise to try and answer that systematically. I'm assuming here that the object is not simply to establish an outpost of humanity but to seed a new civilisation on what I call our "cousin planet". Let's look at the most serious challenges, one by one.

Keeping humans healthy.

This covers a lot of potential sins. Obviously you have to get your people safely to Mars. That's probably not as difficult as people sometimes think. If you can get a Starship rocket to Earth orbit, it's not that difficult to get it to Mars. A Starship rocket will have plenty of cargo space for consumables like food, air and water, in order to keep crews alive.

Life support on *Mars* is more challenging, because of course there won't be a welcoming party. You'll have to create your accommodation and life support systems.

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Feeding people on Mars

In principle this challenge should be met with relative ease. We know how to grow food indoors using artificial lighting and hydroponics for instance. Longer term, though, when it comes to feeding millions, this will be a greater challenge. We are going to have to develop soil technologies suited to Mars, transparent agricultural domes or similar, and adjust crop planning to the Mars seasonal cycle (closer to 2 Earth years). With insolation being something like 40% of that on Earth, we may have to supplement natural direct sunlight with reflectors or artificial external lighting.

Making People on Mars

No civilisation without procreation…A major and serious challenge will be whether humans can reproduce successfully on Mars.

The jury is still out on this. Various experiments conducted in Zero G Earth orbit have suggested that foetal development might be compromised in mammals. However, Mars's gravitational force is not negligible – It might be strong enough to allow for normal foetal development. It's possible that pregnant women might have to spend their first trimester in an artificial 1G (e.g. a centrifugal facility orbiting Mars) in order to allow for normal development.

Making Mars Beautiful

To build a Mars colony, you need to make Mars an attractive place to live in. For a lot of scientists, the beauty of what Mars offers to humans is probably beside the point: they will go because they are driven by intellectual curiosity. OK, but to build a secure human civilisation people will need to feel that Mars gives them good things that make life there worthwhile.

Of course well remunerated employment will be a huge pull factor. So too will the prospect of living in a low aggression environment with virtually no violent crime and no wars.

Stopping People Going Stir-Crazy

I think anyone can see that being holed up indoors for the whole of your life is not an appealing prospect. People going to Mars need to feel that this will be a pleasant environment in which to live.

So, firstly we need to make clear that the ambition has to be to create pretty large spaces in which humans can associate. People will not migrate to Mars if they think they are going to be kept in glorified tin cans.

We need big internal spaces with lots of things to interest and distract human beings: restaurants, retail outlets,

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restaurants, art galleries, gyms and so on.

More than that, the décor needs to be enticing and intoxicating. Interior designers will need to use all their arts – materials, textures, lighting and so on to make the Mars experience

To dream of Mars does not mean to deny Earth.

By Peter Robinson

I've got a question: is it really so bad to dream of Mars and Mars colonisation?

When I discuss Mars with friends or pick up stray comments in the media, the argument seems to be that dreaming of Mars amounts to dereliction of your duty to Earth. On my car radio the other day I heard Ruth Davidson on Times Radio put the argument that anyone who cares about Mars colonisation is somehow avoiding their duty of care to planet Earth. This makes no sense to me at all!

I really can't follow see what is meant by this argument! It's almost like people are saying you should only ever have one child because no parent could love more than one child!

I think we in the Mars colonisation movement should face this head on. Firstly, what happens on Earth is primarily controlled by governments and elites. Accusing individual Mars enthusiasts of dereliction of duty towards the planet is an absurdity. An individual has very little input into what happens on Earth. I do my bit. I would never vote for someone who wants to pollute the planet or start a war. Personally I am a keen recycler, I drive an EV, I have solar panels on my house and I am a virtual vegan. Moreover, I have never taken up arms against anyone. I lead a peaceful, modest existence. Why I should be labelled as an Earth-destroyer because I want humanity to be able to live on Mars is beyond me!

Clearly, we are not in an area of rational debate…something deeper is going on.

I think part of it is that a very narrow part of humanity – the part that is highly paid and highly politicised – don't want us to dream of Mars. Why? Because their comfortable existence depends on conflicts on Earth (commercial, political, international and class-based conflicts). People like that really don't like the idea that ordinary people might migrate to Mars and live there in something approaching productive harmony.

So I am calling out the naysayers, the party-poopers and the mood hoovers. If you love your Earth-bound misery so much, well that's your choice but don't try and stop the rest of humanity from having a much more optimistic approach. People have bettered themselves in the past and they can do so in the future. Mars is the planet of optimism!

PICK OF THE PICS

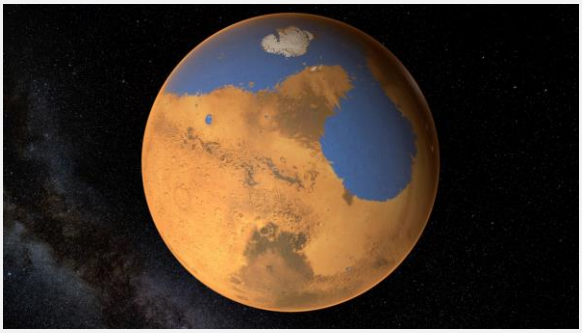
Zadok the Pleased *says: "I find the idea of these lumpy potato moons orbiting Mars fascinating. Surely it will be one of those bucket list things that people on Mars have to go do – visit the twin moons of Mars. This photo is of Phobos. I think it would be so cool to roam across its surface."*

Credit: NASA

We agree Zadok. Will be a fantastic venture heading up to the moons for a bit of exploration! We need to look into the physics but you might need to hang on or at least avoid jumping too high…you might just float off!!!

Gravity is going to be pretty minimal in fact, so maybe you will have to be tethered to the surface at all times.

OCEANS ON MARS



The past or the future?

There is a wealth of evidence suggesting that Mars in the past was *wet* not *dry* at its surface. There were rivers and there were oceans.

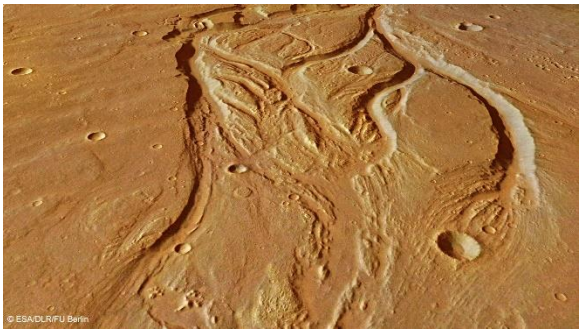
Earlier in the planet's history it is posited that nearly a third of the surface of Mars was covered in ocean (compared to some 70% ocean cover on Earth today). This ocean – referred to as Mars's "Paleo-Ocean" or the "Oceanus Borealis" (matching the Borealis Basin we observe on Mars today) was very shallow compared to the sorts of ocean depths we are used to on Earth but it was pretty extensive for a planet the size of Mars – probably the equivalent in area of the Arctic Ocean.

We can make out in some detail the ancient shorelines of the ocean and the mouths of rivers that emptied into the ocean (deltas and so on).

The consensus is that this ocean existed a very long time ago (often the period is given as between 4.1 billion and 3.7 billions of years ago but climate studies suggest substantial bodies of water would still have been possible some 3 billion years ago). These guesstimates might be wildly wrong. The Chinese space agency rover that landed in 2021 on Mars has found evidence

that substantial water (a hydrosphere) persisted on Mars until as recently as perhaps a few hundred thousand years ago! So, clearly, we are not at the end of this story yet.

Evidence of an ancient Ocean has been gathering since the Viking lander missions in in 1976, when two potential shorelines were identified. There are many topographical features e.g. gullies merging into larger channels that suggest we are observing ancient riverbeds, similar to those found on Earth. In fact, some of these channels might be thought of as "mega-rivers" as they would have been in some cases about 25 km wide, being fed by aquifers in the Southern Uplands. The general picture is of water flowing from the south to the north. Mars's ocean was a Northern Ocean.



Credit: ESA

Pic: Ancient river channels on Mars.

Of course, the ocean and river systems date back to a period when Mars had a much denser atmosphere and a warmer climate, allowing liquid water to run freely over the surface of the Red Planet. There is a close connection between vulcanism in the Tharsis region and the creation of oceans. Mars has the biggest volcanoes in the solar system. The Tharsis volcanic system vented out huge amounts of gases of various composition, so helping create a greenhouse effect which warmed the planet and allowed for the free flow of water. Weirdly, it is also possible the vulcanism was associated with changes in the axis tilt of the planet (the "Polar Wander"), which may explain why variations or puzzling discrepancies in the shoreline have been observed. It appears the shifting shoreline was in a state of flux.

Calculations suggest that the average depth of the Mars Ocean would have been something like 1 mile, comparable with Mediterranean Sea but otherwise much shallower than the major oceans on Earth.

With oceans comes the risk of tsunamis. There is evidence that major meteorite impacts produced super-tsunami events during the oceanic period on Mars, with wave height reaching 50 metres and creating significant topographical effects such as huge stranded boulders the size of cars and houses. Of course such powerful tsunamis will likely have reformed and reshaped shorelines, complicating the observable visual evidence we see today.

So will Aresians ever be able to enjoy the beach life? Will we see the Mars ocean reconstituted? Almost inevitably so if terraformation proceeds, meaning that Mars once again has a dense atmosphere that helps warm the planet. Sustained above-zero temperatures (which already occur briefly during summer on Mars) will mean of course that water will once again be flowing freely over the surface. The future people of Mars will have to factor in water motion on the planet into their terraformation plans. It may be the case that cities and settlements are found to be sited in the wrong place and will need to be abandoned once water starts flowing freely again, so as to make way for rivers, lake and ocean. They will also have to get used to rain, which is not so great. But there's a plus

side to that – gradually the amount of dust in the air and at the surface will decrease which will make life a lot easier for humans on Mars.

So – let it rain!

READERS' COMMENTS

Makeitso says: *"I really liked the feature on key industries for Mars. It is this sort of pragmatic approach that is going to get us to Mars and make a success of living there. I think glass will be a great Mars industry because plastics will be difficult to produce there but it will be much lighter than on Earth."*

Excellent comment, Makeitso! Glass should be easy to make on Mars whereas the planet seems not to enjoy the huge hydrocarbon resources we find on Earth that support the plastics industry. So, yes – we agree that glass could be a big part of Mars's future for all sorts of things such as liquid and food containers.

Bob Edwards says: *"I'm concerned that Musk is getting so involved in US politics. He should stick to what he does best – rockets!"*

Well there are certainly dangers in Musk being so keen to get involved in the American culture wars. We hope he and his ventures don't become a casualty of those wars.

Here are some first words suggestions we have received:

We come as free people with a free spirit. (Andy SP)

Don't mind us – we're just footling around. (John Stanley)

We stand on Mars as the first humans on another planet. We make this humanity's second home. (4Musk4Mars)

Let us make the planet of war the planet of peace. (Marsgirl 2022)

MARS FACTSHEET

1. The highest temperature ever recorded on Mars was **35** degrees Celsius (in the shade). This data came from the Mars Spirit Rover.
2. There are 7 active Earth-origin satellites currently orbiting Mars.
3. The Valles Mariensis canyon system in Mars's northern hemisphere dwarfs the USA's Grand Canyon. It is more than 4000 kms long, up to 200 kms wide and up to 7 kms deep.

News in Brief

NASA has chosen Bezos's New Glenn rocket to deliver satellites to Mars to study the Red Planet's electromagnetic fields. The (optimistic) launch date is August 2024.

The Daily Mail (22 November 2023)

Curiosity Rover has clocked up over 4000 sols on Mars.

NASA (6 November 2023)

MARS WEATHER UPDATE

Here's the latest on Mars' meteorological record (relates to Elysium Planitia).

1 November 2023: **Sol 681**Oct.h: 24° F Low: -139.8°

High: - 12 *degrees Celsius*

Low: - 75 *degrees Celsius*

Would you like to write for The Aresian?

If you've got a great idea for an article in *The Aresian* get in touch with via Mars Futures Forum. Just head up your email **"For The Aresian"**

MARS QUOTE

"I would like to die on Mars. Just not on impact."

ELON MUSK

Do you have a favourite Mars quote?

Let us know!