Chinese Mars Exploration
Mission Analysis

China Academy of Space Technology
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Foreword

• Mars is the nearest terrestrial planet.

• In recent years, Mars exploration is the focus of deep space exploration all around the world.

• Mars is also the major object of Chinese deep space exploration in the coming future.

• In the Following, some suggestion is given for Chinese Mars Exploration.
Foreword

• Based on technology and facility developed by CLEP (China Lunar Exploration Program, finished CE-1 \ CE-2, developing CE-3).

• At the end of 2015, we try to finish Mars probe development and get ready for launch.

• Look forward to international cooperation for Demonstration Lander, scientific payloads and so on.
Foreword

Suggested goals of Chinese Mars Exploration Project:

- To develop technology for Mars exploration
- To initiate scientific exploration and application research
- To find resources on Mars.
Proposed Steps of Chinese Mars Exploration

Three steps:

• Launch a Mars Orbiter;
• Complete a soft landing on Mars surface;
• Complete a robotic sample and return from Mars.
Proposed Steps of Chinese Mars Exploration

Orbiting Mars

Landing on Mars

Returning from Mars
Concept of 2015 Mars Explorer

Orbiter

Demonstration Lander
Mission Objectives

• To acquire image and analyze abundance of elements and distribution of different materials on Mars surface;

• To explore the circumstance of Mars;

• To develop technology and facility for Mars and Deep-space exploration

• To demonstrate the key technologies for Mars exploration.
Summary

- Mass: ~2000kg
- TTC: UXB + VLBI
- Life on Mars Orbit: 2 years
- Mission orbit (elliptic Orbit): perigee altitude 300km
- Inclination: 85° ~95°
- Extension: circular orbit (Aerobraking)
Launch Vehicle

Long March – 3B(CZ-3B)
Payload Fairing : \( \Phi 4000 \text{mm} \)
Launch orbit: Earth-Mars trajectory
Launch Mass: \( >2T \)
TT&C system

Deep space network:

64m antenna and 35m antenna which will be completed in 2012 on schedule. VLBI as an assistant.

International networking:

ESA (Deep space Network) ….
Application system and Launching site

**Application system:**

the data receive station of CLEP, including Beijing receive station and Kunming receive station. Moreover, antenna array technology is developed.

**Launching site:**

Xichang satellite launching centre.
Payloads

• CCD camera
• Mars Surface Penetrating Radar
• Infrared spectral instrument
• Imaging spectrometer
• \( \gamma \)-ray spectrometer
• High-energy particle detector
• Solar wind particle detector

……

At present, these payloads are still in discussion.

It is open to international co-operation.
Flight Procedure

1) Launch phase
2) Earth-Mars Cruise phase
3) Mars Orbit Insert phase
4) Relay & EDL phase
5) Mars Explore phase
6) Extended phase
   (Aerobraking)
Flight Procedure

1）Depart
2）Entry
3）Parachute Deployment
4）Heatshield jettison
5）Landing
Landing Site

Considering the terrain of Mars surface, the landing site is allocated at northern hemisphere of Mars.
Major Subsystems of Mars Orbiter

- **Structure**: central bearing cylinder, honeycomb panel, upper module and bottom module.
- **Thermal Control**: active + passive, thermal paint, passive MLI & radiator, controlled heater, heat pipe and controller.
- **Power Supply**: GaAs triple junction solar panel, Li-ion battery.
- **GNC**: three-axis stabilized, solar sensor + star tracker + gyroscope, reaction wheel with thrusters,
- **Thrusters**: Bi-propellant thrusters, 1000N(main engine) and 10N(attitude thrusters)
- **TT&C**: X-band omni antenna, X-band HGA.
Demonstration Mars Lander

- Separation: From Mars orbit
- Mass: 20~50kg
- TT&C: UHF
- Life on Mars surface: 3days~5days
- Entry Velocity: 4.7km/s
- EDL: Based on a rigid aeroshell with parachutes
- Landing style: ‘semi-soft’ landing
Considerations of Other Planets Exploration

In the near future, the mission of Venus Exploration, Jupiter Exploration and near-earth asteroid Exploration is under development.
Thank you for attention!

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