



Space 2069

After Apollo: Back to the Moon, to Mars, and Beyond

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Attributed to Arthur C. Clarke and other authors predicting the future:

We will never know what we got right.

Niels Bohr once said:

Predictions are difficult especially about the future!

It's true also about space activity.

The author David Whitehouse tries to predict where we stand with respect to 'Moon, Mars, and beyond' at the 100th anniversary of the Apollo Moon landing in 2069 with the technical knowledge of 2021 (publishing date of the book).

When I started reading the book I was looking for the following visions and reflections about the 2069 status for the following current (2024) plans:

Moon settlement:

- >> US Artemis program
- >> European Moon village
- >> Chinese International Lunar Research Station (ILRS)
- >> Role of India

Mars colonization:

- >> Is Elon Musk's dream taking shape?

The book starts with an interesting summary of the meandering of American space policy decisions with respect to strategic plans after the termination of the Apollo program in 1970 and their dependency on the preference of the various American presidents, the influence of NASA administrators, the budget situation and the general state of world affairs. Slogans like 'Star Wars' (Reagan), 'Space Station Freedom' with Russia (Clinton), Bush's 'Vision of Space Exploration' (VSE), 'We have been there already' (Obama) and Trump's 'Mars and beyond'.

All this eventually led to the Artemis program as it stands in 2024: Currently the un-crewed Artemis-1 flight around the Moon is completed, Artemis-2 (two astronauts orbiting the Moon) is planned for 2025, and two astronauts to set foot on the Moon might take place in 2028.

Moon

Unique for this book is that David Whitehouse takes us on a poetic sightseeing tour of the Moon pointing out the significant characteristics of the most famous craters and other 'enchanted' features. The tour also covers all the landing/crashing sites since the Soviet Luna program and the 'historical' landing sites of the Apollo missions. Those two chapters render a portrait of the Moon as I have never seen in a book before – it just brings you closer to understand our orbiting companion.

The author explains seamless and in detail the exploration of the moon through an international armada of satellites and robotic landers beginning with the Soviet Luna-2 satellite (launched in 1959, the first spacecraft reaching the lunar surface.

Since then the following nations developed a growing interest in the Moon: USA and Europe, Russia, China, India, and Japan.

The ultimate goal is to search for water or ice and for places with almost permanent sunlight or energy to stay on the Moon.

This also explains the shifting from equator landing sites to South- and North Pole landing sites.

Another outstanding feature of the book is that it not only enumerates the various satellite and robotic mission to the Moon, but also explains their purpose and discusses the findings and new astonishing results expanding gradually our knowledge of our 'neighbor'.

NASA has selected three commercial providers for delivering landers for the Artemis program: Dynetics, Blue Origin's 'National Team' and SpaceX with its *Starship*. The designs are discussed and probability of success assessed. Elon Musk's much publicized unorthodox approach with his *Starship* is not only to have a moon lander, but to create a 'interplanetary transport system' which finally might transport astronauts to Mars.

Of course the author does not miss to discuss the hazards of Moon settlement and travelling to Mars. The latest research status on all relevant issues is presented, e.g., radiation, dust mitigation, 3D printing, H₃ fusion, Moon ice and in situ material processing, manned pressurized rover development and more.

Another subject with growing significance is the military aspect of the Moon for competing nations which is discussed and the consequences outlined.

Mars

The author follows the same pattern as for Moon also for Mars; this time he conducts his tour with a fictitious James Cairn-2 mission, named after the life-saving boat of Shackleton's famous expedition which is considered the worst possible voyage by boat.

James Whitehouse explains and discusses the history of Mars exploration, starting with Schiaparelli who first saw what he called 'canali' and again explains the scientific results achieved by the many satellites and robots sent to Mars already.

The geological survey of Mars is all-encompassing the author even traces the fictitious travels of Mark Watney [*The Martian*, by Andy Weir]

A fine example of how the most detailed planning can run into problems due to imponderables is the European ExoMars project, praised in the book for its search for life on Mars planned for 2022:

As part of the sanctions against Russia in response to the attack on Ukraine, ESA announced the termination of its cooperation with Roscosmos. A launch in 2022 was therefore no longer possible. In November 2022, ESA decided to bring the rover to Mars in 2028 with its own lander.[8] The new plan calls for a newly designed landing platform from ESA and a collaboration with NASA. In this new plan, the new lander will have a short lifespan, no scientific experiments of its own and will only drop off the rover. ExoMars Trace Gas Orbiter will receive the weak signals from the rover and send them to Earth as a relay station. [1]

The author does not hold back on his criticism 'of millionaires who want to create self-sustaining cities on Mars'. He quotes Jeff Bezos quipping about Elon Musk: "Go live on the top of Mount Everest for a year first and see if you like it, because it's a garden paradise compared to Mars."

Whitehouse illustrates the dangers of a flight to Mars with a return trip to Mars with a first James Cairn-2 mission in 2040: A long journey exposed to unprotected Sun- and galactic radiation, psychological condition of the crew having 'lost Earth', and the lack of gravity with all its medical complications on a human body.

A second mission could start in 2046, possibly with a Nuclear Thermal Propulsion (NTP) rocket, shortening the trip time by 6...8 weeks to reduce the risk.

Landing on Mars is even more tricky ('6 minutes of terror') and has failed many times using different landing methods for placing probes and robots on the surface of Mars.

Crewed landing requires even more effort with respect to staging a landing module in orbit and placing an ascent module on Mars before trying a crewed landing.

...and Beyond

The third part of the book deals with the 'beyond' of the renewed Vision for Space Exploration: 'Moon, Mars and Beyond'. In this part the exploration of the solar system beyond the orbit of Mars is explained and scientific findings presented for Jupiter, Saturn, Uranus, Neptun and farther out. But also the two inner planets Venus and Mercury carry their secrets beckoning to be explored. The same is true for asteroids and comets. All known facts and expectations are duly summed up in the book

Of particular interest for scientists is the icy Jupiter moon Europe and its 'warm' ocean under the ice crust. The author expects it might be a source of life among hydro thermal vents. He ponders "I wonder if the forces of evolution are in action on this tiny moon thousand million kilometers away" while writing this book.

To go there and explore Europe's ocean is way beyond our capability, but might be starting in 2050? We must go there!

Similar hopes rest on the Saturn moon Enceladus with respect finding origins of life. NASA, ESA and a privately funded mission to Enceladus are planning scientific exploration robotic flights [*as it is 'riskier than anything NASA would attempt on its own'*]. [2]

Whitehouse's predictions for 2069

>> In 2069 will be a big 100th anniversary celebration of the Apollo Moon landing on Moon and Earth.

Moon settlement:

>> Three Moon bases by America and International partners, and the Chinese Space Agency will exist:
- In mid-2030 the exploration of the Shackleton crater to create a base at the South Pole will start.
- A secondary lunar outpost will be established near the equator
- A Chinese base near the North Pole & a secondary base is established

Mars colonization:

>> Mars colonization will start by mid-2020, and by 2069:
- 18 'Martians' will be living in a Mars colony
- 8 'Martians' will be living in a Chinese Mars base

Beyond the Asteroid belt

>> The author expects 'hardened' crews i.e., modified, enhanced, resilient, and against radiation protected astronauts.

>> In 2069 we will have visited all worlds we can.

In my opinion the author's most optimistic prediction is: Regardless future US elections turn out, the space program will stay because of the reasons explained in the book – but, we must not forego what we have to do on Earth, because Moon and Mars explorers “are no Mayflower pilgrims, we will take our tyrannies with us”, in my interpretation that means, if we don't get our act together on Earth we will not be able to create better living places in space.

In his book David Whitehouse provides ample evidence that the above statement is true and he points out that the future of space exploration is influenced by many factors and imponderables outside of human control. It's a long way to go and the book sums up what we have learned already and what hurdles are in front of us.

The author presents an educated well researched look into the next fifty years of space exploration for everybody, based on current technological advancements and intelligent extrapolations.

For me, the impressive 'geographical' descriptions of the planetary landscapes and their features of Moon, Mars and Jupiter and their moons written in a stirring, poetic language were most fascinating.

References:

[1] <https://de.wikipedia.org/wiki/ExoMars>

[2] https://en.wikipedia.org/wiki/Breakthrough_Enceladus_mission

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