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Technical and Economic Constraints for the Design and Operation of a Martian Colony

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Mars is acknowledged as the most desirable destination for a future human space settlement, mainly on account of its environment and its usable resources. Accordingly, the setting up of a permanent Martian outpost is generally envisioned. But to the boldest visionaries Mars is fitted to accommodate a much more significant human presence, a colony which population could range from a few hundred residents to a million people!

Studies of such establishments more often poorly cover a set of very noteworthy aspects related to the feasibility and, more basically, to the practicality of such a venture. The goal of our study was to perform a survey of the most significant of these points. Mainly:

- What minimum scale should the colony attain in order to operate in a sufficiently autonomous mode and under satisfactory economic conditions? This is a matter of accumulation of facilities on site, but also of the size of the personnel complement needed to ensure the whole spectrum of the colony logistical and functional services.

- Which stretch of time is acceptable for the colony to attain a sustainable and even profitable operational condition? The different categories of investors: space agencies, philanthropic foundations, research and technology companies, public shareholders, will have varied expectations.

- What is the scale of the upfront investment? This is the most decisive parameter, which forcefully constraints the choice of habitats technology and design, as well as the production rate of those facilities. In order to illustrate the scale and difficulties of the

endeavor, we choose a scenario based on the use of glass panels, a solution offering attractive features. Of course this is only one of the possibilities (bricks masonry, steel, plastics and troglodytes) that we considered comparatively.

- Last but not least, what is the actual purpose of the colony, what does it offer? This is a point for which most of colonization proponents did not present a realistic scheme. We develop the view that, at least for the first colonization phase, the most accessible prospect is the offer of residential facilities and services (including interplanetary transfers). Customers would be researchers sent by their institutions / companies and wealthy adventurous tourists for which a sojourn on Mars is the dream of their life. Selling ponderous goods (metals, propellant…) to hypothetical space industry sites is not a foreseeable prospect. And immaterial goods should indeed be preferably issued on Earth.