Human Spaceflight
SPACE FOR LIFE

Potential European-Russian Cooperation on an Advanced Crew Transportation System

Background

- In 2004 Roscosmos invited ESA to undertake talks about a possible European participation to the development of the Clipper crew transportation system
- During 2005 ESA and Roscosmos elaborated a "Joint Vision of the Development and Operations of Clipper" endorsed by the respective Directors General
- Also Roscosmos and ESA discussed the activities for a two-year “Joint Preparatory Programme”, aiming at identifying:
  - System requirements definition and concept consolidation;
  - Preliminary system design
  - Design maturation and bread-boarding
  - Cooperation framework development and drafting of related arrangements

Background

- Following its Ministerial Council in December 2005, ESA has decided to undertake a study to further address the Crew Transportation Vehicle regarding
  - Mission
  - System concept
  - Programmatics

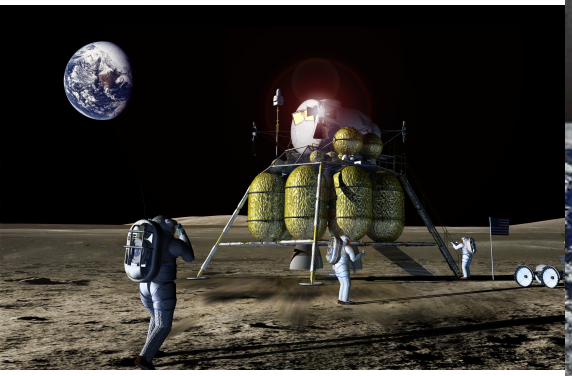
- This work has been performed in close collaboration with Roscosmos

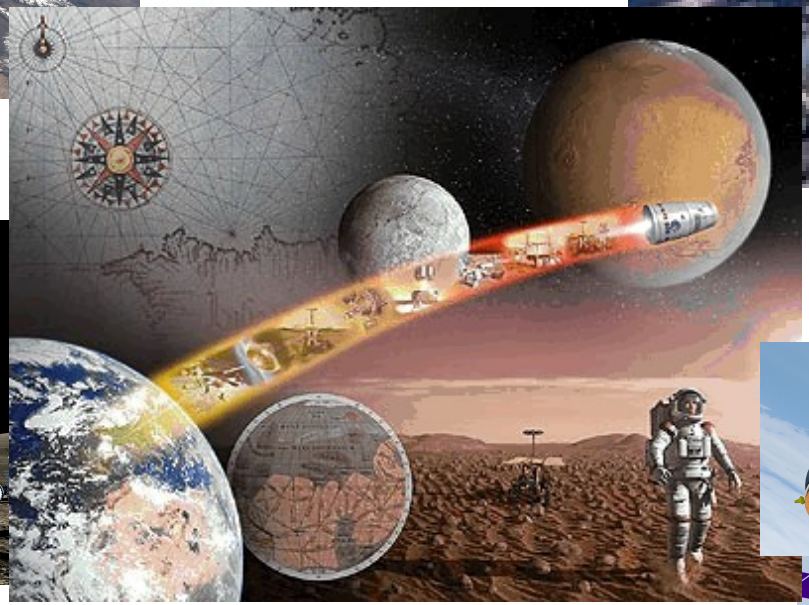
- These elements have formed the basis for
  - An European proposal for a Preparatory Programme that will be presented to the ESA Council end of June 2006
  - An update to the Russian ITT

Overall Context

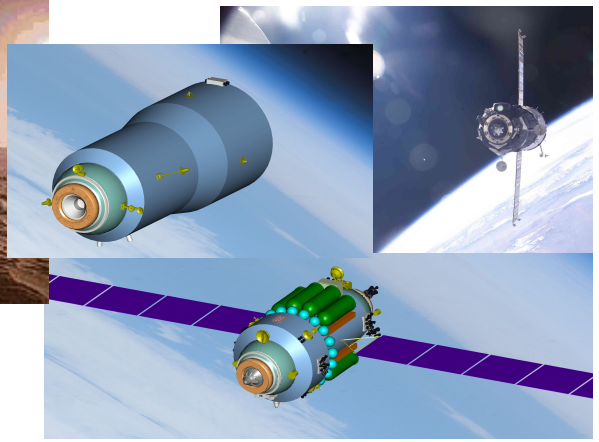
US

China





Europe



Russia

ESA Reference High-Level Mission Drivers

2. To develop a modern crew transport system to support human exploration missions, either directly or via LEO assembly

4. To also serve, during both its initial testing and qualification phase, as well as the initial operational phase, as a complementary crew transportation system in support to the exploitation phase of the ISS

6. to satisfy mission requirements in terms of number of crew, together with a limited cargo mass, whilst minimising operational complexity and cost per flight-seat;

8. to use existing or evolved launch systems, or systems the development of which is currently approved/planned;

ESA Reference High-Level Mission Drivers

2. to achieve crew safety levels equal or higher than the current crew transportation systems for LEO missions; to maximise crew safety levels for other missions.

4. to have compatible interfaces, such as rendezvous and docking, internal atmosphere, communication protocols, ground control, etc. with other elements of the future exploration infrastructure, including transportation systems (e.g. CEV);

6. To be compatible with a launch from the European Spaceport (CSG / Kourou) and the launch systems currently available or foreseen at this site, taking into account the overall launcher performance, the crew escape system capability and the abort possibility at the launch site;

8. to enable landing at a variety of sites, through improved cross range and landing accuracy capabilities, whilst achieving also improved crew comfort levels, to the extent compatible with the above drivers.

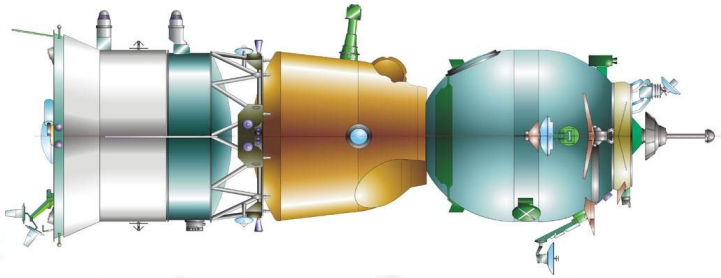
ESA High Level Programmatic Drivers

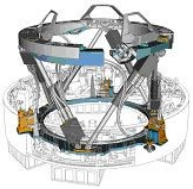
- To acquire a right of access to space for European astronauts
- To achieve a European participation as a major player in the joint development and operations of a modern crew transportation system
- To apply to the maximum extent the systems and technological competence and heritage of Europe and Russia obtained from previous space programmes in order to minimize development cost and risk
- To exploit the industrial dimension of the programme

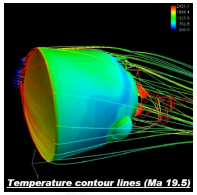
Reference Exploration Mission

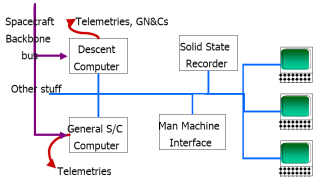
- Circum lunar mission (Lunar orbit injection).
- Launch from CSG and Baikonur
- Assembly/docking in LEO
- Three launches per lunar mission
- Direct Earth re-entry from the Moon orbit
- Crew size: 3 – 4
- Mission duration : no less than 18 days

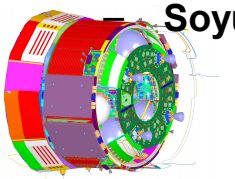
Proposed Approach









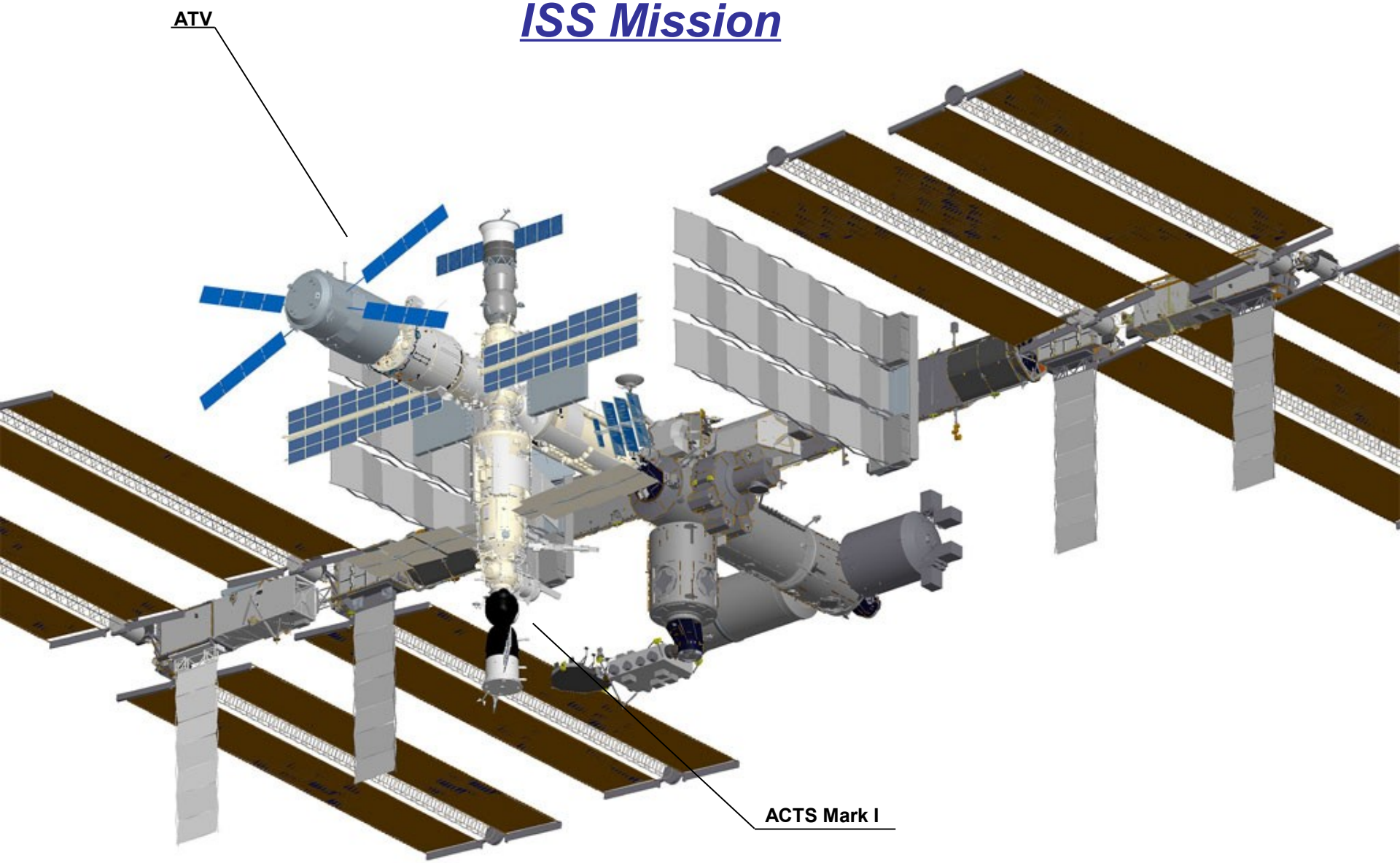


- **Incremental Development based on Soyuz Vehicle Architecture**
  - **Avionics**
  - **Orbital Module**
  - **Propulsion Module**
  - **Re-entry Technology**
  - **Rendez-Vous and Docking**
- **Based on European and Russian Heritage**
  - **ATV, Columbus, X38/CRV, Hermes, etc…**
  - **Soyuz TMA, Clipper, Buran, etc…**

ACTS Mark I

ACTS

ISS Mission



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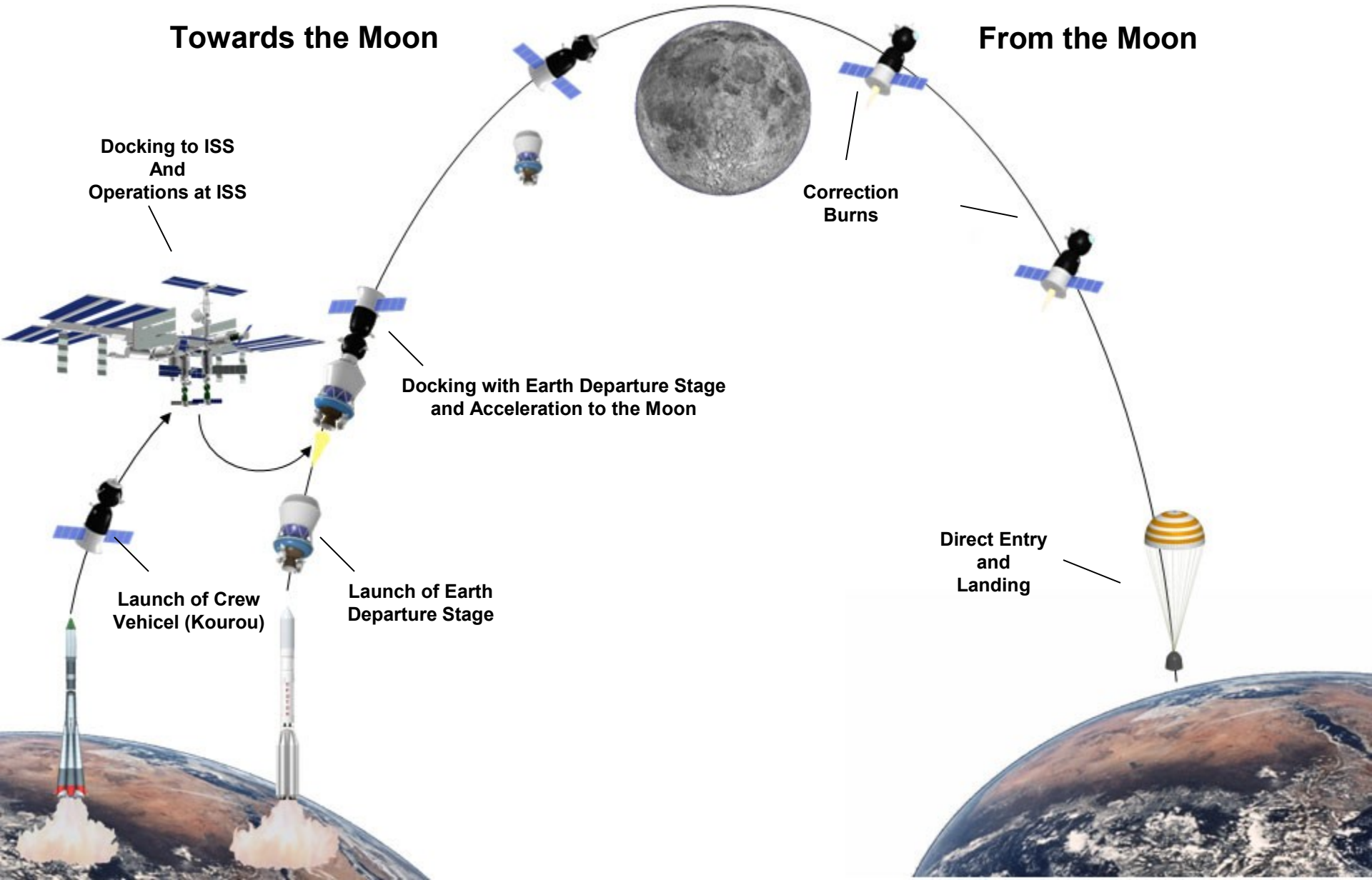
Lunar Flyby



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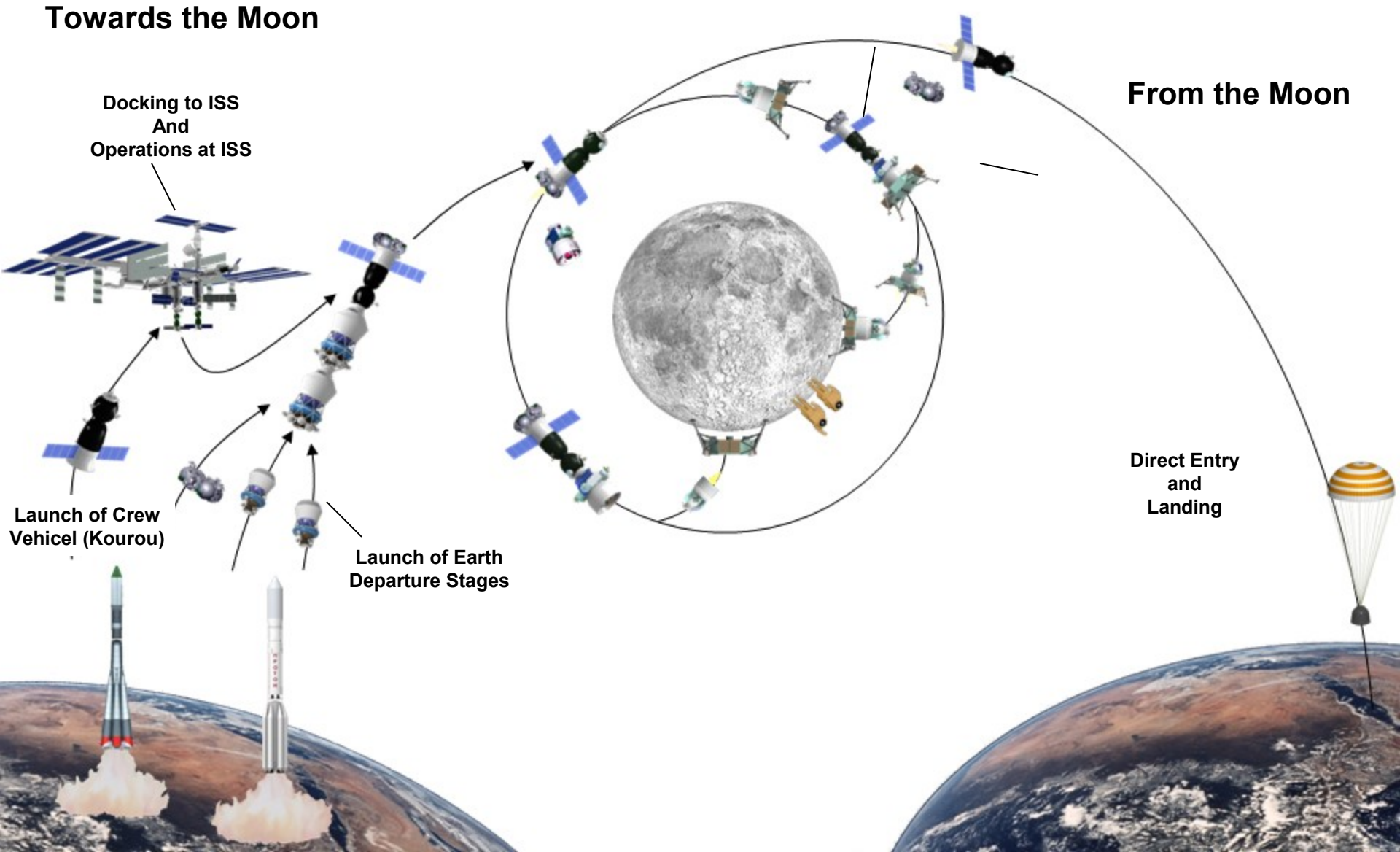
Lunar Operations



Next Steps

- Updated Preparatory Programme Proposal intended to be submitted to ESA Council in June 2006 for subscription
- Two Year Preparatory Phase
  - Refine the Mission
  - Establish ACTS Configuration
  - Operations Concept
  - Roles and Responsibilities (Development and Operations)
  - Cooperation Agreements (Agency and Industry Level)
- Preparation of a full Development and Operational Programme Proposal for 2008 Ministerial Council
- First Mission around 2012