## HIGH RESOLUTION STEREO CAMERA (HRSC) EXPERIMENT PROPOSAL FOR THE SOVIET MARS 94 MISSION

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A High Resolution Stereo Camera (HRSC) Experiment has been proposed by DLR (former DFVLR) for the forthcoming Soviet Mars 1994 Mission. It will be one of the most important instruments on the Orbiter S/C of the misson and the principal instrument of the so-called TV complex of the orbiter. It has already been accepted as part of the payload by the Soviet side and will be supported financially by the FRG government provided the agreement is signed finally. The effort is led technically and scientifically by the DLR Oberpfaffenhofen and supported by a large German, American and European group of scientists.

Any high resolution camera on a new mission after Viking has to incorporate certain design features like

- **highest resolution** on the order of 10m-20m or better
- **stereo capability** with a vertical resolution comparable to the lateral one
- **multispectral capability**
- high photometric accuracy and **multi-phase angle capability**
- ability to cover larger areas under reduced spatial resolution.

Some of the fundamental issues of Martian science will be addressed by the HRSC experiment:

- *Investigation of the Martian surface*
  - Determination of the topography from photogrammetric evaluation of three-line stereo imagery and from photoclinometry.
  - Analysis of the surface composition and physical surface structure from multispectral and photometric measurements.
  - Study of the morphology, photogeology, tectonics and impact structures from high resolution stereo imaging data.
  - Determination of surface ages and crater/meteorite size distributions on the basis of impact crater statistics.
- *Comparative Studies*
  - Examination of the geophysical properies of the crust and lithosphere based on topographic data, line-of-sight gravity data, tectonical stress analysis and refined age dating.
  - Investigation of the evolution of the Martian crust, the geologic history and the stratigraphic sequences on the basis of refined age dating and comparative photogeologic studies.
  - Investigation of processes and surface dynamics pertinent to volcanism, weathering, erosion and time-variable features.
  - Scientific data evaluation from a integrated data base.
  - Summary of specific results by using cartographic and thematic mapping techniques.
- *Investigation of the Martian atmosphere*
  - Examination of aerosol and condensation clouds in the atmosphere.
  - Study of the dynamics and evolution of regional and global dust storms.
  - Investigation of the interaction between the atmosphere and the surface.

The main data analysis techniques and methods of interpretation applied to the HRSC data are:

- photogrammetry,
- photometry,
- spectrophotometry,
- scientific image processing,
- impact crater statistics,
- photogeology and cartography.

The High Resolution Stereo Camera fits the stated scientific requirements by using a dedicated camera design. The design concept applies one optics of 24° by 40° or 50° total field of view with a number of parallel linear CCDs covered by individual filters in a hybrid focal plane. Due to its flexible CCD technology and optical design the High Resolution Stereo Camera will provide:

- High resolution of 10m - 20m ground pixel size at periapsis.
- Stereo capability; since the currently chosen nominal viewing angle is ±20°, the vertical resolution will be at least as good as 15m -30m.
- Improvement of image geometry and navigation data by photogrammetric strip adjustment of stereo-triplets.
- Large swath width of 8000 to 10000 pixels for central scan line and 4000 to 5000 pixels for all other scan lines.
- Four to six spectral channels between 0.4μm and 1.0μm will allow simultaneous coverage in different spectral bands.
- Observation of photometric signatures at 5 to 9 phase angles.
- Super pixel format and adaptive data compression for large area coverage.

The camera will be built by DLR (former DFVLR) in cooperation with the German industry.

The proposed High Resolution Stereo Camera has several advantages over the monoscopic video cameras of Viking.

| | Viking | HRSC |
|---|---|---|
| ground pixel | 10m - 1000m mainly in the range 30m -100m | 10m - 20m (mainly) |
| vertical pixel | --- | 15m - 30m |
| phase angle | 1 | 5 - 9 |
| pixel/scanline | 1100 | 4000 - 10000 |
| spectral range | 0.42μm - 0.62μm | 0.40μm - 1.0μm |

The Soviet side plans to specifically support the HRSC aims by

- latitudinal drift of periapsis and
- drift of local time for equatorial crossing.

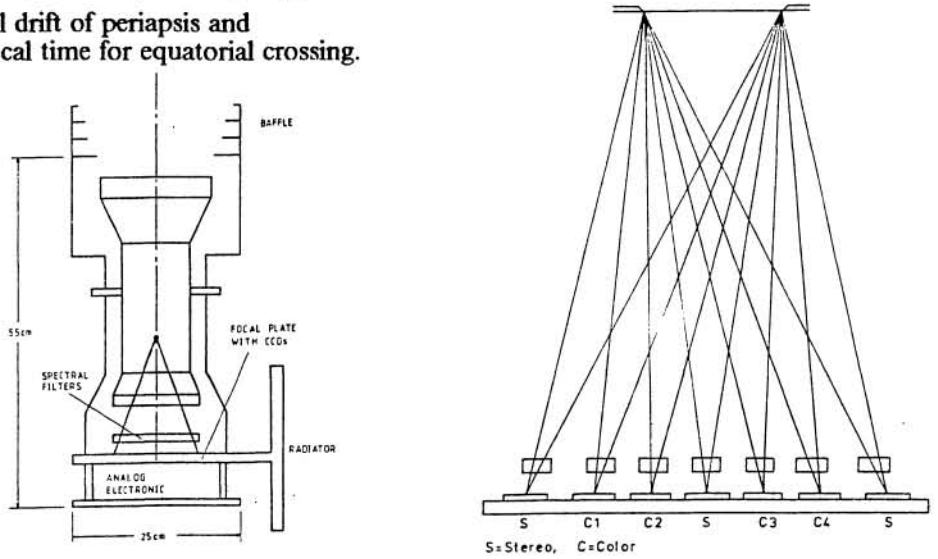


**Figure 1. High Resolution Stereo Camera (left) and Focal Plane.**

References:
G. Neukum et al., (1988). High Resolution Stereo Camera (HRSC) Experiment Proposal for the Soviet Mars 94 Mission, Prephase A Study Report, DFVLR Oberpfaffenhofen.