

**A Quick Look at a European Strategy
for
Solar System Exploration
(The Wide Vision)**

Wide Vision Impact on Economy

- Most of scientific discoveries, and technological developments induced by Space Exploration will have a direct application on Earth, so inducing an immediate economic impact.
- Soon however, Space Exploration will generate, as for most of past humankind explorations, new markets and a new economy by itself.
This fact will be an important source of wealth, and is essential to assure the sustainability of the program.
- Moon can supply materials, and products, at an overwhelming cost advantage, versus the same items lifted from Earth's surface: their availability will also remarkably help to make affordable and sustainable Space Exploration.

Possible European Contribution to Wide Mission (New Aurora)

- To protect its long term interests Europe, while selectively participating to ESAS, has to define a much wider and articulated program, open to equal participations of other Countries.
- Europe has time. While U.S. is focused on “quick” LEO missions and to the Moon, Europe may invest in a complementary programme, optimised to achieve the wide vision: manned exploration of the solar system.
- Europe has scarce financial resources; compared to U.S. and Russia, has even more scarce experience in manned flights and space stations. It has, however, the opportunity to implement a step by step programme, in which **every single step is a self-standing achievement and, at the same time, a building block of the overall Wide Space Exploration system.**
- Bilateral or multilateral agreements with other space-faring countries will provide a fundamental help. More resources may also be supplied by Europe itself, by stimulating potential, but at present unaware important stock-holders (scientific, governmental, industrial, commercial)

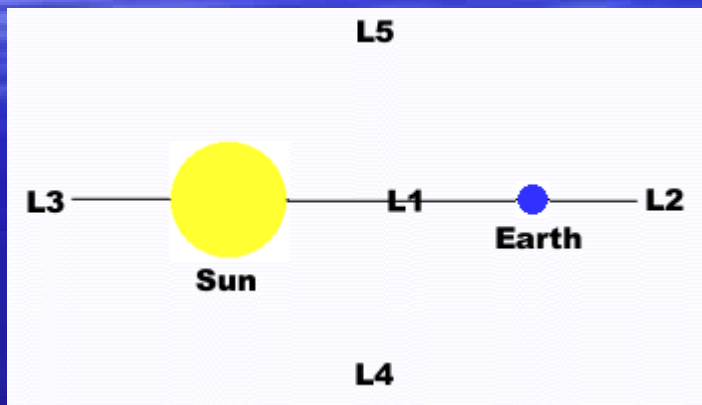
New Aurora Outlines

To be successful, New Aurora has to be:

- Inspiring, to capture the continuous interest of the public opinion, through fundamental science discoveries, solution of Earth major problems, satisfaction of human need for vision and adventure.
- Affordable, through multilateral cooperation and a streamlined architecture.
- Sustainable, through an architecture friendly to private investors, and with legal, fiscal, contractual approaches favoring private investments and public-private partnerships (PPPs).

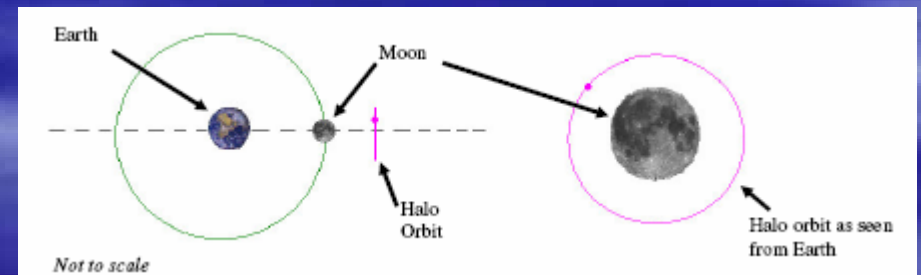
Importance of Libration's Points

Libration's Points (or Lagrange Points) and their halo orbits are becoming a popular location for space mission.



- NASA will place the James Webb Space Telescope (JWST) in Sun-Earth L_2 . So will ESA do for its Herschel, Planck, and Darwin observatories. (SEL₂ energy level differs from Earth-Moon L_1 by only about 50 m/s).
- Earth – Moon L_2 halo orbits may be used for a single comsat for continuous lunar farside communications.

But the real importance of Libration's Points is coming from being them real gateways for solar system exploration.



Inter Planetary Superhighways

The solar system is interconnected by a vast system of tunnels (IPS) winding around the Sun, generated by the Lagrange Points of all the planets and their moons.

This colossal labyrinth provides an ultra-low energy transport, and the halo orbits of Lagrange Points are the portals to enter it.



All these facts combine to suggest that halo orbit around EML_1 provides an ideal location for a space hub (Moon Base Harbor-MBH).

Huge telescopes could be assembled in EML_1 and shipped to SEL_2 , and called back to EML_1 for servicing.

Moon itself is always reachable from MBH, which is also a good platform to go to Mars and beyond.

New Aurora Architecture Characteristics: Assumptions/Elements (1/2)

- An incremental and modular approach, where each following step makes full use of previous investments
- The full use of existing facilities and means, namely compatibility of every single module of the architecture with existing launchers (Ariane 5, Soyuz and other) and their affordable derivatives, for the Earth-to-LEO transport, and intensive use of ISS (or its derivatives) as test-bed, as assembly site (with the help of robotic arms and RV-D capabilities), and as LEO space-gate for deep space departures and arrivals.
- A participation to ESAS focused on in-situ infra-structures instrumental too to implement beyond the Moon space exploration: e.g. propellant production facilities; nuclear power plants; greenhouses; ...

New Aurora Architecture Characteristics: Assumptions/Elements (2/ 2)

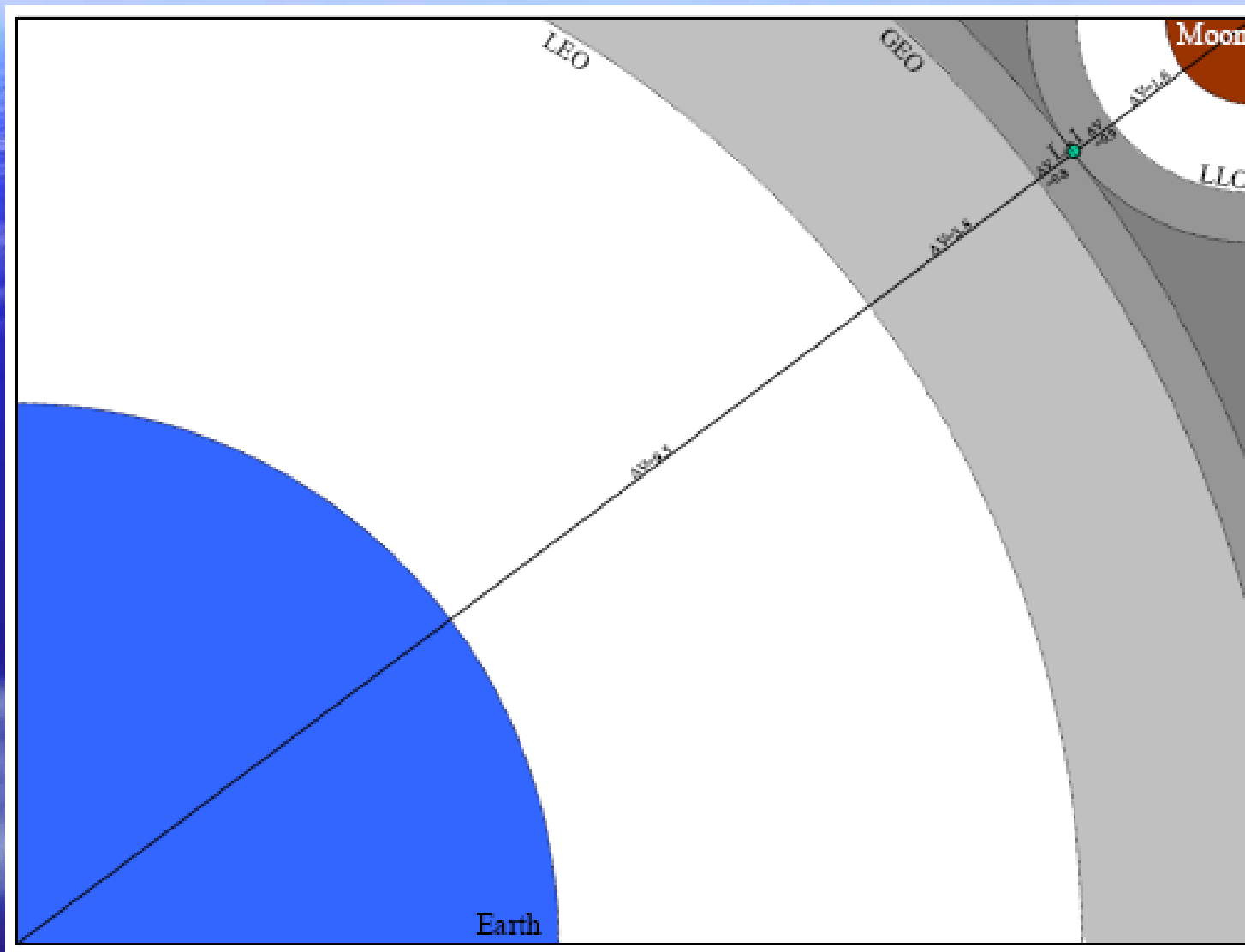
- The construction of the Moon Base Harbor in EML₁ halo as a safe haven, and to assemble and serve huge space telescopes, provide sustainable logistic support to Moon exploration and exploitation, as well as supply competitive Moon produced propellants to the overall space transportation chain, and assure an efficient and capable gateway to Mars.
- A LEO-EML₁ and EML₁-Moon surface transportation system entirely composed by reusable (cargo-manned) vehicles, conceived to use low cost Moon produced propellants

New Aurora : Peculiar Aspects

To have MBH adds an overall flexibility to the Space Exploration endeavor:

- A large facility at EML₁ reduces the requirements for Moon surface infrastructures: medical support, spare parts stock, major repairing facilities, fresh product production . . . may remain in EML₁
- Rescue operations for crew on Moon surface will be timely, with psychological relief for the involved people, and important saving in the system deployment and system operating costs
- MBH will also allow a quicker development of space tourism, as well as other leisure or scientific/economic activities
- If enough water is available on the Moon, propellants may also be produced at MBH, with a “just in time” approach, so drastically mitigating the cryogenic and radiation protection problems.

Earth-Moon Transportation Energy using ΔV scale



New Aurora First Major Step

- To build-up MBH, which is a large civil engineering effort, one has first to build-up huts for workers, equipments and the related logistics.
- These huts can be quickly implemented, by the consortium of involved Countries, using modules and capabilities developed for ISS, and now easily reproducible, although adapted as required for the new mission.
- Huts will have also a number of advantages for other applications (e.g. micro-gravity experiments). Last but not least, they would be a stimulus for the public opinion: neither the layman, nor the political man are interested in decisions bringing the first results too many years later.