

9th SYMPOSIUM ON VISIONS AND STRATEGIES FOR FAR FUTURES (D4)  
Human Exploration in Deep Space (1)

Author: Dr. Frank Little  
Texas A&M University, United States, f-little@tamu.edu

THERE AND BACK: PROPULSION SCHEMES FOR DEEP SPACE HUMAN EXPLORATION

**Abstract**

New means of propulsion will be required for deep space manned missions. Chemical propulsion, while a reliable and known technology will not be sufficient. More efficient means of propulsion must be developed and implemented to accomplish manned exploration missions beyond the near-earth environment. While the possibility exists for extracting and/or synthesizing chemical fuel from resources found on Mars, no such resources exist at the Earth-Sun Lagrange Point and cannot be counted on at near-earth objects or beyond Mars. For long-range missions, speed is of the essence to conserve the most important and fragile mission resource, the crew. In general, highly efficient propulsion is achieved by adding energy to the propellant from an external source. Examples include Hall effect and ion thrusters, solar thermal and nuclear thermal engines. Several types of propulsion systems are compared and matched to candidate human exploration missions with the object of identifying the most appropriate propulsion system for the mission within the trade space of required mass, thrust, efficiency, mission time and technical maturity.