

## Briefing Notes

### *Introduction:*

The following two briefing notes refer to CSA's involvement in the international Polar Space Task Group. The PSTG was established in 2011 to build on the legacy of the successful satellite data collection efforts during the International Polar Year and is charged with prioritizing requirements, engaging in a dialogue with polar science authorities, and supporting the development of satellite sensor derived products for cryospheric research and applications.

In order to assist with the collection and utilization of spaceborne synthetic aperture radar (SAR) data sets, a SAR Coordination Working Group (SAR CWG) was subsequently formed by PSTG; it is currently chaired by CSA. The members of the SAR CWG are public space agencies and commercial data providers. They are, working together to acquire in a coordinated fashion extensive sets of spaceborne SAR data to respond to scientific requirements, taking advantage of the specific characteristics of each sensor. The PSTG and the SAR CWG support data distribution and sharing principles

The goal of the Canadian contributions is to develop and demonstrate techniques where the rich store of archived RADARSAT data of polar ice sheets contributes useful information, either alone or integrated with other data sources, about surface elevation change, ice velocity, grounding line location, and calving front location. The contributions are also important to close a potential coverage gap following the successful internationally coordinated data collection during the International Polar Year. Data collection between 2012 and 2014 came at a particularly crucial time, since several spaceborne SAR missions ended between 2011 and 2013, and next generation missions are not planned to be launched until 2014.

## **Agreement between ESA, Norwegian Space Centre, KSAT, CSA, MDA, NASA and ASF on the reception, processing and distribution of RADARSAT-1 data acquired over Greenland.**

### *Background:*

Early in 2013, Canada acquired near-complete RADARSAT-1 InSAR Fine mode coverage of Greenland and Svalbard as part of our contribution to the Polar Space Task Group EO data collection over polar ice sheets. The data acquisition plan was executed between January and March 2013. As part of the Norwegian Space Centre's contribution to PSTG, KSAT downloaded the passes to the station at Tromsø where the raw data has been stored since. The campaign was successful, except coverage of the south-west portion of Greenland could not be obtained because it lies outside of the Tromsø station mask; post-mission analysis also revealed some minor coverage gaps over central Greenland. The SAR CWG members have since made a coordinated effort in 2013 that will result in three tangible outcomes: (a) formatting and processing the acquired RADARSAT-1 SAR data, (b) repatriating the processed data sets to Canada, and (c) making the data set available to the global science community concerned with the analysis and monitoring of polar ice sheets.

### *Current Activities and Status:*

PSTG partners have devised a plan to process the InSAR C-band SAR data in two steps prior to transfer to CSA. The first step involves data formatting of telemetry data by KSAT at Tromsø in Norway early in 2014. This portion of the processing work is carried out by KSAT under a procurement contract with ESA. It involves TPM funds and Statement of Work devised by ESA, with input from CSA.

Approximately 250 segments / [or: 800 minutes of satellite on time] have been formatted and transmitted to Alaska Satellite Facility (ASF) in Alaska, USA, for further processing.

In the second step, the ASF is prepared to process the data into unfocused SAR (RAW) data and into single-look complex format in the months ahead. As part of their contribution to PSTG, NASA is paying ASF to accomplish the work. This work is ongoing.

### *Plans:*

Once ASF has completed the processing, the 2013 RADARSAT-1 InSAR data sets of Greenland and Svalbard will be repatriated to Canada. Canada, through CSA agreement with PSTG and as a Canadian contribution to PSTG, will then be able to archive and to distribute these data sets to the global science community.

### *Significance:*

This is another example of coordinated acquisition, downlink, back-haul and processing of datasets of global importance, orchestrated through the PSTG and its sub-group, the SAR CWG. Making this data available to scientists will contribute to the collection of critical environmental baseline data sets and to our knowledge of global environmental change.

The end of several spaceborne SAR missions between 2011 and 2013 could have led to a potential data shortage in the years following the International Polar Year effort. The 2013 campaign follows a record summer melt in Greenland and therefore helps capturing the ice sheet response to this significant event.

## **Agreement between CSA, MDA and DLR on the use of the Inuvik station in 2014 for downloading RADARSAT-2 data of Greenland within the PSTG framework.**

### *Background:*

The RADARSAT-1 InSAR data acquisition campaign over Greenland during the first quarter of 2013 resulted in near-complete coverage requested by the PSTG (Polar Space Task Group) and coordinated by the SAR CWG (Coordination Working Group, a sub-group of PSTG). Continuation of the monitoring activities was originally planned through ESA and Sentinel-1 SAR. However, the delay in launching that SAR satellite precluded a winter 2013/14 campaign. In trying to secure EO data continuity and complete data coverage of Greenland, the scientific community involved in global change and ice sheet monitoring approached Canada through the SAR CWG to request RADARSAT-2 data collection over Greenland on short notice. CSA is pledging support for this initiative as part of the PSTG Phase 1 coordination effort. The plan is a Canadian contribution, however, it also involves a concerted effort by CSA, DLR and MDA regarding the acquisition of RADARSAT-2 SAR data, subsequent downlinking of crucial data at DLR's satellite receiving station at Inuvik, NWT, data relay and processing by MDA and eventual dissemination to the science community through the SOAR program by CSA and MDA. The total SAR data volume is currently estimated at 950 standard frames.

### *Current Activities and Status:*

CSA initiated RADARSAT-2 InSAR data acquisition planning for parts of central and south-west Greenland during winter 2013/14. This process is ongoing, and plans are being developed by the members of the PSTG SAR CWG for processing the data and making it accessible for scientific research through existing Canadian data distribution mechanisms. In December 2013, CSA approached DLR regarding the use of their satellite receiving station at Inuvik for downloading a number of crucial acquisitions (i.e. ascending acquisitions of coastal Regions in Greenland). The acquisitions were planned in addition to a descending coverage of the Greenland ice sheet to increase the chance of coverage of critical coastal areas and to fill known data gaps due to acquisition conflicts. Downlink of these important acquisitions to the Canadian receiving stations was deemed difficult because of potential conflicts with commercial or other high-priority clients of MDA. DLR explored ways to account for the downlink and handling fees that usually accompany the use of the Inuvik station and, through internal funding arrangements, has agreed to assume the station fees as part of the DLR contribution to PSTG. Approximately 10 % of the data were downlinked to Inuvik. However these acquisitions were crucial to ensure some coastal coverage in areas where we knew of data gaps otherwise. The contribution of Inuvik meant that there was a virtual 100% chance of downlink – almost immediately after acquisition. Whereas downlink in Canada for these acquisitions would have included a considerable risk of the data being dropped.

### *Plans:*

CSA is pursuing plans with MDA to bring the RADARSAT-2 to its SAR processing facilities via a broad bandwidth line. Following the data dissemination model of the Radarsat-1 InSAR data set of 2013, the RADARSAT-2 InSAR data set of 2014 will be distributed to the science community via the SOAR program. CSA plans to cover the RADARSAT-2 processing cost as part of its contribution to PSTG.

### *Significance:*

This is another example of coordinated acquisition, downlink, back-haul and processing of datasets of global importance, orchestrated through the PSTG and its sub-group, the SAR CWG. Making this data available to scientists via the SOAR – Ice Sheet program will contribute to the collection of critical environmental baseline data sets and to our knowledge of global change. Together with the 2013 campaign this data set closes a potential data gap and therefore represents a crucial milestone in the data record of the world's ice sheets.