EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

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# A WIDE-SWATH FREQUENT REVISIT CANADIAN HYPERSPECTRAL MISSION

**Abstract**

The Canadian Space Agency (CSA), in collaboration with other Canadian government departments, has carried out activities and initiated early phase studies for a Canadian Hyperspectral Mission (CHM). The goal of CHM is to provide a new and powerful space-based tool for delivering frequently updated hyperspectral remote sensing information products for a broad range of operational users in governments and industries worldwide. With renewed interest in space-based hyperspectral imaging, CHM is intended to fill a niche between narrow-swath missions, such as upcoming PRISMA or EnMAP, by launching a constellation of three microsatellites that can provide frequent revisit (every 3 days) and large area coverage of the whole of Canada. With a small ground sampling distance (GSD) (threshold 30 m, goal 10 m), wide-swath (250 km) and 10 nm spectral resolution in VNIR region and multispectral in SWIR region, CHM will be capable of providing high spatial and spectral resolution information relevant to a large number of land and coastal areas applications relevant to Canadian end-user communities.

CSA funded Canadian industry teams and have completed feasibility studies of hyperspectral imager that is compatible with a microsatellite platform. Two different concepts of low-mass hyperspectral imaging systems have been proposed and studied. These two concepts are of a compact Dyson imaging spectrometer and a linear variable filter (LVF)-based imaging spectrometer. Thanks to its compactness and high optical throughput a Dyson form spectrometer design has the potential for significant benefit to a microsatellite mission. An LVF-based imaging spectrometer essentially replaces a separate spectrometer assembly with a simple LVF mounted in front of the detector array at the focal plane. This results in a much more compact design when compared to the conventional approaches using a Dyson or Offner spectrometer. The feasibility studies concluded that both concepts can accommodate to a microsatellite and are feasible.

The CSA has subsequently completed a concept study of the CHM. The study identified two key technological advances beyond the current state of the art: 1) a new filter-based hyperspectral imaging approach, and 2) wide-swath hyperspectral imaging with frequent repeat coverage. The CHM concept is unique at this point of time, and no similar space mission has been currently planned in the world today. Such a system would provide a foundation for hyperspectral research applications to be transformed into truly operational applications with socio-economic benefits on a world-wide scale.