

Preface

On August 22nd, 2001, when NASA's adventurous Galileo spacecraft skimmed just 138 km above the surface of Jupiter's moon Callisto, on-board cameras captured the sharpest pictures ever of that moon's mysterious landscape: an icy surface that happens to be the most heavily cratered place in the Solar System. For billions of years, little has changed on Callisto other than the relentless accumulation of craters, but magnetic readings picked up by Galileo suggest the pock-marked satellite harbors one of the Solar System's biggest salty oceans. But the water, if it's really there, doesn't lie atop the frigid surface, but may instead be hidden deep below the moon's crust – a tantalizing puzzle for future spacecraft and explorers.

Human interplanetary missions are widely considered the next logical step in space exploration. Scientific motivations include the search for extraterrestrial life, while inspirational, cultural, and economic considerations are also key factors. The prospect of these and future new discoveries will eventually fuel the impetus to embark upon a manned mission to far-flung destinations such as Callisto. After decades of speculation, such a mission may go far towards answering the question of whether extraterrestrial life exists in our Solar System. But how will such a mission be designed, what propulsion system will be used, and what are the hazards to humans embarking upon such a mission?

Interplanetary Outpost answers these questions by following the mission architecture template of NASA's plan for Human Outer Planet Exploration (HOPE), which envisages sending a crew to Callisto to conduct exploration and sample return activities. To realize such a mission, the spacecraft will be the most complex interplanetary vehicle ever built, representing the best technical efforts of several nations. A wealth of new technologies will need to be developed and qualified, including new propulsion systems, hibernation strategies, and revolutionary radiation shielding materials. Some of the technology development will require quantum leaps in innovation, while others may appear to be more science fiction than science. Step by step, this book describes how the mission architecture will evolve, how crews will be selected and trained, and what the mission will entail from launch to landing.

The focus of *Interplanetary Outpost* is on the human element. Just as a six-month

tour of duty on board the International Space Station is fundamentally different from a two-week trip to the Moon, the challenges of a five-year mission to Jupiter will be unique. Although the three types of missions share superficial similarities, the extended duration, logistical challenges, radiation concerns, communication lag times, isolation, and deleterious effects upon the human body will conspire to not only significantly impair human performance, but also affect the behavior of crewmembers. *Interplanetary Outpost* addresses each of these issues in detail while still providing the reader with a background to the necessary elements comprising such a mission.

Throughout human history, explorers have ventured into the unknown and challenged harsh environments. Nansen, Amundsen, and Shackleton are but a few of the more prominent members of this intrepid class of individuals, many of whom spent months, if not years, actively and successfully investigating remote regions without any contact with their home base. Humans are long overdue for an era of exploration that rivals these earlier journeys in terms of scope, duration, isolation from sources of supply and assistance, and potential for exciting new discoveries. Spaceflight opened a new realm of exploration for human crews with its first tentative steps in the early sixties. In the intervening years, capabilities have been gradually developed for a long-term, sustained presence in this realm. These capabilities will shortly reach the level of sophistication and durability necessary for human crews to explore the surfaces of the outer planets.

Interplanetary Outpost

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the Outer Planets

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