

**Network of small satellites  
for the exploration of planetary  
Magnetosphere:  
Application to Mars  
NETSSEM**

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# **NETSSEM Scientific goals**

**A global view of Mars' magnetosphere up to Mars' interior at large and small scales**

**How does Mars' environment respond to the constantly varying solar conditions?**

**How is Mars' unique hybrid magnetosphere formed?**

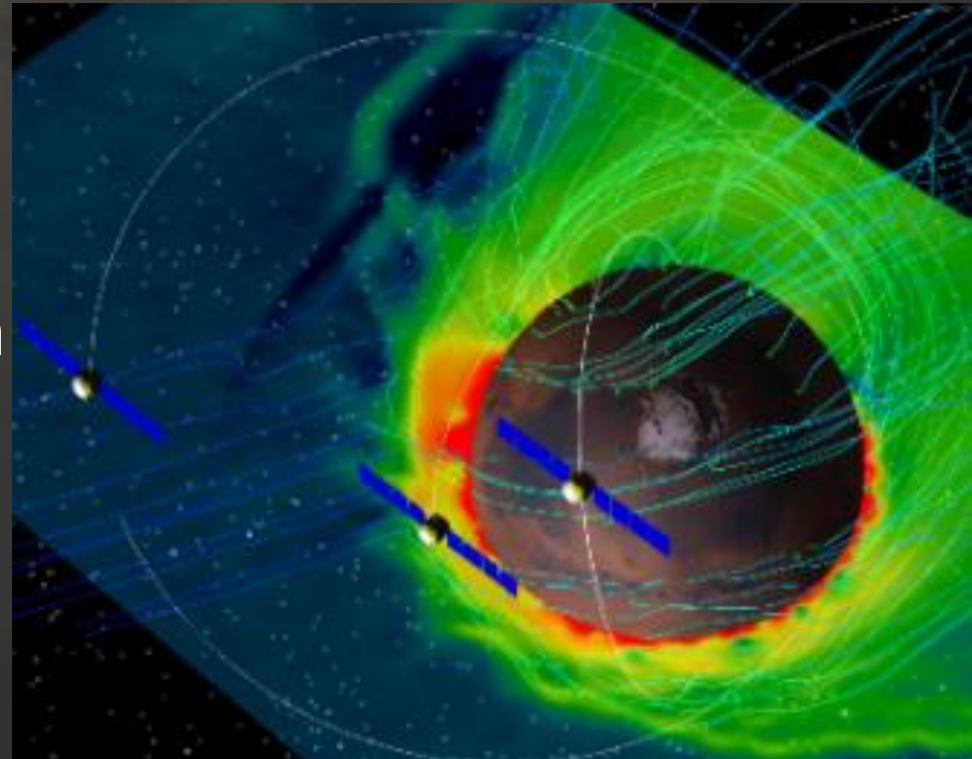
**What are the effects of the electrical conductivity inside the ionosphere, magnetosphere and the solid planet on the Mars space environment?**

# Mars' magnetosphere and atmosphere at large scales

**How does Mars' Bow Shock adapt to the constantly changing Solar Wind?**

**How does the induced magnetosphere adapt to constantly changing Solar Wind conditions?**

**What is the Solar Wind energy and momentum transfer to the atmosphere? How do ionospheric currents close at Mars? How does the Crustal Field affect the global picture?**



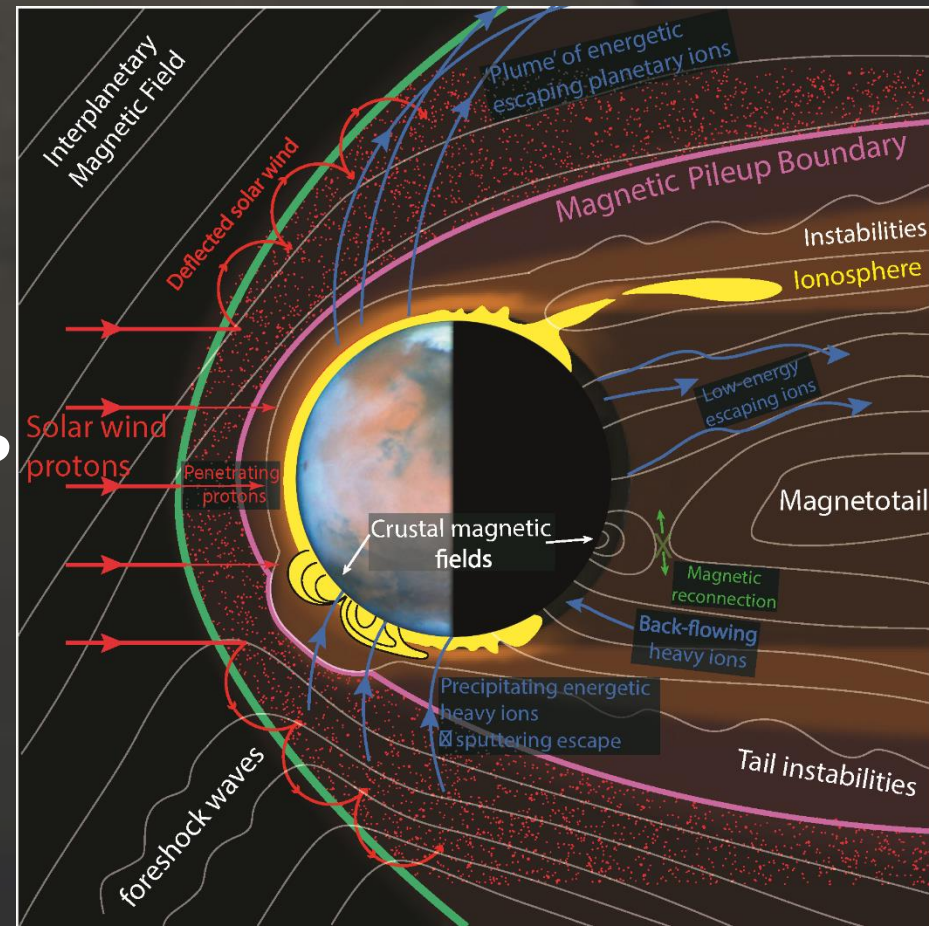
Courtesy: R. Modolo, CNES, CDPP, 3DView

# Mars' magnetosphere and atmosphere at small scales

How is Mars' bow shock affected by the Solar Wind forcing?

How is Mars magnetospheric Piled-up Boundary formed and how does it change with various solar wind conditions?

What are the acceleration processes in Mars' magnetosphere?

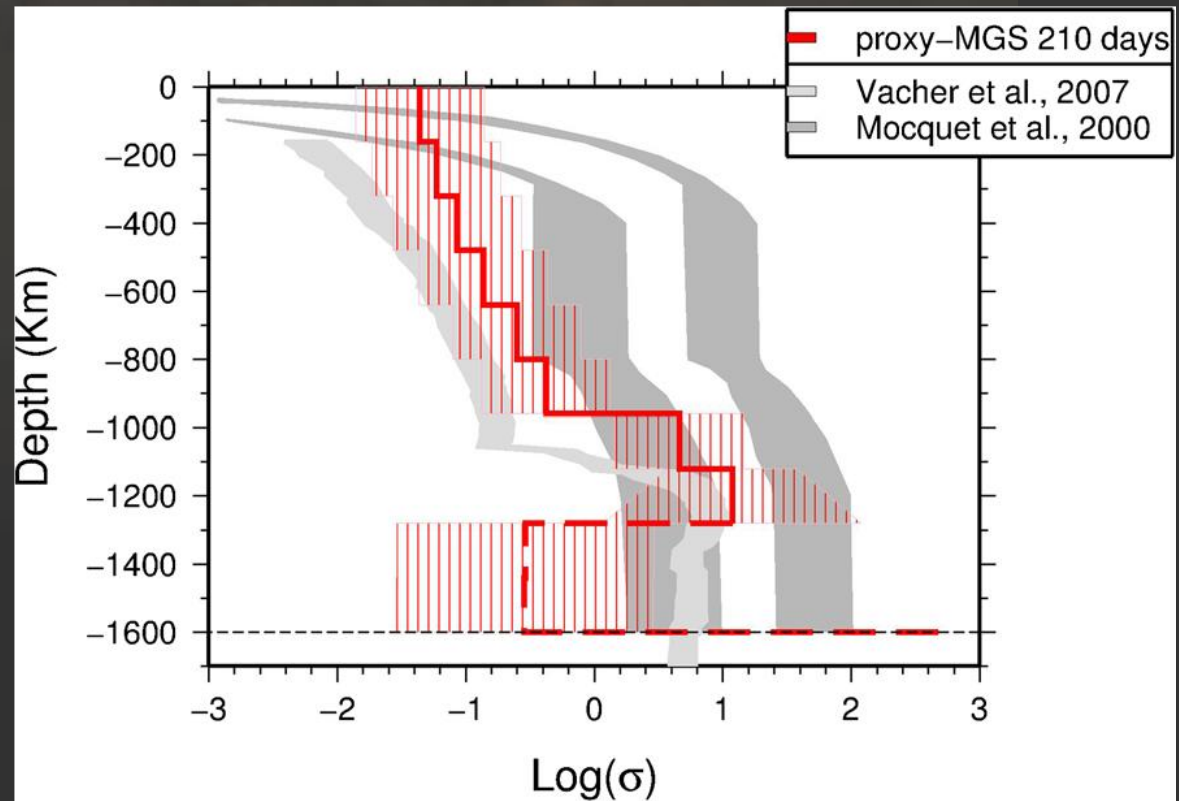


# Mars' magnetosphere and interior at small and large scales

How the magnetosphere is affected by currents inside Mars?

What is the structure of the lithosphere?

Example of retrieval of the internal conductivity ( $\sigma$ ) from MGS data (Civet and Tarits, 2014)



# Mission design

- ① **A Nano-satellite dedicated to the solar wind**
- ② **Two Nano-satellites dedicated to magnetospheric in-situ observations**
- ③ **A mothership close to the planet for telemetry and in-situ observations**

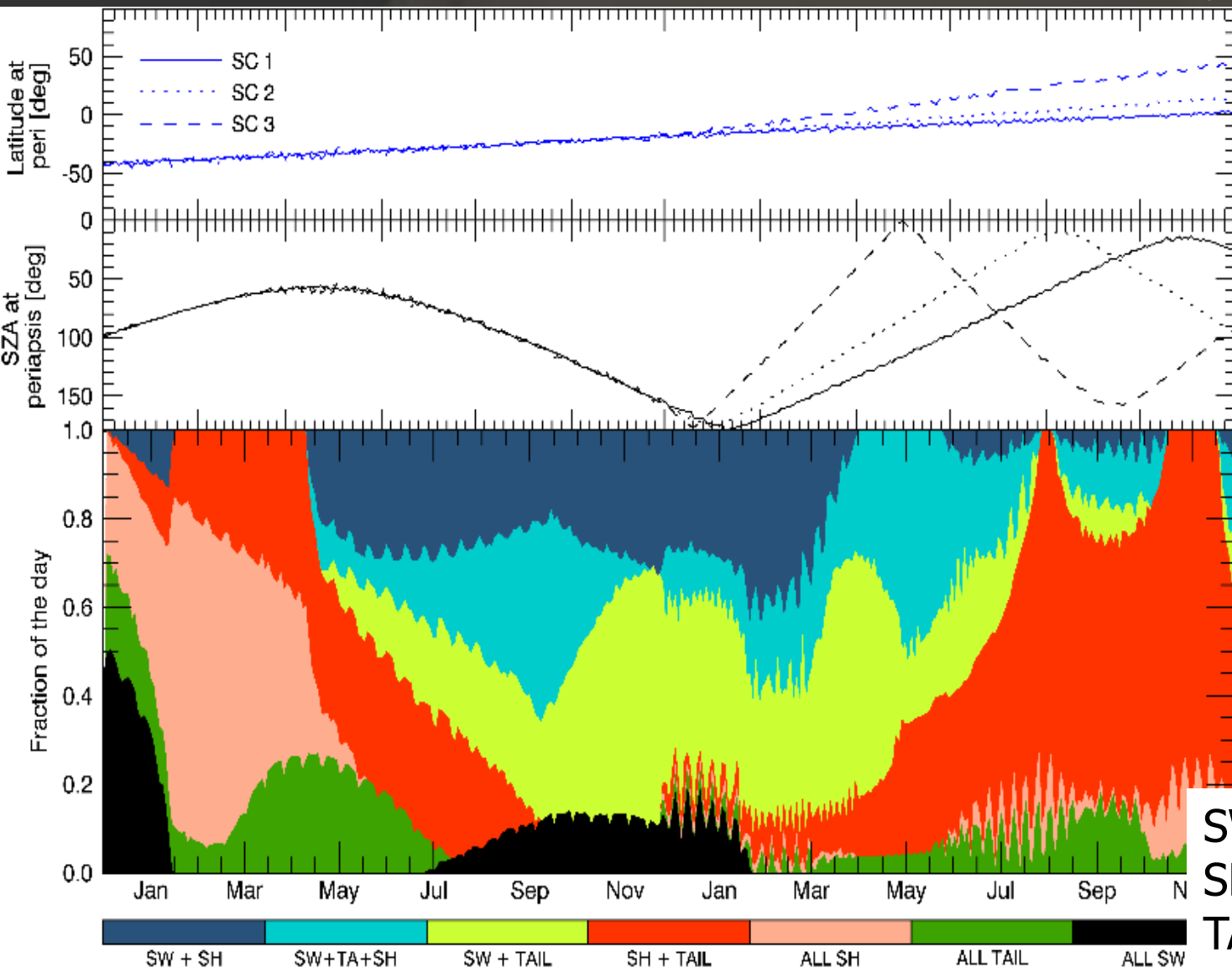
## Scientific measurements

- ① **In situ plasma measurements with permanent Solar Wind monitoring**
- ② **Radio-occultation to probe the ionosphere**
- ③ **Probing Mars' interior by electromagnetic induction**



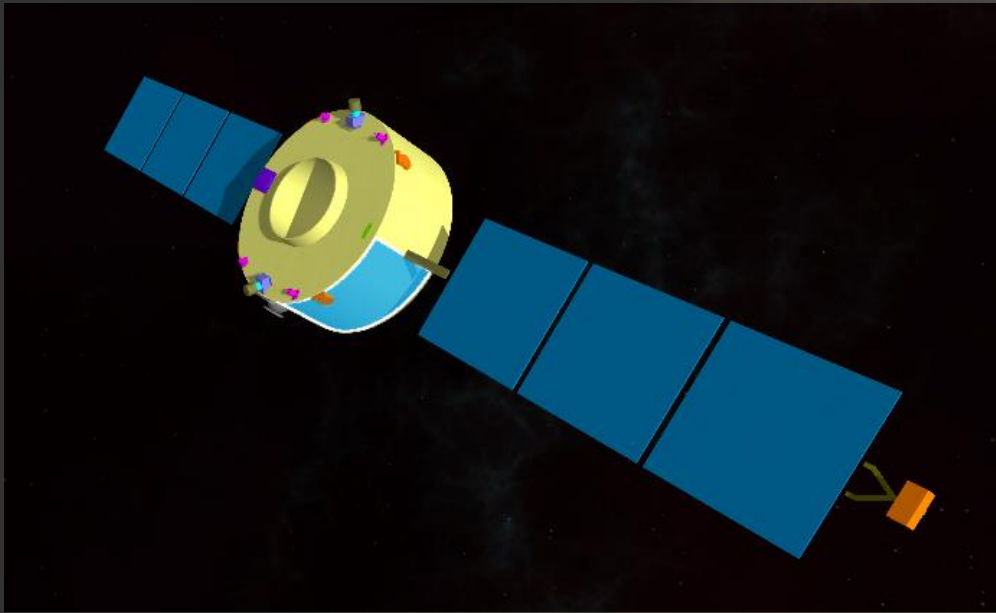
**First period  
(Small scales)**

**Second period  
(Large scales)**



**Example  
of S/C  
coverages  
(Curry S.)**

SW: Solar Wind  
SH: Magnetosheath  
TAIL: Magnetotail



**Example of possible configuration of the nano-satellite**

**Mass of the mother ship: 520 kg**

**Mass of the nano-satellites: 50 kg each**

**Expected payload: DC magnetometer  
Ion/Electron spectrometer  
Radio-occultation capability  
and other instruments if resources allow it**



# Conclusions

**A generic concept of mission for the exploration of planetary magnetosphere**

**→ On-going Phase 0 at CNES to study such concept**

**→ Proposed as an answer to Phase 1 ESA call mission class-F**