

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)  
Space Systems and Architectures Featuring Cross-Platform Compatibility (7)

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MODULAR RADAR AND OPTICAL CONSTELLATION SUPPORTING COMMERCIAL ARCTIC  
OPERATIONS

**Abstract**

A common spacecraft platform and avionics suite has been developed to support the needs of a multi-purpose constellation of radar, optical remote asset management and telecomm satellites. The commercial application for this constellation is provision of environmental and operational data and services for resource exploration companies operating in the Earth's arctic region. The constellation design specifically addresses the following arctic challenges (i) Climate: Improved accurate weather modelling and forecasting by providing high temporal resolution data tailored to specific polar regions of interest; (ii) Ice impact: ice edge determination and iceberg tracking to maximise the operational season and provide in field early warning, using high resolution, wide area sensors with regular updates from one or more satellites; (iii) Environmental sensitivity: oil spill monitoring e.g. using radar data to detect slicks or penetrate ice; (iv) Remoteness: using satellite instruments to relay asset health and position data, augment navigation services and implement secure, high data rate communication links.

Exploration companies operating in the arctic, with typical platform costs at £1M / day must ensure cost effective operations; demand safety of their personnel during the short summer operating season, and are highly concerned about the potential for pollution incidents such as contaminating ice with oil.

Dedicated satellites, now affordable to commercial organisations since the advent of small satellites are ideal for providing high temporal and spatial resolution data entirely under the control of the owners. This contrasts with the limited (or nationally controlled), cross format public domain satellite data currently relied on by international companies such as BP.

This paper will address how a modular satellite design is well suited to being built-up into a phased constellation supporting commercial arctic operations. A production line of spacecraft is needed to support the long term commercial operational data requirements for the arctic, the range of instrumentation suitable for small satellites, and spacecraft replenishment. The cost of building a modular, or unoptimised design suitable for several different sensors, as well as automated identification services and high data rate telecommunications relay can be offset by the cost savings inherent in a constellation production line. We assume a principally high resolution optical remote sensing, and all-weather synthetic aperture radar spacecraft constellation, supporting supplementary needs for AIS, remote health monitoring and data relay services.

A preliminary, modular multi-sensor spacecraft design will be discussed; with particular emphasis on the development of a small radar (SAR) carrying satellite and the value of radar to complement optical data for arctic monitoring. SSTL is developing its smallsat SAR capability with partners for under \$50M

per spacecraft launched and commissioned in-orbit. The combination of data derived from dedicated small satellites, combined with airborne and sea platform based sensors to form an arctic web providing real time situational awareness to commercial operations in the region is the long term goal of this research.