

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND  
DEVELOPMENT (D3)Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and  
Development (1)

Author: Prof. Ernesto Vallerani  
International Space Pioneers, Italy, cris.vallerani@iol.it

Dr. Nicole Viola  
Politecnico di Torino, Italy, nicole.viola@polito.it  
Dr. Maria Antonietta Viscio  
Politecnico di Torino - Thales Alenia Space Italia, Italy,  
Maria.Viscio-somministrato@thalesalieniaspace.com

## ITINERANT HUMAN OUTPOST FOR FUTURE SPACE EXPLORATION

**Abstract**

The exploration of space has so far been attempted only through a limited sequence of missions, not strictly linked among them in terms of accumulation of achieved experience and hardware utilization. The paper presents an innovative approach to the exploration of regions beyond Low Earth Orbit, which is assumed to occur through an orderly sequence of interlinked missions, targeted to specific locations, where human outposts are put in place, to progressively enlarge the boundaries of human presence in the Solar System. Each human outpost is built “on the shoulders” of the precedent one, through physical transfer at the new location of all or at least some of the major building blocks of the previous outpost. Dedicated building blocks may also be considered to build up the final architecture of the new outpost. The new approach proposes therefore the development of an “Itinerant Human Outpost” for future space exploration, growing eventually in complexity and transforming itself. At each step of the space exploration journey the outpost is utilized as technology and operation test-bed to prepare the “next step”. The sequence of locations starts with a Equatorial Low Earth Orbit Human Outpost. Next locations are Earth-Moon Lagrangian Points, Near Earth Asteroids Region, Low Lunar Orbits and Martian Orbits to finally build up Martian human outposts in Low Martian Orbits or on one Martian natural satellites. The overall scenario can be considered the “Grand Tour of the Earth Neighbours”, performed by the “Itinerant Human Outposts”, whose successive multiple utilization and growth potential have to be taken into account as design requirements of each building block. The practice of introducing in the design the “Revolutionary Approach” of the “6R Space Systems”, i.e. the “Repairable, Refurbishable, Replaceable, Reconfigurable, Retrievable and Reusable Space Systems”, has to be adopted as well, in order to optimize in the long term the costs of the outposts building up and of their operations, even if in the front end such an approach requires more complex and costing solutions. The paper describes into some detail the proposed new approach, establishes the main requirements and defines the System of Systems Architecture of the first Human Outpost in Equatorial Low Earth Orbit. The significant endeavours, required to sustain over quite a long period of time such an initiative, are going to offer to new generations perspectives that will act as catalyst of economical growth and will encourage the involvement of the Private Sector.