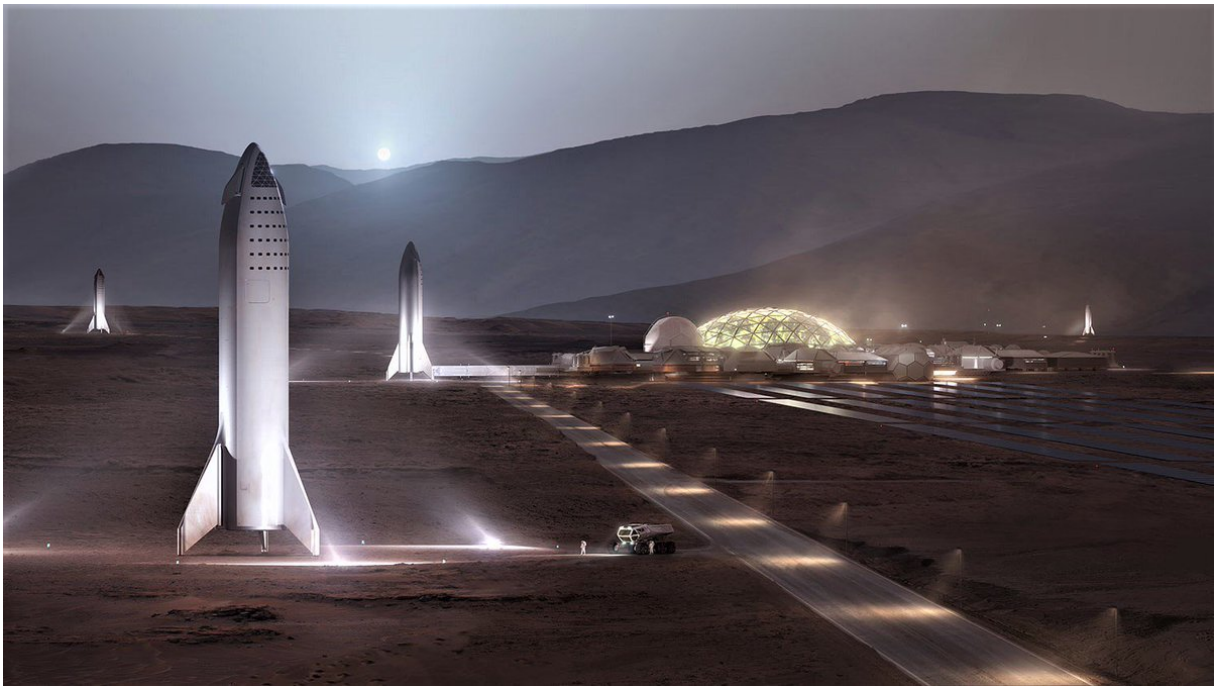
Logistic and economic challenges to realize a Martian village



Mars Base Alpha, illustration SpaceX (credit SpaceX)

The principle of setting up of a Martian Village is evolving from utopia towards reality. The constraints that must be taken into account for its realization are well known and solutions to the challenges they put, are theoretically possible. What is missing now is the will to implement them.

Constraints :
Launch windows widely distant from one another (26 months!); reduced launching capacity (100 metric tons on Mars per flight); low atmospheric pressure (6 mbar); un-breathability of the atmosphere (96% carbonic gas); irradiance low and evolving within a broad range along each synodic cycle (492 to 715 W/m^2); radiations (GCR and S*e*P turning from time to time into SPE); perchlorates; dust and aridity; possible biochemical danger; total lack of infrastructure, very limited manpower; need for an important funding.

Preparation, Phase 1:
Gather the necessary funds to start the project and organize a way towards profitability.
Finalize (up to TRL8) the design and testing of a super-heavy launcher (BFR, Blue-Origin or SLS?); keep making progress (up to TRL6) in life-support sciences (MELiSSA); make the first landing tests of a heavy mass on rough (unprepared) Martian grounds (up to TRL8); complete (up to TRL8) the nuclear reactor that should be the main source of energy (NASA's “MegaPower”, issued from the work on “KiloPower”); continue improving the capacity of solar panels to convert light into electricity (= /> 40%).

Preparation, Phase 2:
Build the first BFR & Starship fleet (= 6 BFR for the launching, 6 x 2 Starships for the voyage, 3 tankers to fill a Starship before interplanetary injection, 2 Starships +2 BFR for back-up); select the first crews, then the first residents, to get all the specialties that the village needs; begin to create

energy facilities (nuclear and solar); install the communication system, including antennas; import public-works engines; build up to six smooth & solid landing areas for Starships; install production and storage facilities: metallurgy, glass manufacturing and processing, chemical products ; import means of locomotion (rovers); import medical equipment; import 3D printing machines.

Realization:

Choose the place of establishment (low latitude, low altitude, water ice); Build, gradually and continuously, the structures of the Village, habitats and greenhouses, then fish ponds and small livestock habitats, while allowing the first residents to live within those structures: provide computer equipment (networks and storage of data), shelters against radiations, heating and air conditioning, water recycling, food production, processing and storage, clothes production, recycling of organic matter and other wastes, control of microbial growth; 3D printing for tools and furniture.
Human operational organization of the Village. Provide services for residents, researchers, engineers, tourists, "people-who-want-to-go-to-Mars"…and who can afford it; foster the creativity and entrepreneurship of the New Martians in order to facilitate their generation of income for themselves and the Martian community.

And beyond?

The problem, more than the establishment of the Martian village, will be its sustainability. Success on the long run will depend on the dedication of private entrepreneurs who should be leading the project, the support of the various Space Agencies (first of all NASA), and the response of the Public among which the clients will arise. A positive response will be conditioned on the one hand by the affordability of the prices that the promoters of the Village will be able to offer them and on the other hand, by the strength of the clients motivations. Such motivation could be either scientific research, to do what the robots cannot do or do it better, or it could be engineering, to get satisfaction in realizing some extraordinary feat, or it could be satisfying an adventure spirit and/or an opportunity to make money. The latter will not be negligible as economic profitability will be key for long term durability.

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