Chapter 2
Moon and Mars Space Exploration Concepts

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“Many say exploration is part of our destiny, but it’s actually our duty to future generations and their quest to ensure the survival of the human species.”

Buzz Aldrin

1. INTRODUCTION

The Apollo 11 landing on the Moon on July 24th 1969 marked a new era of human space exploration, due to which a new generation of space scientists, visionaries and dreamers was born; a generation for which Lunar habitats, Mars missions and interplanetary colonization are were only but a natural step to interplanetary space exploration.

Today, almost 40 years after the last Moon landing in 1972, we are starting to understand the benefits from space exploration to humankind. Therefore, this chapter will provide an overview of the Apollo mission benefits, NASA 1969 space exploration strategy, Russian, European, Japanese, other countries Moon and Mars programs.
In his “Plan of Space Exploration”, the father of space rocketry, Konstantin Tsiolkovsky, already in 1926 defined at least sixteen steps for human space exploration, such as using solar radiation to grow food, transport throughout the Solar System, colonization of the entire Solar System and the Milky Way. His vision not only became the road map of modern rocketry, but described some of the benefits from space exploration, such as using solar radiation for food growth and transportation.

His vision was carried out by Korolev and Wernher von Braun, who were the fathers of modern rocketry. Korolev launched the first artificial satellite “Sputnik” in 1957 and the first man in space Yuri Gagarin in 1961, while Wernher von Braun launched the first humans on the Moon in 1969. Regardless of the success of human space flight missions, the challenges in justifying human space flight still remain. Therefore, in this chapter there is an analysis of the expected benefits from space agencies Moon and Mars space exploration visions and description of the reasons behind benefits definition.

2. APOLLO MISSION BENEFITS

The Apollo program started in 1963 and finished in 1972. During this period six successful Moon landings (i.e. Apollo 11, Apollo 12, Apollo 14, Apollo 15, Apollo 16 and Apollo 17) were performed. These missions brought back lunar samples and resulted in scientific and technology benefits. For example, as a result of the Apollo missions more than 1,500 spin-offs were developed from the space technology developed (Greene, 2008). Many of these spin-offs became important to our day-to-day lives, such as scratch resistant lenses, lunar boots, kidney dialysis machines, water purification technology, dry lubricant and fire resistant materials as presented in Table 1.

For example the Apollo computer system led to the automation of retail check-out systems, as software programs allowed faster and safer credit authorization. Other examples are the development of freeze dry foods processes for preserving food nutrients and the use of the Apollo space suits fabric for environmentally friendly building material, such as the Teflon-coated fiberglass use. Or the use of the metal-bonded polyurethane foam insulation for protecting the Apollo spacecraft has been widely used for insulation of the Alaskan pipeline (NASA, 2009) (Figure 1).

The Apollo missions brought not only scientific benefits, but also political and national ones to American people. Funding the Apollo program was not an issue as it was initiated in the peak of the Cold War when the US and the Soviet Union were engaged in fierce political, strategic and technological competition. In 1966, NASA informed the US Congress that the estimated cost for the Apollo Program corre-
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