

Electro-Optical Imaging Requirements

Sensors Development Area of SAC/ISRO has designed and developed electro-optical payloads for earth observation and planetary missions for ISRO's satellite program. These include IRS and INSAT series of satellites catering to land and water utilization, vegetation, forestry, oceanography, meteorology, etc. They provide imagery with different resolutions catering to the user needs. Spatial resolution has improved from nearly a kilometre to better than a meter in the current and future systems. Similarly, spectral resolution has increased from few tens of nanometres (nm) & few bands in panchromatic/multi-spectral sensors to a few nm and large number of bands in hyper-spectral sensors. The sensors are custom designed and optimised for the user applications.

IRS-1C/1D and subsequently Resourcesat-1/2 carried a set of three sensors optimised for agricultural applications. Cartosat-1 carrying fore and aft cameras provides stereoscopic view of the land surface. High resolution imagery for cartography is provided by Cartosat-2 Series of payloads. Oceansat-1/2 satellites equipped with high temporal resolution ocean colour sensors are providing data useful for mapping phytoplankton in the oceans and consequent identification of potential fishing zones (PFZs). Very High Resolution Radiometers (VHRR) are developed and flown onboard METSAT (Kalpana) and INSAT-3D/3DR missions to provide cloud motion vectors and atmospheric parameters. Temperature and humidity sounder payload are also flown on INSAT-3D/3DR. Planetary sensors include optical cameras onboard Chandrayaan-1 and Mars Orbiter Mission and those planned for forthcoming Chandrayaan-2. Sensors are also flown on airborne platforms for generating site-specific data for scientific studies and generating spectral and spatial signatures of ground features.

Through this journey of about two decades, enormous advances in the field of electro-optical payload development has taken place and many state-of-the-art technologies have been developed in the field of optics, electronics, mechanical, detector, ground checkout system and integration & testing with spin-offs in non space usage. Also, in the development of these cameras, Industry has contributed to some extent. Considering the large number of upcoming future projects requiring extensive subsystem development, it is essential that industry participation needs to be increased and extended to end-to-end subsystem realization by industry.

Following are some of the technological fields in which SEDA looks for collaboration from industry:

➤ **OPTICS**

- **Requirements from industry**
 - Mirror fabrication with light weighting
 - Lens assembly fabrication
 - Optical filter development
 - Optical components (e.g. cube, small mirrors, retro reflectors etc)

- Thin film coating
- Optical metrology tools
- Telescope alignment and testing
- Optical test bench development

➤ DETECTORS

- **Requirements from industry**
 - CCD & CMOS detectors (linear and area array detectors from small formats to very large formats)
 - TDI detectors (multi line small to large format detectors)
 - Detector test set up development
 - Night imaging cameras
 - Infrared detector development
 - Development of Focal plane array
 - Integrated detector cooler assembly
 - Micro Bolometers

➤ ELECTRONICS

- **Requirements from industry**
 - High speed video processor
 - ASIC development
 - Digital control and processing electronics development
 - PCB design and fabrication
 - Electronics test setup development
 - Miniaturization
 - 3D packaging
 - Signal simulators
 - Multilayer Polymer PCB, pitch < 10 MIL
 - Core development of 1553, Ethernet, USB, CAN bus
 - Miniaturized data storage: 32Gb – 1TB, EDAC, TMR method
 - Fabrication of Hi-Rel packages
 - Test software development
 - Test and evaluation of packages
 - Pulsed Laser design
 - Avalanche photodiode array development & ROIC

➤ CHECKOUT & EVALUATION

- **Requirements from industry**
 - High speed data acquisition system
 - Payload commanding system
 - PCB design and fabrication
 - Data processing and analysis software development

➤ INTEGRATION AND TESTING

- **Requirements from industry**
 - Harness fabrication
 - Test setup development and installation
 - Payload integration & testing