

Meeting Summary and Recommendations International Polar Year (IPY) Space Task Group (STG) Synthetic Aperture Radar (SAR) Workshop

March 5 and 6, 2008

Canadian Space Agency – St. Hubert, Quebec, Canada

The International Polar Year 2007-2008 (IPY) provides an international framework for understanding high-latitude climate change and predicting worldwide impacts. Recent and well-documented observations of the sometimes dramatically changing components of earth's cryosphere and particularly at high latitudes make IPY science investigations particularly timely and relevant to scientists, policy makers and the general public. IPY 2007-2008 is intended to lay the foundation for major scientific advances in knowledge and understanding of the nature and behaviour of the Polar Regions and their role in the functioning of the planet.

The Space Task Group (STG) was formed in December 2006 in response to a letter from the WMO and ICSU requesting the active involvement of space agencies in the IPY. The STG is tasked with reviewing the IPY space data requirements and making data acquisition plans, processing, archiving, and distribution recommendations regarding contributions in close consultation with science end-users. Contributions by the space agencies are to be consistent with each respective Agency's own resources and capabilities, and coordinated so that the total effort can satisfy IPY satellite data needs.

At the second STG meeting, the Canadian Space Agency (CSA) received an action item to set up an inter-agency meeting of SAR (synthetic aperture radar) mission managers to optimise SAR coverage - in order to address top-level scientific objectives/requirements stated in the GIIPSY (Global Inter-agency IPY Polar Snapshot Year) User Requirements Document. CSA hosted the IPY STG SAR Workshop on 5-6 March 2008.

The objective of the workshop was to forge an acquisition strategy for SAR and InSAR data that achieves the maximum number of IPY science objectives in such a way as to distribute the acquisition load across the different agencies – understanding that no single agency can accommodate all of the tasks. The workshop primarily focused on data acquisition requirements, as outlined by the scientific community, based on Agencies' strategic plans for IPY and the unique capabilities of their systems.

The workshop approach was:

- To review existing GIIPSY science requirements (the GIIPSY Strategy Document).
- To present the Agencies' strategic priorities in line with IPY science activities.
- To present and review current acquisition plans focused on IPY.
- To present the satellite and ground segment operators' system capabilities and constraints related to the acquisition of data in support to IPY.
- To forge a coordinated / multi-agency SAR acquisition plan in support to IPY (remainder and legacy).

Based on information compiled from the meeting, it was suggested that the acquisition strategy focus on a few themes that satisfy these criteria:

- Solve an important science problem
- Fill a gap in planned coverage for IPY
- Involve interagency collaboration.

Participants generally agreed with this approach and the following themes were defined:

- C-Band coverage (3-day snapshots) for the Arctic Ocean during the remainder of IPY (background missions, operation data acquisitions, etc.).
- Winter Pole to Coast InSAR coverage of the Antarctic in high-resolution mode (3-4 consecutive cycles in ascending and descending).
- Greenland and Major Canadian Icefields of InSAR acquisition over 3-4 consecutive cycles of high-resolution in winter.
- Supersites (where possible using what exists already): determine acquisition parameters (frequency, resolution, etc.) for multi-polarisation and polarimetry data collection.

The Action Items were listed as STG-C1 *An*, meaning STG Coordination meeting 1, Action *n*: this will facilitate future tracking of action items. The resulting action items were:

1. (STG-C1 A1) Request systematic ALOS coverage of Greenland (InSAR) and the Arctic basin. Request that JAXA continue polar observations beyond the conclusion of IPY as their capabilities and mandate permit. (KJ)
2. (STG-C1 A2) Provide similar refinement of acquisition plan to other space agencies (RK, IJ, KJ)
3. (STG-C1 A3) Request CSA and NASA to explore near term (1 month) approaches for using RADARSAT-1 during the IPY to cover areas of the Arctic where there are Envisat ASAR data gaps.
4. (STG-C1 A4) STG SAR coordination group to formulate a letter to be submitted to CSA, NASA external relations and MDA to avoid the planning and data reception gap for RADARSAT-1 over both polar regions during IPY.
5. (STG-C1 A5) Submit recommendations for RADARSAT-2 background mission and Government Allocation acquisition complementary to existing archive for IPY and which supplement gaps in other existing systems and archival data sets (science community + YC, RSJ, GR, KW).
6. (STG-C1 A6) For the science community: develop a one page statement of requirements for each of the four themes listed above.
7. (STG-C1 A7) Investigate possibilities for ENVISAT reception over Chukchi sea for IPY – Follow-on on discussions between ESA, ASF and KSAT for the reception during IPY.
8. (STG-C1 A8) For the science community – to develop and submit a proposal to DLR for IPY related data acquisition.
9. (STG-C1 A9) Post information about CNES DEMs and data sets.
10. (STG-C1 A10) Recommend follow on meeting to coordinate Optical acquisitions and DEM creation (eg ASTER, PRISM and SPOT5).

Wednesday March 5, 2008

1. WELCOME

9h30

Welcome address

Raymond Guillemette – Director,
Technology management and
Applications

9h35

Meeting Objectives

Yves Crevier

2. SETTING THE STAGE

10h00-10h15

STG Framework and role of Space Agencies

Yves Crevier

Format: Presentation and brief discussion

Objectives: Introduce the STG; present the accepted role and responsibilities of the space agencies in STG

10h15-10h45

Science Requirement Summary

Ken Jezek

Format: Presentation and brief discussion

Objectives: Introduce the Global Inter-agency IPY Polar Snapshot Year (GIISPY) Strategy Document; Summary description of the thematic requirements; brief discussion

11h00-13h00

Space Agencies strategic objectives and portfolio for IPY, system capabilities and constraints and current acquisition plan over the Poles,

Format: Presentation and brief discussion

Objectives: Provide a better understanding of the policy framework under which each agency operates. Present agency strategic objectives, policy drivers, national/regional/international mandate, preferred region of interest, and current portfolio. Provide information on the Satellite operation activities which are linked to IPY activities and/or to the monitoring of the polar environment (current acquisition plan over the poles). The presentations should also include details on system capabilities, operation capabilities and constraints that may have an influence on the elaboration of a coordinated plan for IPY.

- CSA, DLR, ESA, NASA

13h00-14h00

Lunch

14h00-15h00

Mission and ground segment capabilities

Format: Presentation and brief discussion

Objectives: The organizations targeted here are those who have an operational mandate which use SAR as their main source of data. The information to provide here is related to the potential opportunities or conflicts that the operations

can generate within the context of the elaboration of the acquisition plan. Present infrastructure capabilities and constraints, potential contribution and/or information on national framework to access contribution. The organizations are invited to present a summary of their operations and where they feel it overlaps with the acquisition plan.

- ASF, CIS – IICWG, CSA Government of Canada Allocation, MDA,

3. CROSS-CHECKING SCIENCE REQUIREMENTS WITH AGENCIES CAPABILITIES

15h15	Open forum	All, Moderator: Barry Goodison
	Format: Discussion	
	Objective: Assess how the science requirements can be delivered in the context of the current portfolio; identify the gaps between the science requirements and current imaging activities; Science community to prioritize and re-confirm their objectives in light of the Space Agencies framework; prioritize and look how to fulfill the GAP. Solicit pre-meeting information on Agencies data portfolio.	
16h45	Summary	Ken Jezek
17h00	Ajourn	

Thursday March 6, 2008

4. FORGING THE PLAN

9h30	Presentation of a draft plan	Ken Jezek and Barry Goodison
10h00	Open Discussion on Draft plan	All
11h00	Summary of the meeting and action items	Yves Crevier

MINUTES - IPY STG SAR Workshop

March 5 and 6, 2008

Canadian Space Agency – St. Hubert, Quebec, Canada

Participants

Yves Crevier (CSA), Henri Laur (ESA), Barry Goodison (EC), Mike Manore (EC), Paul Briand (CSA), Don Ball (DB Geoservices), Raymond Guillemette (CSA), Daniel DeLisle (CSA), Robert Saint-Jean (CSA), Ron Kwok (JPL), Don Atwood (ASF), Michele Harbin (ASF), Ian Joughin (U of Washington), Dana Floricioiu (DLR), Erhard Diedrich (DLR), Gordon Rigby (MDA), Yves Louis Desnos (ESA), Eric Thouvenot (CNES), Larry Tieszen (USGS), Craig Dobson (NASA HQ), Darlene Langlois (EC), Catherine Wilson (IPY-INAC), Ken Jezek (Byrd Polar Institute), Vladimir Zabeline (EC)

Apologies: Chu Ishida (JAXA), Matsunobu Shimada (JAXA), Per Erik Skroveth (Norwegian Space Center), Mark Drinkwater (STG Co-Chair), David Williams (STG Co-Chair), Tillmann Mohr (JC), Ed Saruhkanian (JC), Vladimir Ryabinin (WCRP)

Workshop Objective: The objective of the workshop is to forge an acquisition strategy for SAR and InSAR data that achieves the maximum number of IPY science objectives in such a way as to distribute the acquisition load across the different agencies – understanding that no single agency can accommodate all of the tasks. The workshop will primarily focus on data acquisition requirements, as outlined by the scientific community, based on Agencies' strategic plans for IPY and unique capabilities of their systems.

The workshop approach is:

- To review existing GIIPSY science requirements (the Global Inter-agency IPY Polar Snapshot Year or GIIPSY Strategy Document).
- To present the Agencies' strategic priorities in line with IPY science activities.
- To present and review current acquisition plans focused on IPY.
- To present the satellite and ground segment operators' system capabilities and constraints related to the acquisition of data in support to IPY.
- To forge a coordinated / multi-agency SAR acquisition plan in support to IPY (remainder and legacy).

DAY 1

1. Introductory Comments

Raymond Guillemette, CSA Director of Technology Management and Applications, offered welcoming comments.

Yves Crevier reviewed the agenda and workshop objectives. He noted that the workshop is in response to STG action item STG2-A9 and that the STG SAR coordination meeting is a unique opportunity for the IPY science community to influence Space Agency mission managers.

Crevier reviewed STG background to the SAR Workshop on behalf of STG co-chairs. He noted the excellent response to the meeting in terms of agency and science participation. He stated that the STG SAR Coordination Meeting is a unique opportunity for the science community of IPY to influence Space Agencies' Mission management.

Ken Jezek presented a summary of GIIPSY requirements and presented a strawman matrix for developing an acquisition strategy. Henri Laur suggested that rather than science themes, the starting point for the strategy should be the Space Agency capabilities and existing plans. Laur's comment was seconded by Mike Manore who also asked that more information be provided about resolution and timing. Jezek noted that such information is included in the detailed science requirements.

Barry Goodison queried whether the agencies had flexibility to continue data collections and other activities beyond the formal end date of IPY. In response, Laur noted that as we are in IPY, it is easier for him to push acquisitions towards IPY. However ESA would not stop all acquisitions subsequently. Saint-Jean also noted that time is not a constraint for CSA. DLR and NASA confirmed that they will continue beyond IPY again as resources permit. Following on this, Laur suggested that the workshop also recommend to JAXA to continue past the formal end of IPY.

Action Item: Workshop report to request that JAXA continue polar observations beyond the conclusion of IPY as their capabilities and mandate permit.

2. Agency Status Reports, Capabilities and Constraints

2.1 ESA

Henri Laur provided introductory comments on behalf of ESA. He expressed strong support for and offered extensive contributions to IPY. He discussed plans for continued observations using ERS-2 and Envisat. He also reviewed plans for follow-on satellites for cryospheric observations including GMES (Global Monitoring for Environment and Security). He concluded with a review of the ESA data portfolio and data access policy.

Yves Louis Desnos reviewed the ESA IPY AO, recent IPY related science results, and Polar View. IPY AO investigators are making substantial requests for SAR data. Optical and IR are also requested but not at the level of the SAR data. For SAR, both ERS-2 and Envisat data products are requested. Of this, 75% of the ENVISAT are data available on line. Desnos gave several examples of ESA cryosphere contributions including: Greenland and Antarctic mass balance from InSAR; Alpine glacier motion; ASAR sea ice monitoring; sea level change in the Arctic from ERS-2 altimetry. He also gave examples of ESA efforts to merge multiple data sets including ERS-2 and Envisat, ERS-2/Envisat Tandem, and ERS/RSAT/Envisat. He concluded with comments about the ESA/ESRIN organized IICWG meeting and the Polar View data portal for accessing ice charts of ice covered waters.

H. Laur continued with discussion of capabilities and constraints. For example, ASAR has 5 modes which is a capability but also a constraint in that selection of one mode can preclude use of the others. He commented that high data rate modes and downlink capacities are capabilities not constraints. In particular, high data rate modes can be acquired up to 30 minutes per orbit. The remaining 70 minutes of the orbit are available for low-bit rate modes (e.g. Global Monitoring Mode). The high bit rate data are acquired on average for about 18 minutes per orbit. Acquisitions are made achievable by using the ARTEMIS data relay satellite along with downlink stations. About 25 % of the ASAR data stream is stimulated by direct user requests. The remaining 75% is available for background mission including IPY. As a further contribution to IPY, Antarctic data are given priority 1. This is an example of IPY influence on acquisition plans.

Laur briefly summarized SAR coverage of sea ice:

- Systematic coverage of Antarctica, the Southern Ocean and the Arctic Ocean and marginal seas using ASAR wide swath
- Supplementary coverage with Global Monitoring mode.
- Excellent wide swath mode coverage of Antarctic ice covered waters.

Assessment by participants was that wide swath mode coverage of the Arctic basin is very good in general. Coverage is poor off the coasts of Alaska and Siberia because of the cost of repatriating data from ASF and in fact any other foreign ground station. Better coverage could be obtained over the entire Arctic by developing a complementary acquisition plan using RADARSAT and Envisat.

Laur went on to discuss legacy SAR Acquisitions in Image mode and for interferometry. Since 2007, there is ASAR coverage of Antarctica, Greenland, Ellesmere, Iceland Svalbard and Franz Josef Land.

Envisat-ERS-2 Tandem Insar is available from 07-08.

Participants noted that ASAR image mode and InSAR coverage of Antarctica is excellent. ERS-2 coverage of West Antarctica is extensible to east Antarctica with more MGS support.

A constraint is that the ARTEMIS data relay satellite will not be available for 1 month while it is devoted to Space Station support and the completion of the ATV mission. The prior ESA plan was to devote ARTEMIS to Space Station related work for up to 6 months. The reduction represents a considerable concession to IPY. Nevertheless there will be a likely impact on Antarctica and Greenland acquisitions.

Discussion of coverage and gaps. Ron Kwok noted gaps in the Beaufort Sea routine repeat coverage for ice motion measurements. While the coverage is good over time, it is difficult to assess systematic coverage for sea ice motion as part of the background mission. Jezek noted that other systems such as TerraSAR could increase southerly Antarctic Ice Sheet coverage

2.2 DLR

Erhard Diedrich gave an overview of all DLR activities. DLR has capability to downlink ESA data to 3 ground stations:

- O'Higgins possible year round operation in 09
- Svalbard
- Planning to establish one new station in North America (northern Canada or Alaska) operational 2009

DLR has acquired ERS data at O'Higgins from 1991 to 2006. DLR is capable of receiving Envisat data at O'Higgins if needed. Delayed status of the DLR data relay satellite places burden on data downlink capacity.

TerraSAR-X is the primary DLR contribution to the IPY data portfolio. 50% of TerraSAR acquisitions are devoted to science and 50% to commercial applications. Acquisitions are constrained by power and thermal limits. Down link capacity is not the constraint.

Commercial and scientific users are both requesting access to the system. Infoterra provides interface to data for commercial order service and customer support. DLR is responsible for science coordination and management of data access. Science access is organized through a PI process. DLR is considering developing a single coordinated proposal in specific response to the IPY acquisition requirements.

TerraSAR does manage a background mission that could be used to support IPY acquisitions. However there are many competing requests for background mission acquisitions.

Data policy restrictions (ITAR) complicate providing a freely accessible, high-resolution, phase-information data pool. Antarctica could be the test case for working through these complications.

Discussion: Jezek encouraged IPY data coordination proposal for anticipating future science requirements. Goodison asked about the feasibility for release of commercial acquisitions at some later time (5 years or so). Diedrich responded that commercial data in the archive ultimately will be available for scientific exploitation. Crevier commented that RADARSAT-2 also will have a background mission that will make commercial acquisitions available for scientific use through the archive.

Dana Floricioiu provided a detailed review of TerraSAR-X capabilities and constraints. Details on TerraSAR-X instrument specifications can be found in the slides. TerraSAR-X is beginning acquisitions over the Arctic and Antarctic. Acquisitions are possible to 89 degrees for Antarctica and Greenland. Left looking acquisitions have been tested over Beardmore glacier and the results are excellent.

2.3 NASA

Craig Dobson reviewed NASA's ongoing partnerships with international space agencies (such as ESA, DLR and CSA) and with sibling agencies (such as NOAA, USGS and NSF). He reviewed NASA's IPY augmentation to the cryospheric program which includes sea ice dynamics, and glacier and ice sheet dynamics. NASA maintains a balanced science portfolio of global scale observations. Portfolio data include: collaborative Landsat mosaic of Antarctica; ICESat topographic data; GRACE gravity data over the polar regions. Other collaborative work includes partnership with CSA on RADARSAT-1 and with JAXA on ALOS. Technology development includes L-band airborne SAR interferometer and a Ka-band airborne SAR. In the future, NASA plans SMAP (coarse resolution SAR) for soil moisture and permafrost, and DESdyni (L-band InSAR).

NASA provides a support role to IPY SAR activities through downlink and processing support at ASF and MGS for ERS-2, RADARSAT and ALOS/Palsar. Joint testing with JAXA is planned for TDRSS downlink for PALSAR.

Discussion:

Laur, Crevier and Goodison engaged in a discussion about how to best continue CSA NASA collaboration for use of RSAT for science and Ice Service operations.

Action Item: Request CSA and NASA to explore approaches for using RADARSAT-1 during the IPY to cover areas of the Arctic where there are Envisat data gaps.

2.4 Canadian Space Agency

Yves Crevier discussed CSA commitment to IPY for the period 2006-2010. He reviewed the status of RADARSAT-1 and -2 as well as discussing future plans for the RADARSAT

Constellation. CSA IPY projects include Arctic Science Archive Processing (ASAP) Project. CSA has worked on the RADARSAT Polar Science Data set and is an active participant in the STG.

ASAP data sets include coverage of frozen ground across Canada. Sea ice minimum and maximum extent maps have been extracted from the archive. Canadian scientists developed an extensive set of supersites across Canada where in all RADARSAT-1 data have been processed. CSA has limitations in disseminating data and this is part of the Polar Science Database project.

CSA has several key near term objectives: RADARSAT-1 archive availability; RADARSAT-1 operational continuity; RADARSAT-2 data availability; contribute to development of virtual SAR constellation.

Robert Saint-Jean discussed RADARSAT-1 mission status. Degradation of existing systems after 12 years of operation means that there is now 1 tape recorder downlink today. This is mitigated by the extensive network of ground receiving stations. In case of RADARSAT-1, the background mission is a smaller fraction than the customer requests but there is still unused capacity on the satellite. The Extended Background Mission has included four season coverage of the Arctic Basin down to the 10° July isotherm line since 2003.

Discussion

Comparison of Envisat and RADARSAT-1 coverage maps reveals exceptional complementarities in Arctic coverage. Unless issues can be resolved regarding downlinks to foreign ground stations, the science and operational communities risk substantial data loss in one month's time.

CSA has a policy for repatriating data should ground stations go out of existence. Long term data preservation policy at ESA is being developed.

3. Mission and Ground Segment Capabilities

3.1 RADARSAT-2

Daniel De Lisle discussed RADARSAT-2 mission objectives, framework, data and the SOAR program. RADARSAT-2 is in the commissioning phase. Government of Canada data can be used for scientific, R&D and non-commercial institutional use. There is interest within CSA for using RADARSAT-2 for IPY research purposes. All data acquired through the RADARSAT-2 background mission is not included in the GoC allocation and consequently the background mission can be an efficient mechanism for providing IPY acquisitions.

Discussion: Current and upcoming SOAR announcements of opportunity are for applications development. Decisions are yet to be reached on whether end-user licensing agreement can be reached such that multiple scientists can use a particular scene or whether each independent use of the scene constitutes a new research request for the data.

A background mission plan is in preparation for RADARSAT-2 and this means that there is a good near term opportunity to develop a plan for polar acquisitions including Greenland, Antarctica, and the Arctic basin. An issue is the processing fee for pulling data out of the archive. The fee is the same for pulling out raw data product as a higher level product.

Action Item: Submit recommendation for RADARSAT-2 background mission acquisition complementary to existing archive for IPY and which supplements gaps in other existing systems and archival data sets.

Gordon Rigby provided a perspective on RADARSAT-2 operations from MDA. He described testing for left looking mode acquisitions over the Antarctic and presented an example of imagery of East Antarctic megadunes in left looking mode. MDA is responsible for mission operations of RADARSAT-2. MDA is interested in much wider use of RADARSAT-1 and RADARSAT-2 data and while recognizing its commercial focus, MDA is interested in seeing applications for IPY.

Discussion: Background-mission left-looking mapping of the Antarctic pole hole can be an excellent complementary contribution of RADARSAT-2 to IPY. The processing costs for RADARSAT-2 are covered for Ice Center and Canadian government users. Thus far, IPY data availability is not covered by current budgets.

3.2 ASF

Don Atwood discussed ASF operational capabilities in support of IPY. ASF is now an ALOS data node in collaboration with NOAA. The ASAP program is a collaboration between CSA and ASF to make RADARSAT-1 data available to the research community.

3.3 JAXA

Don Atwood gave a short presentation on behalf of JAXA. JAXA has planned 3 cycles of acquisitions for coverage of Antarctica. The cycles are not consecutive cycles (8, 14 and 16). The data will be used to prepare image maps. These will be available on the JAXA web site. Confirmation is requested as to whether consecutive cycles will be available for interferometry.

Action Item: In response to JAXA request for additional information about PALSAR data science requirements, recommend ALOS coverage of Greenland and the Arctic basin.

3.4 Canadian Ice Service

Darlene Langlois described operational ice service activities, services and products. Their reasons for monitoring include sea ice, oil pollution and special projects. Ice information is produced in support of icebreaking operations, marine traffic, climate monitoring and weather forecasting. The ice service supports an Inland Lake Monitoring Project which identifies dates of freeze-up and break-up. About 130 lakes across North America are monitored. The Canadian Ice Service (CIS) is part of the North American Ice Service, with production of ice maps shared between Canada and US. CIS has transferred their archive of processed products to soft copy. The intention is to find ways to make RADARSAT-2 data sharable to Canadian government and researchers.

Discussion:

Ron Kwok showed maps of 3 day coverage of the Arctic Basin using ASAR, RADARSAT-1 and ALOS. He needs 3 day repeat coverage to study the ice dynamics.

Ian Joughin stated that the loss of ASF as a RADARSAT-1 ordering, receiving and processing station is serious. We lose coverage of a large Greenland glacier right in the middle of IPY!

A few people stated that plans should be made not only for acquisition of data, but also for processing, access and distribution. Others felt that today's urgency is wall to wall acquisition, and that the community can solve problems of processing, access and distribution later.

Day 2

1. CNES

To support planning for optical sensors at CNES and coordination with SAR observations, Eric Thouvenot reviewed CNES optical (SPOT 4/5) data acquisition plans. He showed composite SPOT 4 images of the Arctic and Antarctic. Data less than 3 months old is available on line. Formosat-2 is acquiring data for select glaciers with 2 m observations. HRS/SPOT5 stereo imagery is creating DEMS of glaciers in the Arctic and Antarctic.

Action: Post information about CNES DEMs and data sets (KJ)

Action: Recommend follow on meeting to coordinate optical acquisitions and DEM creation (eg ASTER, PRISM and SPOT5)

2. Summary of Day 1.

Ken Jezek summarized Day 1 discussions and reviewed action items and a final statement of the action items compiled.

3. Plan

Based on information compiled from the meeting, Jezek suggested that the acquisition strategy focus on a few themes that satisfy these criteria:

- Solve an important science problem
- Fill a gap in planned coverage for IPY
- Involve interagency collaboration.

Participants were generally agreeable to this approach with the stipulation that recommendations be based on a clear understanding of the available data archive.

The following themes were tabled and now await further definition:

- C-Band coverage (3-day snapshots) for the Arctic ocean during the remainder of IPY (background missions, operation data acquisitions, etc.)
 - Coordinate between CSA and ESA Mission Management desks to elaborate a plan within the constraints (RSJ, HL, DL)
 - Provide science requirements (RK).
- Winter Pole to Coast InSAR coverage of the Antarctic in high-res mode (3-4 consecutive cycles in ascending and descending)
 - Use the coverage of the Continental Margin already planned by ESA

- RSAT2 background mission (Left looking) (KJ, IJ, GR, RSJ)
 - Pole hole mapping with TerraSAR-X (KJ, IJ, DF)
 - 3-4 cycles of L-Band PALSAR
 - Provide science requirements (KJ, IJ).
- Greenland and Major Canadian Icefields of InSAR acquisition over 3-4 consecutive cycles of high-resolution in winter
 - Large-scale synoptic acquisition plan to be assessed by ESA and CSA for C-Band
 - Suggesting improved L-Band coverage
 - Fast moving glaciers – showed in CNES presentation – suggested coverage by TerraSAR (DF)
 - Provide science requirements (IJ).
- Supersites (where possible using what exists already): determine acquisition parameters (frequency, resolution, etc.) for multi-polarisation and polarimetry data collection
 - Consider sea ice, snow water equivalent, glacier facies, permafrost.

The action is now for the science community to develop one page statements of requirements which will be posted to the GIIPSY web site. These one page descriptions will complement the existing requirements documents and coverage documents already on the web site. Mission managers indicated that this approach would provide sufficient information for them to update their acquisition plans and to coordinate plans between agencies. The acquisition matrix will also be filled in and used to assemble a detailed inventory of acquisition plans.

4. Planning for STG-3

The acquisitions strategy documents will be forwarded to STG members for concurrence and commitment at STG3.

5. Action Item Review

Note that the action items are listed as STG-C1 An, meaning STG Coordination meeting 1, Action n. This will facilitate future tracking of action items.

- **Action Item 1:** (STG-C1 A1) Request systematic ALOS coverage of Greenland (InSAR) and the Arctic basin. Request that JAXA continue polar observations beyond the conclusion of IPY as their capabilities and mandate permit. (KJ)
- **Action Item 2:** (STG-C1 A2) Provide similar refinement of acquisition plan to other space agencies (RK, IJ, KJ)
- **Action Item 3:** (STG-C1 A3) Request CSA and NASA to explore near term (1 month) approaches for using RADARSAT-1 during the IPY to cover areas of the Arctic where there are Envisat ASAR data gaps.
- **Action Item 4:** (STG-C1 A4) STG SAR coordination group to formulate a letter to be submitted to CSA, NASA external relations and MDA to avoid the planning and data reception gap for RADARSAT-1 over both polar regions during IPY.
- **Action Item 5:** (STG-C1 A5) Submit recommendations for RADARSAT-2 background mission and Government Allocation acquisition complementary to existing archive for IPY and which supplement gaps in other existing systems and archival data sets (science community + YC, RSJ, GR, KW).

- **Action Item 6:** (STG-C1 A6) For the science community: develop a one page statement of requirements for each of the four themes listed in Section 3 above.
- **Action Item 7:** (STG-C1 A7) Investigate possibilities for ENVISAT reception over Chukchi sea for IPY – Follow-on on discussions between ESA, ASF and KSAT for the reception during IPY.
- **Action Item 8:** (STG-C1 A8) For the science community – to develop and submit a proposal to DLR for IPY related data acquisition.
- **Action Item 9:** (STG-C1 A9) Post information about CNES DEMs and data sets.
- **Action Item 10:** (STG-C1 A10) Recommend follow on meeting to coordinate Optical acquisitions and DEM creation (eg ASTER, PRISM and SPOT5).