BUILDING STRATEGIC CAPABILITIES FOR SUSTAINED LUNAR EXPLORATION

Alessandro Bergamasco

Strategic Planning Office, Directorate of Human Spaceflight and Operations

01/11/2016
Moon Village Vision

- “Sustainable moon surface operations”

- “Free and open access, multiple uses and multiple users”

- “People working and living together in the same place [...] on the Moon.”

- “Combine the capabilities of different spacefaring nations, with the help of robots and astronauts”

[ESA’s Director General Jan Woerner]
“the responsibility of Space Agencies [...] is to do activities which make the future possible”

ESA’s Director General Jan Woerner at IAF Spring Meetings in Paris, 23 March 2016.

ESA is currently consolidating its proposal for a European Exploration Programme (E3P), defining concrete near-term activities and preparing long term perspectives hat help making the Moon Village vision a reality
Consistent with the ESA Exploration Strategy, E3P is driven by three destination-specific goals:

1. Sustained and sustainable utilization of Low Earth Orbit

2. Enable human lunar exploration

3. Engage in Mars Sample Return
Enabling Human Lunar Exploration Goal

Goal: “Acquire access to lunar surface for advancing knowledge of the Moon, understanding role of its resources for future human space exploration and advancing scientific questions related to the history of the Solar System and the origin of life on Earth”
Path to Moon Village

1. Robotic Missions to Lunar Surface
2. Humans in Cislunar
3. Sub-scale demonstrator of crewed Moon landers
4. Humans on the Lunar Surface
5. Moon Village

Technology Development and Demonstration
Partnership with Roscosmos

ESA is partnering with Roscosmos in the frame of the Luna Resurs mission to:

1. Demonstrate landing guidance, navigation, and control

2. Advance the understanding of lunar resources

Goals

- Acquire access to lunar surface
- Understand role of lunar resources
- Advancing scientific questions
Developing Roles in the e-DSH

ESA contributions to the evolvable Deep Space Habitat (e-DSH) will focus on:

1. Enabling access to the lunar surface from the staging location in cis-lunar space

2. Providing robotic means enabling scientific activities from the staging location in cis-lunar space
Participation to Architecture Definition Activities

Building on previous work performed by ISECG, activities will focus on defining:

1. A staged Architecture
2. Mobility based
3. Moderate duration
4. Multi-mission

Goals

- Acquire access to lunar surface
- Understand role of lunar resources
- Advancing scientific questions
Human Campaign Preparation

ESA is defining, with international partners, an un-crewed demonstration mission to sufficiently reduce the technical and operational risks of the human campaign.

1. Demonstrate human-related landing capabilities/subsystems
2. Demonstrate human-related ascent capabilities/subsystems
3. Demonstrate human-related roving capabilities/subsystems

Goals
- Acquire access to lunar surface
- Understand role of lunar resources
- Advancing scientific questions
Private Sector Involvement

ESA is establishing partnerships with the private sector to enable these partners providing key services in communication and logistics.

1. Telecommunication Satellites

2. Robotic Lunar Landers
Spaceship EAC – Innovation for a Lunar Base

- Energy Production & Storage
- Radiation Shielding
- In-situ Resource Utilization
- Materials & Additive Manufacturing
- Water Processing & Waste Management
- Systems Architecture & Habitability
- Robotics and Human Factors
- Simulation & Virtual Reality

ESA UNCLASSIFIED - Releasable to the Public
Summary

Activities are on-going at different levels (mission implementation, architecture definition, technology development)

ESA is working within international partners to advance elements that are instrumental to achieve sustainable lunar exploration

The E3P is the program ESA is proposing to its Member States to reach those capabilities necessary to realise the Moon Village vision

In the frame of the E3P programme concrete elements are proposed that enable affordable roles for ESA in an open and sustainable lunar exploration architecture
Thank You!