Visible And Near Infrared 64-band Imager For Mineralogical Mapping Of Moon

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Abstract. The Hyper Spectral Imager (HySI) having 64 bands in the visible and near infrared spectral region will be an Indian instrument on Chandrayaan-1 for mineralogical composition study of the moon. The HySI instrument will map the lunar surface resolving the spectral region of 400-950nm in 64 continuous bands with a resolution better than 15nm and spatial resolution of 80m. The data will be 12-bit quantized. This instrument along with Moon Mineralogical Mapper (700-3000nm) and SIR-2 (900-2500nm), the other instruments on Chandrayaan-1, will significantly improve upon the available compositional information of moon. Study in deep regions like South Pole Aitken basin, which represents lower crust or upper mantle material, will also help in understanding the composition and mineralogy of the interior of the Moon and its formation and evolution. Table-1 summarizes the specifications of the instrument.

TABLE 1. Specifications of Hyper Spectral Imager.

Spatial resolution (m)	80m from 100km altitude
Swath (km)	20
Spectral range (nm)	400-950
No. of spectral bands	64 continuous
Spectral resolution (nm)	< 15
No. of gains	2
Quantization (bits)	12
SNR (± 60° latitude for mature mare soil)	> 100
Power (W)	≈ 2.5
Weight (kg)	4

New technologies like Linear Variable Filter (LVF) for spectral separation and Active Pixel Sensor (APS) area detector are used to achieve the compactness of the instrument. The instrument is designed for mapping from polar orbit in push broom mode. The frame size will be 40Km (512 pixels) along track by 20Km (256 pixels) across track (swath). The frame is kept rectangular for achieving the spectral resolution. In a frame 512 lines of moon surface are mapped onto 512 rows of detector. Each row gets different spectral information and the pixels within a row get different spatial information corresponding to that swath coverage. The satellite movement obtains the full spectrum of a target. The frame data at detector output corresponds to 512 spectral bands. The 512 bands will be processed on-board to generate the required 64 bands for reducing the transmitted data volume by averaging 8 spectrally adjacent pixels corresponding to a target. The mapping scheme is shown in Figure-1.

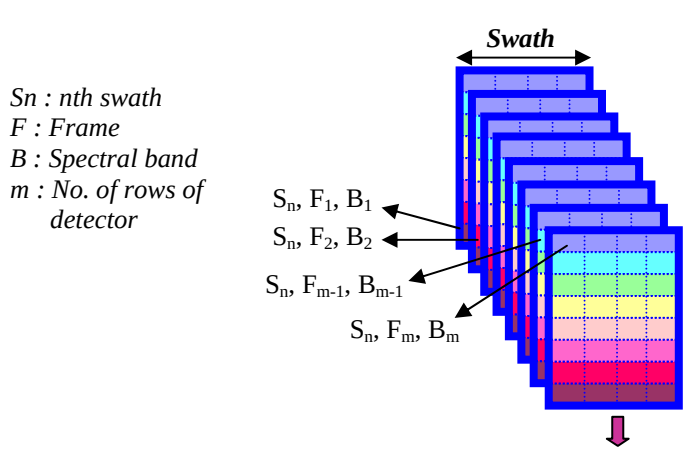

FIGURE 1. Mapping scheme of Hyper Spectral Imager

The instrument schematic is shown in Figures-2. The subsystem proto types are realized, and flight model work has started.

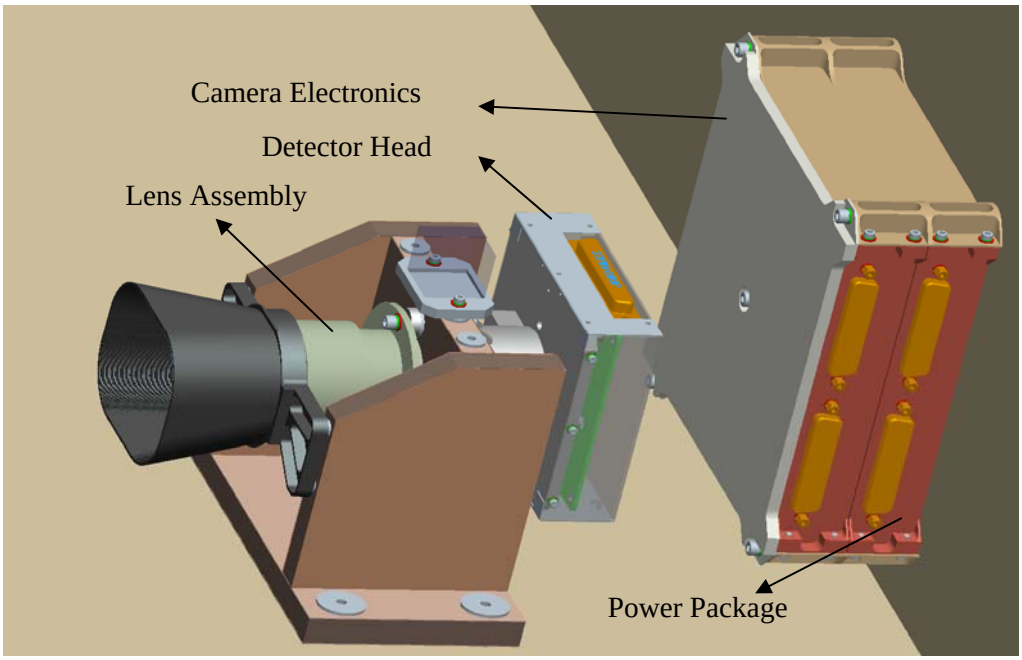

FIGURE 2. Schematic of Hyper Spectral Imager

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A. RoyChowdhury obtained his B.Tech in Electronics and Communication from REC, Warangal. He joined Space Applications Center, ISRO Ahmedabad in 1987 and is working in Remote Sensor Electronics Division. He is involved in the development of Onboard camera electronics for IRS payloads. Presently he is the Instrument Scientist for the Indian Imaging payloads of Chandrayaan-1 mission.