

Abstract

A NASA human mission to Mars is going to last at least 2,5 years. It's the longest space mission of this kind ever planned. Marsonauts will have to face many different problems during such a long time without almost any help from the outside. Four groups of causes of stress are distinguished in this work: concerning external environment, concerning internal environment, sociological and psychological. External Martian environment is a threat to human health and life. Marsonauts will be prisoners of their artificial environment inside a habitat, where they will be supposed to feel at home. Different sociological problems are common in isolated small groups of people living and working together in habitats in extreme environments. Marsonauts will miss their families, friends, home and the Earth. Sociopsychologists indicate a group of at least nine people for such kind of the mission, because lower number of crew members usually has much higher rate of deviances. As in one spaceship six people can be accommodated, two spaceships with twelve people could be sent to Mars. Only a base-like habitat is big and comfortable enough to accommodate such a numerous group. There are many problems to be solved for the Martian habitat architectural design. This is a subject of this PhD dissertation, where in the main thesis it is assumed that: **Martian base can be designed and built as a friendly habitat based on contemporary technologies and actual knowledge about extreme conditions on Mars.** There are also three partial theses:

1. Extreme conditions on Mars require special architectural design approach.
2. Human factor has the highest priority in Martian architecture approach.
3. A physical and psychological comfort can be increased by applying special architectural solutions in Martian base design.

The researches presented in the PhD indicate all theses are true.

The dissertation consists of eight chapters. In the first chapter a present interest in the Martian habitat design is revealed. The approach to the PhD subject is explained. Goals of the thesis, methods used to achieve them and the arguments are presented in the second chapter. In the third one, Mars is discussed as a specific building site. The structure and the shape of the habitat are determined by the Martian environment. The fourth chapter deals with an influence of the human factor on the Martian architecture. Survival, sociopsychological problems and comfort issues are investigated to determine architectural design of the base. In the fifth chapter different habitats in extreme environments (analogous to the Martian one) are analysed. Some of them have been built on the Earth, some – have been sent to space. Interesting architectural solutions suitable for the Martian base are emphasized. In the sixth chapter the architecture of the habitat is discussed in following sections: "structure", "shape", "function" and "interiors". Different building technologies which are expected to be adaptable in extreme Martian conditions are analysed in details. The artificial atmospheric pressure inside the habitat will be much higher than the thin Martian atmosphere pressure. Thus a cylindrical shape for the base is recommended. Several design options are discussed. A problem of the functional arrangement in the Martian base is only generally explained, as the settlement program is still uncertain. An interior design of the base is approached in relationship to structure, shape and functionality restrictions. Based on revealed conclusions, there are four interior design solutions presented. Different concepts of space bases can be found in professional literature. As the

critical analysis reveals, there are a lot of unsolved issues in design methods in these concepts. However, some architectural solutions can be very inspiring. In the seventh chapter the Martian base models are presented, which were designed on the base of author's conclusions from the previous chapters. One of these concepts is elaborated in details in the eighth chapter.

Studies described in the third, fourth, fifth and sixth chapter are based on professional literature, including 189 bibliography items. Every analysis leads to the "conclusions for the architect" assumed as Martian base design guidelines. There are altogether more than 200 of them. All nine architectural models and conceptual design of the Martian base in seventh and eighth chapter are the author's original ideas.