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Missions to the Moon –
Prospects and Possibilities of the European Space Industry

Example: **L**unar **I**nfrastrukture **F**or **E**xploration **(LIFE)**

Towards a European Infrastructure for Lunar Observatories

23.11.2006, Bremen

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Strategy & Market Development

Overview

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1. In the near Future Space Activities will be focussed on utilzation and exploitation of established Infrastructures (ARIANE, ATV, COLUMBUS)
2. Space Product Life Cycles imply the necessity of long term perspective.
3. Future Space Exploration shall serve for
   - Satisfaction of Scientific Demand (Sustainability)
   - Autonomy
   - Motivation of young People
   - Provision of key elements for global co-operation
4. Next implementation steps should provide for utilization of:
   - existing Systems (AR5-ECA, ATV)
   - Consequent utilization European Innovations and Experiences
5. Accordingly a concept (**L**unare **I**nfrastruktur **F**or **E**xploration) has been designed as a plattform supporting multiple scientific and logistics demands and missions.
6. A reference Mission has been designed as bench mark antenna)
7. Elements have been identified opening the option for a European participation in international and global Space Exploration ventures.

The LIFE System

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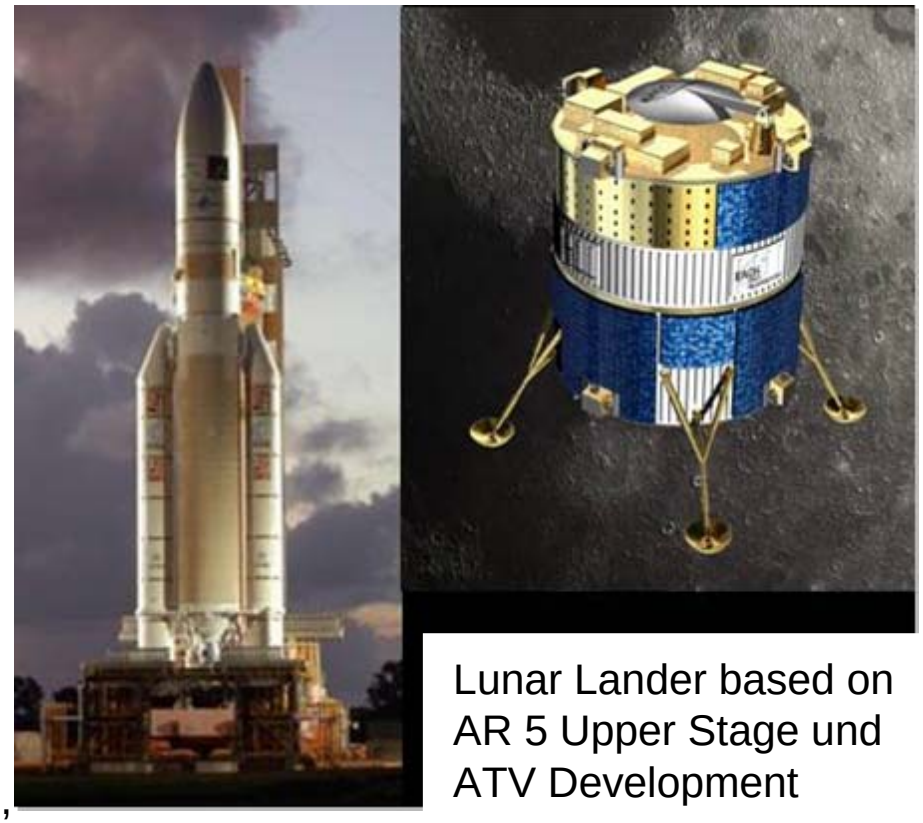
Transport
- One Ariane 5 / ECA Launch
- Direct Injection into Lunar Transfer Orbit
- Circularisation in low lunar Orbit

Lunar Lander
- Soft, High Precision Landing
- Final landing Correction during Descend
- Lander Design based on ATV Developments (Propulsion Automatization/Robotics)

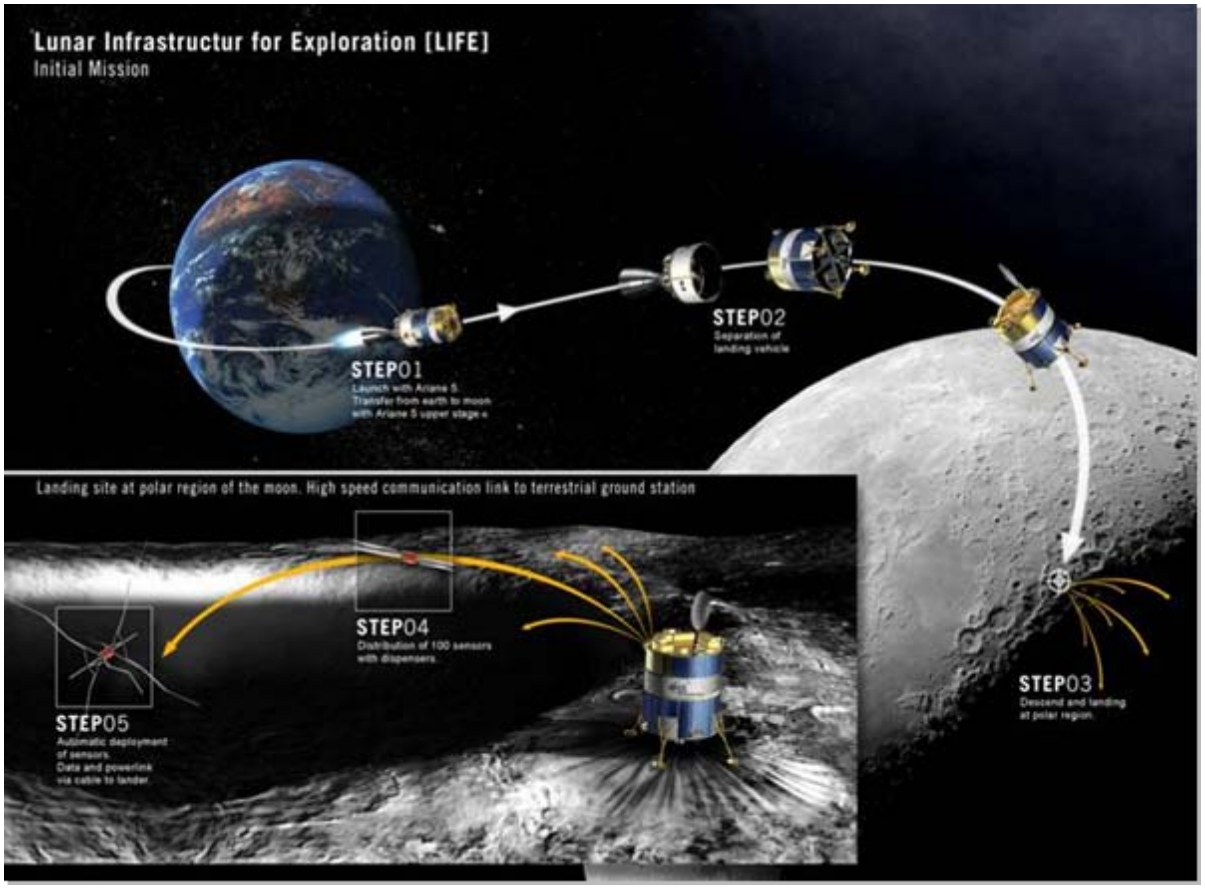
Lunar Infrastrukture
- Net. Payload Mass appr. 1000 kg
- Autonomous Power Supply
- Laser Kommunikationsverbindung
- Suitable for multiple applications (Science P/L, Logistics, Robotics, Sample Return Ascender)

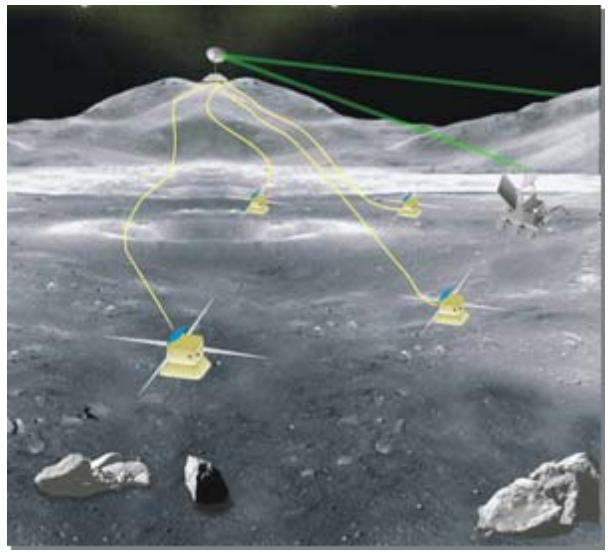


Lunar Lander based on AR 5 Upper Stage und ATV Development

The LIFE System combines existing Systems and Innovations and enables robust and reliable Mission Scenarios.

LIFE Entry Mission LUNAR LOFAR





LOFAR Technology allows the establishment of a virtual Radio Telescope with a Diameter of several 10s of kilometers with only one Ariane 5 Launch

LIFE Main Components Lander

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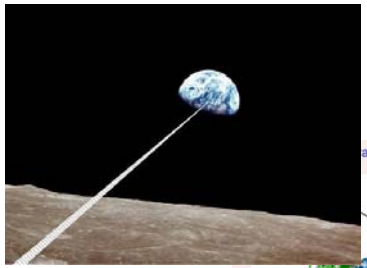
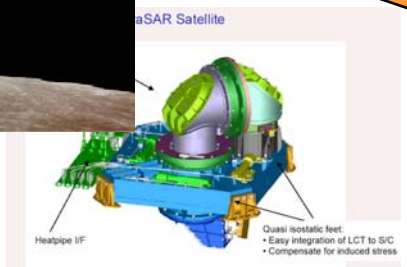
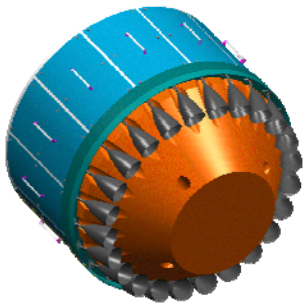
Communication



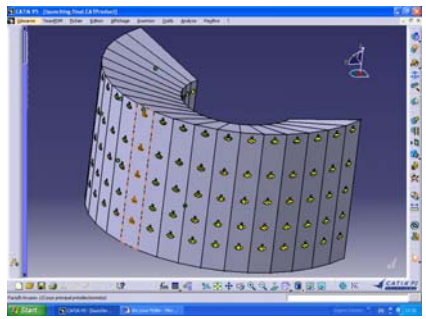


Power Supply

Transportation/Propulsion



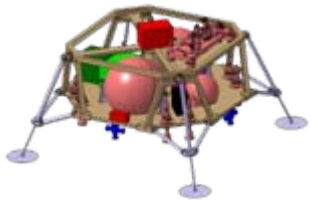
Mobility/Robotics

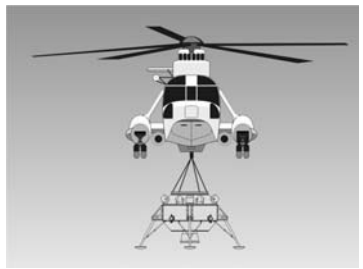


The LIFE Lander is the main element for robotic/automated Lunar Missions. I Key Feature is the High Precision and Soft Landing.

LIFE Programmatics

Step 1: Lander Verifikation Modell





Step 2: Entry Mission „LIFE – LUNAR LOFAR“

Step 3: Qualified Lunar Lander/Infrastructure for further robotic/ automated scientific or logistic Missions to the Moon

Experiences

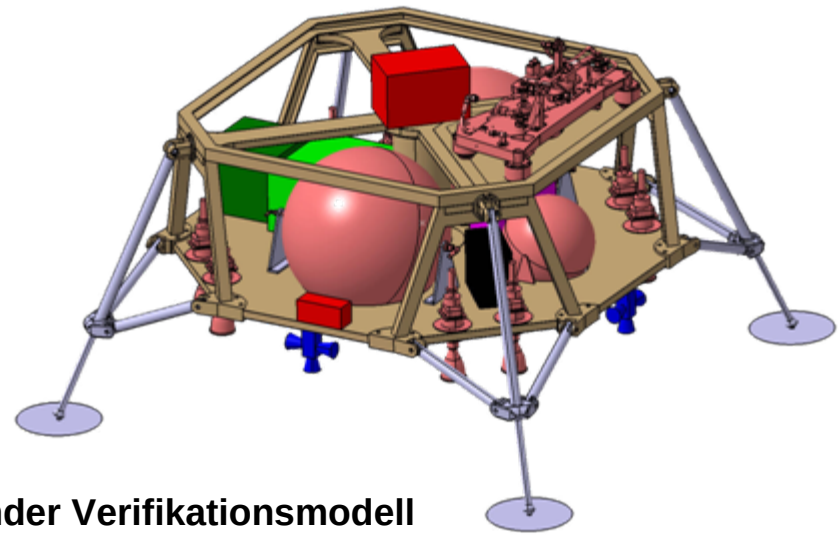
PHOENIX

AR5/ATV

The Participation in a lunar Infrastructure requires early contribution in terms of key technologies and capabilities.

Das LIFE Lander Verifikationsmodell

- Erster Schritt zur deutschen Führung einer Explorations – Schlüsseltechnologie in Europa
- Terrestrische Verifikation der Landeoperation
- Entwickelt und getestet werden autonome Landeplatzerkennung, Hindernis Erkennung und Landeplatzwechsel
- Verifikation von Instrumentierung & Avionik, GNC Software und Antriebsystem
- Landephasendauer ca. 1 Minute



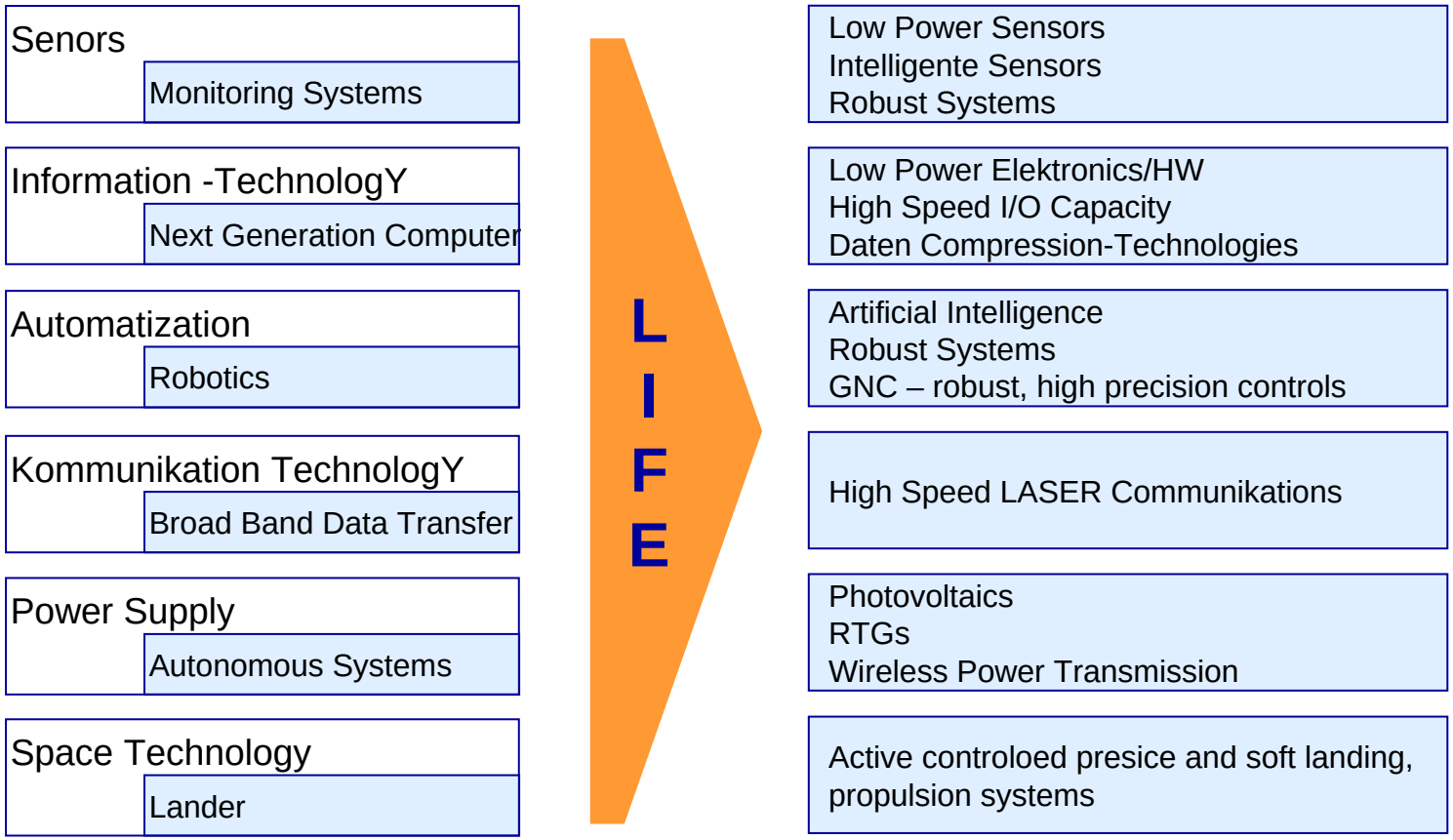
Prinzipskizze eines Lander Verifikationsmodell

Das LIFE Lander Verifikationsmodell ist schnell realisierbar und gleichzeitig ein wichtiger erster Schritt zur Entwicklung der benötigten Technologien.

Implementation – next Steps

- The LIFE Scenario is based on industry finances feasibility studies which have been executed during the last three years. Since 2006 co-funded studies have been releazed by the DLR.
- LIFE pre development studies and start of development of the LIFE verification model are proposed to be started begining of 2007
- A LIFE Lander Verifikationsmodell could be developed and available for test operations in a time frame of two years
- This tool provides tangible prepatory activities and results for the ESA Council Meeting on ministerial Level 2008.
- With positive Decisions in 2008 and 20011 the entry mission of a LUNAR LOFAR could be realized by 2015.

Die LIFE Schlüsseltechnologien



The LIFE Initiative provides an important impetus for development of new technologies across scientific areas and beyond Space activities

Zusammenfassung

1. The LIFE Scenario combines available Capabilities and Innovations and by this provides answers to the question of positioning of the European Space Exploration Activities.

2. There is a demand for the utilization of the moon as scientific plattform

3. „LIFE – LUNAR LOFAR“ provides an appropriate Entry Mission

4. A sound proposal needs to be prepared for the ESA Ministerial Conference 2006

5. Co Funded Studies to be delivered by mid of 2007 (Decision baseline for DLR for further proceeding)

6. Actual and Upcoming Preparatory Meetings and workshops
   - DLR Exploration Conference, Dresden , Nov. 21st, 22nd 2006
   - ESA Exploration Workshop Edinburgh, Jan. 9th 2007
   - DGLR Conference „To Moon and beyond“ Bremen March 14th – 16th 2007