

HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)  
Going Beyond the Earth-Moon system: Human Missions to Mars, Libration points, and NEO's (4)

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THE ANALYSIS OF ONE CONCEPT OF MANNED MISSION TO MARS

**Abstract**

Mars manned mission is researched. One of possible mission concept is analyzed: • Two spacecrafts are used. The first of them (its initial mass 200 tons) is being launched from a low Earth orbit into a circular geo-synchronous orbit (GSO, the orbital period is equal to one day) by the use of electric propulsion (EP). • In this orbit (GSO) the second spacecraft (a piloted spacecraft, its mass 15 tons) is docked to the first spacecraft. The piloted spacecraft (together with crew) is delivered into the GSO by a chemical upper stage. This piloted spacecraft in the further comes back to the Earth. • After spacecrafts docking the crew has an opportunity to use all systems of an interplanetary manned complex (mass of 52.1 tons), which belonged to first spacecraft. EP provides the SC launch from a GSO, as well as leaving of Earth's vicinity and flight to Mars. • At approach to Mars, the same EP is used for twisting around the Mars and for SC insertion into the circular orbit around the Mars. • In a Martian orbit, the spacecraft is located for one month. For this time, the crew is being landed on a surface of Mars by using the landing module (its mass is equal to 24 tons, including a take-off rocket). Then the crew research Mars, and return to the orbital spacecraft by using of the take-off rocket. • The take-off rocket remains in a Martian orbit and EP provides SC transfer from the Martian orbit to Earth. • At approach to Earth's vicinity the manned spacecraft is being separated. Then this SC enters into Earth's atmosphere with rather small velocity (less 12 km/s). The basic characteristics of examined mission and analyzed transport system are: • crew stay time in the space (the range of 1000 day...1100 day is examined); • specific impulse of EP (4500 s is examined); • EP thrust (84 N is examined). Optimization of mission is carried out. The criterion of optimization is a fuel mass which is required for SC transfer. Minimization of such mass is equivalent to maximization of total mass of the electric power and propulsion installations. We have shown, that this manned mission can be carried out, if it will be possible to make electric power installation and propulsion installation with total specific mass smaller than 14 kg/kW (at thruster efficiency 0.8).