Mars Micromissions using the ASAP-5 platform (Ariane 5).

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Introduction: After a brief description of the concept, a number of missions of interest to the French scientific community will be presented using mobile (balloons, rovers) or fixed stations (magnetic, atmospheric, mineralogy and electromagnetic sounding).

The piggyback Ariane-5 concept

The paper *Exploring Mars with left rovers* to this symposium by G.R. Wilson, S.E. Matousek, K.O. Leshly, J.R. Willis, J. Blamont, C. Cazaux explains the principle of the Martian piggyback system using the Ariane-5 ASAP configuration.

The Martian piggyback is placed on a geostationary transfer orbit (200 x 36,000 km) with the help of the commercial launch of a geostationary telecommunications satellite. The • • requirement for reaching Mars from GTO is of the order of magnitude 1.6 to 1.8 km s^{-1} . Therefore the spacecraft has to carry the necessary quantity of fuel (40% of the available mass). The total available mass is 240 kg. According to the study performed for JPL by Ball Aerospace, the capability for a Mars reentry probe varies from 40 to 60 kg and the capability for a payload placed on a Martian orbiter 10 to 60 kg for the 2005 to 2009 launch windows.

Various scientific proposals discussed by CNES

During the major strategy symposium organized by the French Space Agency CNES in Arcachon, France (March 9-12, 1998) a number of scientific missions based on the Ariane piggyback concept were described and supported by the French scientific community.

For instance, the so-called *Dynamo* experiment would be a satellite of Mars devoted to the cartography of the crustal magnetic field and simultaneously to the physico-chemical caracterization of the neutral and ionized atmosphere above 15 km of altitude. This would be the first step of the deployment of an environmental survey of the red planet, pursued by subsequent missions devoted to the understanding of the interaction between dynamics (general circulation, gravity waves) and physico-chemistry (aerosols and clouds).

Another satellite experiment would be the *Kelvin* proposal for the global vertical sounding of the temperature of the atmosphere with a microwave instrument. This operation would be complemented by the *Pascal* network (see below).

A second category of researches made possible by the concept is the deployment of networks. An example is the *Pascal* proposal (in cooperation with Ames Research Center) for global meteorology, (24 sites) which would measure temperature, pressure and dust density for ten Mars years, define the variability of the Martian global climate, and characterize Martian weather for future human exploration. Another network (2 stations) would determine the structure of water reservoirs, the mass of water stored and the existence of liquid water by using seismic active topography as well as magneto telluric sounding.

A third category of uses of the piggyback concept is the direct deployment in the atmosphere of several various vehicles like balloons and airplanes. An airplane launched on a pigyyback probe could fly for 30 minutes with a 1,5 payload. A fleet of gliders, each of them with a life time of 15 minutes would provide on a number of sites along the *Valles Marineris* canyon the vertical mineralogical structure of the strata observed on the cliffs, by *MGS*. A balloon can fly ten days and carry a 5 kg payload. CNES did develop during the 1990-1994 time frame the technology of Martian balloons. In particular, an attractive idea would be to map the crustal magnetic field from a balloon, which may be the best way to obtain a high-resolution map of the linearities of the field. This would be an optimized grouping of ideas : piggyback, balloon, instrumentation for a first class science objective.

A fourth category is the deployment of various rovers. In particular the inflatable rovers, studied in 1979-1982 by CNES and resurrected at JPL could have a mass inferior to 20 kg. It could carry a 20 kg payload over hundreds of kilometers (mineralogy, chemistry, instruments). Such rovers could be deployed by the means of solar montgolfieres of the type developed by CNES for atmospheric research on Earth.

All the above mentioned experiments will be described in detail.