

Exploration of Other Destinations (5)
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Author: Mr. Matej Poliaček
Deutsch Luft und Raumfahrt Zentrum (DLR), Slovak Republic

Mr. BahaaAlDeen AboAlNaga
Brown University, United States
Mr. Erwan Beauvois
THALES GROUP, France
Mr. Rohan Chotalal
Delft Institute Of Technology (TU Delft), Belgium
Ms. Adelina Khalaua
France
Ms. Sofia Sinopoli
European Space Agency (ESA/ESRIN), Italy
Ms. Chiara Zuccotti
Technical University of Denmark (DTU), Denmark

TRIDENT: A MISSION STUDY FOR CONSTRUCTION, DEPLOYMENT, AND OPERATION OF AN
AERIAL PLATFORM FOR SUSTAINED HUMAN PRESENCE ON VENUS

Abstract

This study, a collective effort of 20 engineers, scientists and researchers, presents a mission design for a crewed outpost located in the atmosphere of Venus at an altitude of 56 kilometres. The design utilises an aerial platform constructed by incremental expansion by adding the individual modules, each supported by a separate balloon. The station is sustainable in the long-term, to be inhabited by sequential human crews. Firstly, this paper provides an overview of the Venusian environment, to give an insight into the constraints of the system. This is followed by analysis of mission logistics, including potential launch vehicles and number of launches required for hardware and crew transportation. Trajectory design and the hypothetical mission schedule are also justified. More detailed aspects of transportation are addressed by an entry, descent and landing analysis, along with attitude and orbit control system design. Cost and risk estimates are provided for the entire mission duration. Designs relevant to sustaining crew, such as habitat environmental control, life support systems, and human factors engineering are also provided. An exploration of the interactions between radiation and proposed vehicles are summarised. Further operational aspects discussed include electric power system design, thermal control systems, and communications. A crewed Venusian outpost offers significant opportunities as a base for atmospheric and surface research, including the use of robotics, extravehicular activities, and in-situ resource utilisation, all of which are considered in this concept paper.