

**MARS ROVER MISSION: THE FRENCH VIEWS.** F.M. COSTARD<sup>(1)</sup>, J. ACHACHE<sup>(2)</sup>, J.P. BIBRING<sup>(3)</sup>, M. BLANC<sup>(4)</sup>, S. COUTIN-FAYE<sup>(5)</sup>, Y. LANGEVIN<sup>(3)</sup>, P. LOGNONNE<sup>(2)</sup>, P. MASSON<sup>(6)</sup>, D. MOURA<sup>(5)</sup> and F. ROCARD<sup>(5)</sup>. (1) *Laboratoire de Géographie Physique, Meudon*, (2) *Institut de Physique du Globe, Paris*, (3) *Institut d'Astrophysique, Orsay*, (4) *Observatoire de Midi-Pyrénées*, (5) *Centre National d'Etudes Spatiales*, (6) *Laboratoire Géologie Dynamique Interne, Orsay, FRANCE*.

#### INTRODUCTION:

With a potential view to future cooperations with the United States, the Russia and the European Space Agency (ESA) in the forthcoming exploration missions, the French Space Agency (CNES) has initiated, in 1989, the "Automatic Planetary Rover" program. In that framework, a scientific committee has been settled to define the scientific requirement for Mars exploration missions involving mobile vehicles. This paper summarizes the work of this committee.

#### THE BASIC MISSIONS OF MARS ROVER:

Three main preliminary objectives are currently under study:

1/ The rover will contribute to the *deployment of fixed stations*, either isolated or part of a local or regional network. The involvement of the rover will allow the control of the deployment procedures of the stations and their instruments. These autonomous stations will thus perform seismological, magnetic and meteorological measurements as well as deep electromagnetic soundings of the planet inner structure.

2/ During its traverses, the rover will perform *geophysical profiling* of the main planetary fields and realize vertical soundings (electromagnetic and radar measurements) over distances on the order of few hundred kilometers. It will thus provide, in addition to the gravimetric and magnetic profiles, vertical cross sections of the superficial terrains, of the martian ground-ice, and of the deeper internal structure at different depths.

3/ The rover will also be used as a *mobile surface laboratory* having the capabilities for selection, acquisition and analysis of samples. These analysis will cover geochemistry, mineralogy and dating with an accuracy on the order of 100 millions years over a period running from 0.5 to 4 billions years ago, in view to establish the first chronological scale of the geological history of Mars.

#### SELECTED LANDING SITES FOR ROVERS EXPLORATION:

According to these objectives, a selection of some landing sites is proposed:

##### NORTH/SOUTH CONTACT:

*Kasei Valles*  
*Mangala Vallis*  
*Syrtis Major*  
*Echus Chasma*

##### TECTONISM & VOLCANISM:

*Tharsis*  
*Elysium*

##### FLUVIATIL BEDS:

*Kasei Valles*  
*Mangala Vallis*

##### NORTH POLAR CAP

#### PRELIMINARY STRAWMAN PAYLOAD:

On the basis of the analysis of these three elementary missions, a model payload is defined for the rover itself, as well as for the fixed stations it will carry and deploy. A baseline mission for the VAP is defined. A middle latitude mission, in which a 500 kg rover, carrying a 125 kg payload will be used. The rover will execute a total traverse of approximately 300 km ("straight line"): 1000 km (real distance).

#### THE REFERENCE MARS ROVER MISSION UNDER STUDY:

On this basis, as well as on the results of the basic technical studies, a synthesis has been done in order to define a rover reference mission coping with the previous basic missions requirements.

The main concern is of course, the exploration sites. From the scientific point of view, one can identify a few areas of high interest. Among these possibilities, an exploration site located to the East of Tharsis (landing site: 25°N / 80°W) has been selected for the definition of the reference mission.

### MARS ROVER MISSION: Costard, F.M. et al.

During its traverse, the rover will cross several geological and geomorphological units and deploy 1 big fixed station, to be included in a global network, and 2 small stations which will constitute, with the big one, a local network. During its traverse the rover will perform geophysical profiles and a geochemical and mineralogical analysis of soil samples at various selected points along the traverse.

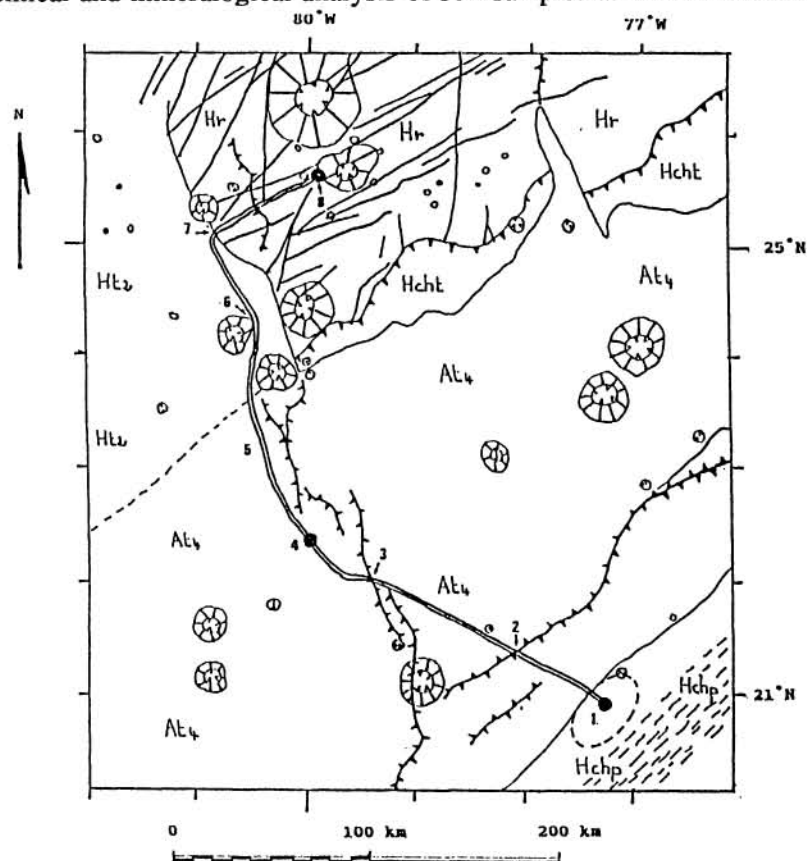


Figure 1: The reference rover traverse (Kasei Valles 21,5°N/78°W).

rover traverse  
 wrinkle ridge  
 impact crater  
 lobate ejecta  
 fracture/break  
 talus/screes  
 limits of geological units.

- 1: Landing site
- Deployment of fixed station 1
- Mineralogical analysis of unit Hchp
- 2: Mineralogical analysis of unit At<sub>4</sub>
- 3: Study of wrinkle ridges
- 4: Geophysical soundings
- 5: Deployment of fixed station 2
- 6: Study of a rampart crater
- 7: Study of Ht<sub>2</sub>/Hr contact
- 8: Deployment of fixed station 3
- Mineralogical analysis of unit Hr
- End of nominal mission.

#### CONCLUSION:

In parallel with the vehicle design study, an important effort will have to be made for the design of scientific instruments and their facilities or their adaptation to the spatial and martian context.

**References:** (1) D. Moura et al. 1990, The French preparatory program for Mars rover missions, IAF-415. (2) D. Moura et al., 1991, Planetary rovers: the French views, IAF-445, 10 p. (3) M. Blanc et al., 1991, Mars rover mission: the French approach, EGS, abstract. (4) Un véhicule automatique pour l'exploration de Mars, CNES, 1991, technical report, 80 p.