

A space-themed background featuring a large blue and white Earth in the upper left, a bright red Mars in the lower left, and a bright yellow star in the center. The background is a dark field of stars.

Mars Pathfinder II

Andreas Mogensen

A vertical decorative strip on the left side of the slide. It features a space-themed background with a view of Earth's horizon at the top, a bright sun in the middle, and the red horizon of Mars at the bottom.

Mars Pathfinder II

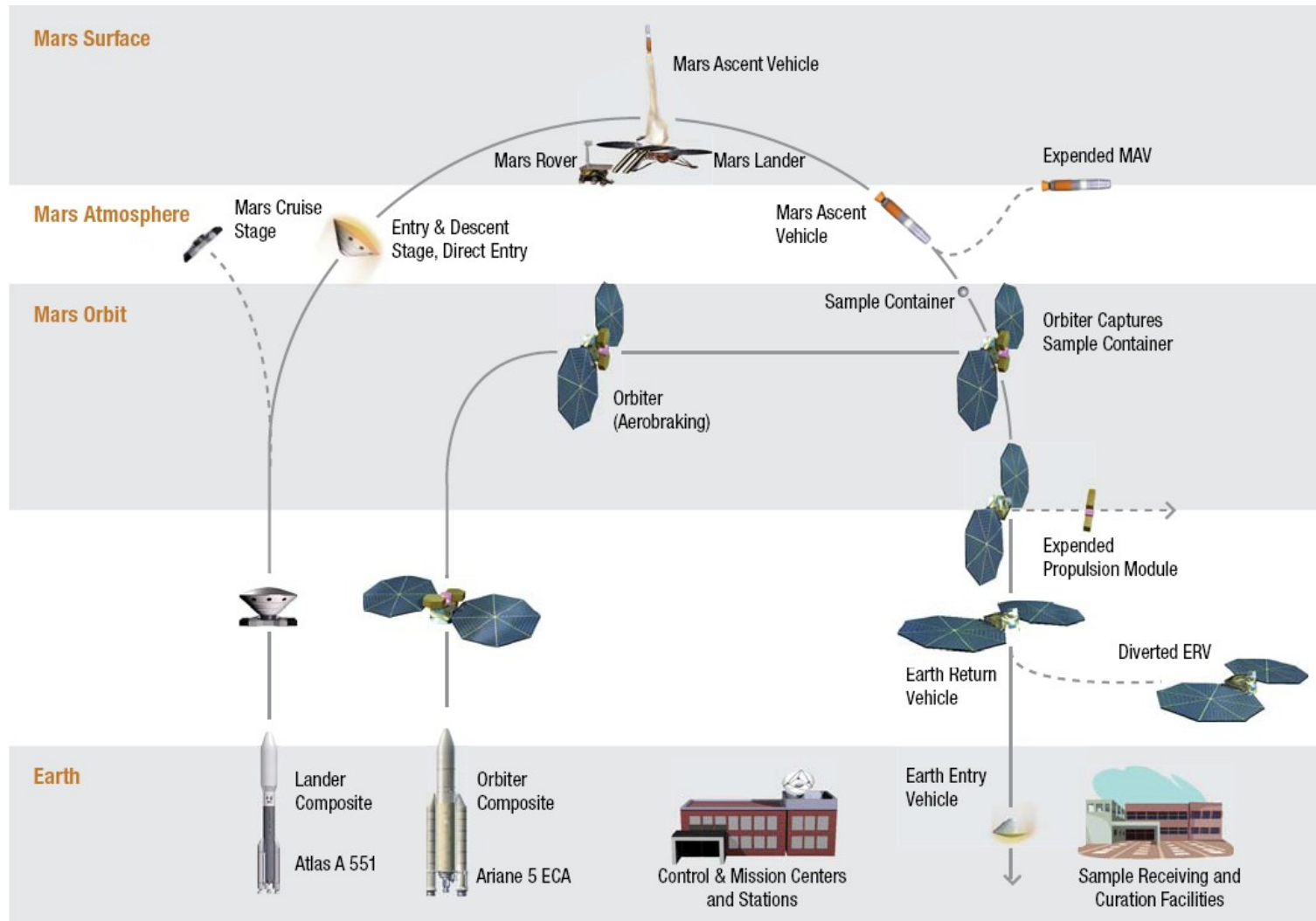
- Technology demonstration mission:
 - In-situ propellant production (ISPP) using atmospheric carbon dioxide and hydrogen feedstock
- A first step towards Mars sample return and manned Mars missions

A vertical decorative strip on the left side of the slide. It features a dark space background with a bright star at the top, a red planet (Mars) at the bottom, and a blue and green planet (Earth) in the middle.

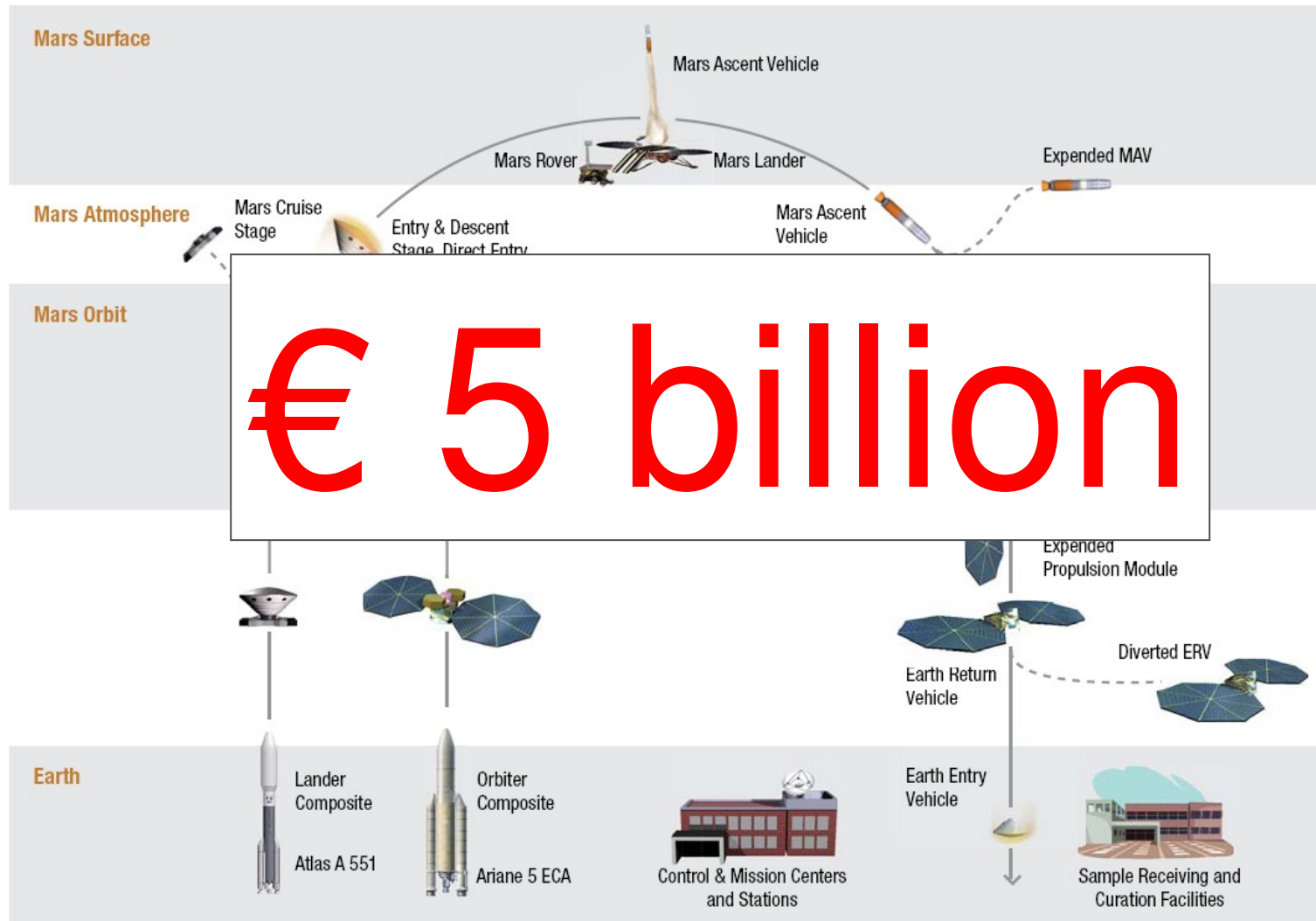
Historical Context

- Mars Pathfinder mission (1997)
- Demonstration of rover technology using Sojourner rover (10.5 kg, 65×48×30 cm)
- Success of mission lead directly to Mars Exploration Rovers Spirit and Opportunity
- Total mission cost \$280 million (including launch and mission operations)

Mars Sample Return



Mars Sample Return



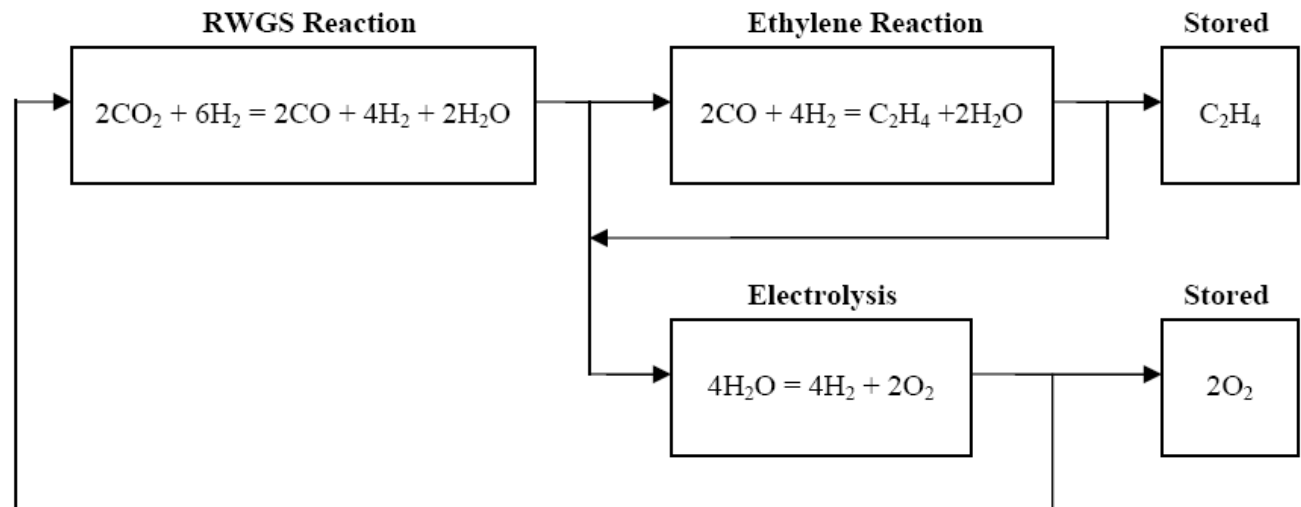
A vertical decorative strip on the left side of the slide. It features a black background with a bright star in the center. Above the star is a curved edge of Earth, showing blue oceans and green landmasses. Below the star is a curved edge of Mars, showing a reddish-orange surface.

Mars Sample Return with ISPP

- Mission architecture:
 - Single spacecraft launched from Earth
 - Entire spacecraft lands on surface of Mars
 - Spacecraft consists of:
 - Lander with chemical processing unit
 - Sample retrieval system (eg. rover)
 - Earth return vehicle (unfueled)
 - Direct return to Earth from Mars surface
- Advantages:
 - Cheaper due to single launch from Earth
 - Avoids autonomous Mars orbital rendezvous
 - Leads directly to manned Mars missions
 - Testability

In-Situ Propellant Production

- Mars atmosphere:
 - Composition CO₂ (96%)
 - Mean pressure 0.01 bar
 - Mean temperature -45 °C
- In-situ propellant production:
 - Ethylene/oxygen bipropellant with I_{sp} of 376 s
 - 10 kg of hydrogen feedstock needed to produce 200 kg of bipropellant



A vertical decorative strip on the left side of the slide. It features a black background with a bright star in the center. Above the star is a curved edge of Earth, showing blue oceans and green landmasses. Below the star is a curved edge of Mars, showing a reddish-orange surface.

Mars Pathfinder II

- Objectives:
 - Demonstrate production of ethylene/oxygen bipropellant from atmospheric carbon dioxide
 - Demonstrate ability to launch rocket from surface of Mars
 - Provide video images of launch and parachute descent
- Mission overview:
 - Low cost mission consisting of
 - Stationary lander
 - Chemical processing unit with hydrogen feedstock
 - Sounding rocket (unfueled)
 - Spacecraft lands on Mars and begins production of ethylene/oxygen bipropellant
 - Sounding rocket is fueled and launched
 - Rocket descends to surface with parachute while imaging surface

Future Missions

- Coherent mission architecture:

