MEMORANDUM OF UNDERSTANDING

BETWEEN

CANADIAN SPACE AGENCY OF CANADA

AND

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

AND

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

OF THE DEPARTMENT OF COMMERCE

OF THE UNITED STATES OF AMERICA

CONCERNING THE RADARSAT PROJECT

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ARTICLE 1 INTRODUCTION

1.1 The two Parties to this Memorandum of Understanding (MOU), (called the Parties in this MOU), are: the Canadian Space Agency (CSA) of Canada, and the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce of the United States of America.

1.2 During the last decade the Parties have each taken part in various Satellite missions that have demonstrated the value of free flying polar orbiting satellites for gathering remotely sensed data describing the earth's surface and troposphere. In particular the synthetic aperture radar of the SEASAT mission demonstrated the microwave technology and the performance requirements necessary for land use determination, sea ice surveillance, oceanography, and geological mapping. Building on this experience the RADARSAT Project, (called the Project in this MOU), has been conceived as an advanced remote sensing mission with a wide range of objectives.

1.3 The two Parties to this MOU are contributing in different ways to the realization of the Project according to their technical capabilities and agency mandates. As a consequence of these differing mandates the reasons for supporting the Project vary and as a result, the emphasis given to each objective listed in Article 4 of this MOU also varies from Party to Party. Thus, for example, the CSA primary need is to obtain data for pre-operational purposes, through a program which includes the participation of those Canadian provinces contributing to the Project costs. For the U.S., the NASA primary need is to obtain experimental data to support global research and application demonstration efforts of its own and those of other U.S. Government Departments and Agencies; NOAA's primary interest is to ensure the availability of this data to U.S. government and private users and promote its use on a widespread basis consistent with U.S. law.

1.4 With these considerations in mind, the Parties jointly undertake the Project with the purpose of advancing space science and technology and the applications of remote sensing technology in areas such as research studies of the earth's land, ocean and ice cover, demonstration projects,

monitoring the earth's natural resources and environment, and the protection of human life and property from natural disasters. Research investigations utilizing RADARSAT data will be solicited by the Parties themselves through their own means of solicitation and/or via an Experiment Announcement of Opportunity (EAO) in order to pursue studies in these and related areas.

1.5 Coordinated studies in Canada and the U.S. have led to the detailed specification and design of the RADARSAT Satellite, (called the Satellite in this MOU), and of the launch and of the ground segment which will support the Satellite after launch. These studies (Phase B) were conducted through previous arrangements between the Canadian Federal Department of Energy, Mines & Resources (EMR) and NASA. (Arrangement concerning RADARSAT cooperation between the Department of Energy, Mines and Resources and the National Aeronautics and Space Administration, dated 29 September 1982).

1.6 The Parties will continue this mutually beneficial cooperation in space science and applications through collaboration to develop, build, launch and operate the Satellite.

1.7 The Satellite will carry a baseline payload consisting of a synthetic aperture radar (SAR). The object of the Satellite mission is to collect, process and distribute data from the SAR. The data will be used for pre-operational and experimental purposes. All data will be made available on a public non-discriminatory basis.

1.8 If the platform accommodation and launch vehicle capability permit, the Parties may make arrangements to fly some small additional instruments.

ARTICLE 2 PURPOSE OF THIS MOU

2.1 The purpose of this MOU is:

i) to define the main Project elements and the respective responsibilities of the Parties,

ii) to define the agreements between the Parties for the coordination and management of the Project,

iii) to define the general provisions for the utilization of RADARSAT data.

ARTICLE 3 RADARSAT PROJECT DESCRIPTION

3.1 The Satellite will weigh approximately 3,200 kg and will be placed in a sun-synchronous orbit at an altitude of about 800 km. The inclination will be approximately 99 degrees and the Satellite will have a descending node (equatorial crossing) of approximately 06:00 local mean time. The launch will be from the Western Test Range by a medium class expendable launch vehicle and is planned for mid-1994.

3.2 The SAR will image the earth at C-band (approximately 5.3 GHz) and will provide data capable of generating four-look processed images with an equivalent spatial resolution of about 28 m. It will also have a high resolution mode giving about 10 m (one look) resolution over a 50 km swath, and a SCANSAR mode giving about 100 m (six look) resolution over a 500 km swath. The SAR beam will be pointed to the north of the ground track and in the vertical plane it will be electrically moveable between 20 degrees and 45 degrees incidence angles, except for the SCANSAR mode which covers this entire range of incidence angles. Power will be provided to operate the SAR for up to 28 minutes in sunlight each orbit.

3.3 Limited on-board recording capability will be provided for SAR data. The tape recorded data will be buffered into the X-Band high bit rate data (HBRD) telemetry system for transmission to the ground. All data processing will take place on the ground.

3.4 After commissioning, data acquisition will commence with the payload operating under the control of an on-board computer programmed from the Mission Control System (MCS). The MCS comprises:

i) the Mission Management Office (MMO) which coordinates all ground services including data quality control and the administration of data policy,

ii) the Mission Control Facility (MCF) which schedules and monitors all communication with the Satellite, including its state of health and,

iii) the Telemetry Tracking and Control Station (TTCS) which is the ground end of the communication link with the satellite.

3.5 The Project will include the following phases:

i) Phase C -
- the final design, development and construction of all hardware up to and including the final qualified designs for the flight model,
- the specification of software for mission operation,
- the design of the ground stations and data processing and archiving facilities,
- the design of the MCS,
- the design and construction of ground support equipment for checkout of the satellite.

ii) Phase D -
- the construction, integration and acceptance testing of the flight model, including verification of all interfaces,
- the construction of the launch vehicle interface hardware,
- launch and orbit achievement of the Satellite,
- the construction of the MCS, and the data processing and archiving facilities,

- the writing and testing of mission operation software,

- commissioning of the Satellite and engineering validation of sensor data.

iii) Phase E - routine operation of the Satellite.

ARTICLE 4 RADARSAT OBJECTIVES

4.1 The objectives of the RADARSAT Project are as follows:

i) to ensure data availability for environmental monitoring,

ii) to create daily sea ice maps based on SAR data collected over the Arctic,

iii) to collect SAR data over selected portions of the globe for the purpose of crop forecasting,

iv) to obtain periodic SAR data coverage of Antarctic sea ice distribution, subject to receiving station or tape recorder availability,

v) to collect a global set of stereographic SAR images for mapping,

vi) to obtain the first comprehensive map of the Antarctic continental ice sheet based on SAR images.

vii) to collect site and time specific SAR data in support of approved research studies or application demonstrations sponsored either individually or jointly by the Parties,

viii) to collect site and time specific SAR data for experiments sponsored by the parties through an EAO,

ix) to collect and make available global data to any persons, on a non-discriminatory basis,

x) to develop applications of SAR data in a pre-operational environment, and

xi) by assigning distribution rights for SAR data to the private sector, to promote the world-wide use of the SAR data.

ARTICLE 5 RESPONSIBILITIES OF THE PARTIES

5.1 Each Party is responsible technically, managerially, and financially for the activities specified below.

5.2 For Canada, CSA will use its best efforts to meet the following responsibilities:

i) to design the overall system, including total system design integrity and to provide technical coordination between CSA, NASA and NOAA representatives to ensure technical compatibility of the elements of the spaceborne and ground system provided by each Party,

ii) to conduct, in consultation with the other Party, the definition studies necessary for the accomplishment of its system responsibilities in the RADARSAT Project,

iii) to design, develop and construct the SAR, and its interface with the platform,

iv) to integrate the SAR with the platform, transfer the satellite to the launch site, and conduct appropriate Satellite level tests on the interface with the launch vehicle, the data acquisition stations, and the MCS,

v) to provide the Satellite communications and management system for the identified and agreed microwave up-links and down-links with the ground stations,

vi) to obtain a platform suitable for the RADARSAT mission and to arrange with the supplier for the provision of all necessary mechanical and electrical ground support equipment for the check out of the platform,

vii) subject to review and acceptance tests, to accept the flight model of the RADARSAT platform from the supplier and all flight hardware and related flight component spares together with all the necessary ground and airborne support equipment and operations handbooks to enable CSA to operate the Satellite,

viii) to provide an uplink transmitter and the associated equipment for the Alaska receiving station in the event that CSA wishes to relay SAR data to Ottawa from Alaska via a communication satellite (See Article 5.3 iv),

ix) to provide and operate the MCS, which includes the RADARSAT MMO. This will provide the principal users' interface, the operating centre for the RADARSAT system, and the coordination for all activities of the RADARSAT system,

x) to control and operate the Satellite after it achieves its nominal orbit,

xi) to provide SAR data by direct transmission from the Satellite to designated U.S. data acquisition stations subject only to the operational constraints of the mission,

xii) to provide and operate two data acquisition stations in Canada to receive data on the X-Band downlink from the Satellite, where such provision and operation is consistent with the available staffing and other commitments of the stations,

xiii) to make SAR data available in accordance with the provisions of Article 12,

xiv) to design and construct mission unique training and testing aids,

xv) to provide technical information necessary to ensure safe and effective interfaces with the other Parties responsibilities, and

xvi) to reorient the Satellite, once during a winter season and once during a summer season, so that the SAR beam is directed to the south to enable complete SAR coverage of the Antarctic continent. The scheduling of this activity will be as early as possible in the mission, the exact timing to be decided by the International Steering Committee (ISC).

5.3 For the U.S., NASA will use its best efforts to meet the following responsibilities:

i) to procure a commercial launch for the Satellite, in the 1994 time frame, using a medium class expendable launch vehicle, from the Western Test Range to an agreed altitude and orbit inclination,

ii) to provide or procure the necessary normal and optional launch vehicle services in support of RADARSAT launch planning, launch vehicle accommodation, pre-launch checkout and launch operations,

iii) to make available existing NASA owned ground support equipment (GSE) appropriate to the platform, to the extent that program plans permit,

iv) to provide and operate a data acquisition station in Alaska to receive HBRD on the X-Band downlinks of the Satellite, and, in the event that CSA wishes to relay HBRD from Alaska via a communication satellite and supplies an uplink transmitter and associated equipment, to operate this data relay; such provision or operation being subject to available staffing and other commitments of the station,

v) to provide supporting telemetry, tracking, and control services from available NASA stations to the CSA MCS during the Satellite launch and early orbit period within the limits and capabilities of the NASA stations and resources as they exist at that time,

vi) to provide technical information necessary to ensure safe and

effective interfaces with the other Party's responsibilities, and

vii) to support application demonstrations for the use of SAR data for sea ice mapping of the Arctic.

5.4 For the U.S., NOAA, through the National Environment Satellite Data and Information Service (NESDIS), will use its best efforts to meet the following responsibilities:

i) to facilitate U.S. Government use of SAR data and to arrange application demonstrations such as sea ice mapping of the Arctic, and

ii) to facilitate the distribution of SAR data by ensuring that the U.S. private sector has an adequate opportunity to participate in distribution rights to this data and that all such arrangements are consistent with U.S. law.

5.5 In the event that either Party is unable to meet the responsibilities described in Article 5, that Party will immediately notify the other Party. The Parties will then consult through the ISC on measures to be taken to continue the Project.

ARTICLE 6 COORDINATION AND MANAGEMENT

6.1 Coordination of the Parties' respective functions will be provided by the ISC chaired by CSA. Membership of the ISC consists of designated and equal representation from each of the countries of the Parties to this MOU and will include at least two representatives from each Party. Meetings will take place at the request of either Party but will not be less than once per year.

6.2 The ISC will be responsible for the following functions:

i) to coordinate the implementation of the provisions of this MOU,

ii) to ensure that the various elements of the Project are proceeding on schedule and, in the event of any difficulty, take appropriate measures to alleviate problems that might ensue,

iii) to approve the Joint Project Implementation Plan (JPIP),

iv) if platform accommodation and launch vehicle capability permit, to approve any additional instrument payload to be carried on the platform,

v) in the event the Parties elect to jointly undertake research studies through an EAO, to approve the science team chairmen and the experiment plan to be supported through the EAO,

vi) to establish Joint Sensor Validation Teams (JSVT),

vii) to establish a subcommittee to coordinate the activities of the change control boards of the Parties,

viii) at the request of a Party, to consult on the distribution of costs resulting from major design changes,

ix) to endeavour to resolve disputes between the Parties,

x) to make arrangements for orderly termination of the project in the event that it should prove necessary,

xi) to set guidelines for changes in operational procedures in the event that the performance of the Satellite falls below nominal at any time during the mission,

xii) to determine the allocation of tape recorder use by the Parties,

xiii) as early as possible in the mission to schedule Satellite maneuvers necessary to obtain SAR imagery of Antarctica, once during the winter season and once during the summer season,

xiv) to advise CSA on the interest of the other Party in continuing the mission beyond its nominal five year life if that is possible,

xv) relevant to the rights of the Parties under this MOU, review arrangements relating to the establishment and ongoing activities of the international company that is granted RADARSAT data distribution rights (cf 12.5, 12.6), and

xvi) to perform such other functions as the Parties may from time to time require of it.

6.3 Where there is a disagreement between the Parties on any specific issue within the purview of the ISC, the matter will be referred to the next higher level of authority of the Parties.

6.4 The ISC may establish sub-committees to attend to specific tasks and will determine the terms of reference of those sub-committees.

6.5 The responsibilities of the Parties described in this MOU are internal to the agencies concerned. For this purpose the Parties may set up such management structures as they deem necessary.

ARTICLE 7 JOINT PROJECT IMPLEMENTATION PLAN

7.1 A JPIP and amendments thereto that fall within the foregoing general descriptions of the Project, including the methods of system configuration control, the phasing, scheduling, deployment of equipment, managerial and working arrangements and guidelines for data acquisition and management, will be developed by CSA, in consultation with representatives of the other Party and subject to approval by the ISC.

ARTICLE 8 DATA ACQUISITION

8.1 Due to recognized spacecraft power limitations, SAR data acquisition cannot be continuous. Therefore, the Parties agree that the available SAR data acquisition time (nominally estimated to be about 28 minutes per orbit) will be allocated among the Parties subject to the following conditions:

i) Collectively the Parties have a right to the available SAR data acquisition time free of charge.

ii) The allocation of the available SAR data acquisition time between the Parties will be in proportion to the value of their contribution to the space segment and the associated GSE and the MCS, the launch and associated launch services. This proportioning will be as determined by the ISC, based on the "as-built" cost at the time of orbit insertion.

iii) Subject to the provisions of Articles 11 and 12 on data use and data distribution, the Parties are free to share their allocation of SAR data acquisition time with other executive branch agencies within their own country, with any person or organization whose research or application demonstration studies are sponsored by the Parties, and with the Distributor (see Article 12.6).

iv) Guidelines for determining how these proportions are applied to actual SAR data acquisition, i.e., per orbit, per day, per season, etc., and the procedures to be followed in establishing priorities on the requests of the Parties will be elaborated in the JPIP. It is recognized that on occasion, and due usually to a potentially catastrophic environmentally related event, such as a volcanic eruption, earthquake or forest fire, there may be a need to provide special SAR coverage of such phenomena as they unfold. Such requests may be made by either Party, at any time, and will be reviewed and acted on immediately by the CSA in accordance with the special provisions for these events contained in the data policy

guidelines.

v) If the SAR is able to image a particular spot on the Earth's surface, the only geographical limitations on SAR data acquisition are technical, primarily due to the need to have either a ground receiving station and/or the onboard tape recorder available to receive/record the SAR data or programmatic, primarily arising from allocations of SAR data acquisition time.

8.2 It is recognized that the tape recorder for the SAR has limited life. Therefore, in order to minimize wear and tear, the Parties agree that, outside of its use to acquire global crop information, global stereographic images and the two coverages of Antarctica, they will exercise restraint in requesting the use of the tape recorder. This use will be proportional to the value of their contribution to the project (cf 8.1 ii) and according to guidelines to be elaborated in the JPIP.

ARTICLE 9 DATA RECEPTION

9.1 Parties to this MOU will make their own arrangements for data reception, processing and distribution, except in those specific circumstances described and provided for in this MOU.

9.2 To the extent that the receiving station masks of the ground stations of the Parties may not completely cover the territory of interest to the countries where the stations are located but will usually cover some of the territory of interest to other countries, Parties will try to assist each other in accommodating data reception and distribution needs. A similar provision will be included in any Third Party agreements, made by CSA for direct readout of SAR data.

9.3 In the event that read-out of recorded data cannot take place at a scheduled receiving station, the Parties will try to assist by providing back-up read-out on request from CSA under agreed terms and conditions. The same arrangements will apply for directly transmitted data within overlapping receiving station masks.

ARTICLE 10 DATA QUALITY

10.1 Using data collected during the commissioning phase, the JSVT will verify that the sensors are performing satisfactorily in terms of their specifications and pre-launch tests.

10.2 Throughout the mission, and on request from CSA, the Parties will collect data samples and provide them to CSA for the purpose of quality control of sensor performance and data processing.

10.3 The Parties do not guarantee data continuity and they do not guarantee the quality or availability of any data during the mission. For this reason the Parties do not warrant the suitability of RADARSAT data for any particular purpose.

ARTICLE 11 DATA USE

11.1 Use of SAR data for internal governmental use by the Parties is the choice and privilege of the Parties, provided only that it is not sold, given, or otherwise made available to Third Parties except as provided for by Articles 11.3 and 12.

11.2 Through an EAO, science teams may be established to conduct research programs using SAR data. The terms of reference and representation on such science teams will be approved by the ISC. They will be chaired by science specialists approved by and representing the ISC. The cost of managing this activity will be borne by the sponsors.

11.3 For research studies and application demonstrations approved individually or jointly by the Parties and for experiments approved and supported through an EAO, SAR data will be made available to the Parties under the following conditions:

i) that this use is restricted to named investigators and co-investigators, approved through a formal review process established jointly or individually by the Parties, is for research and applications demonstration purposes only, and the data may not be made available to Third Parties, to the extent permitted by the prevailing laws of the Parties,

ii) that data acquisition for this purpose is subject to technical constraints and to the data acquisition guidelines set out in the JPIP,

iii) that data requests will only be accepted for experiments that are defined and approved, in terms of their objectives and the resources necessary to perform them, before the request for data is made,

iv) that the results of these experiments are made available to the scientific community in general only through publication in appropriate journals or other such established channels. In the event such reports or publications are copyrighted, the Parties will have a royalty-free right under the copyright to reproduce and use such copyrighted work for their own purpose,

v) that the sponsors of these studies or experiments bear the cost of processing, if necessary, and the cost of reproduction of data required by their experimenters, and

vi) that the sponsored investigators and co-investigators sign an agreement with their sponsoring Party undertaking to respect these conditions.

11.4 Besides SAR data acquired at the specific request of a Party, the Parties also have free access to all RADARSAT SAR data in the archives of the other Party, subject only to the conditions that they may not be sold, given or otherwise made available to Third Parties and that the requesting Party bears any costs incurred in reproduction and transmission.

11.5 The Parties may delegate or subcontract their responsibilities for data acquisition, processing, archiving and distribution as they see fit, but they remain responsible for ensuring that the performance of such tasks is in accordance with the provisions of this MOU. In particular, private sector organizations gaining access to SAR data in this way may not use it to create value-added products for distribution except on behalf of the Government or agency concerned through a service contract.

Restrictions on the distribution of the SAR data itself are described in Article 12.

ARTICLE 12 DATA DISTRIBUTION

12.1 SAR data acquired by the RADARSAT Satellite will be made available in accordance with a policy of non-discrimination.

12.2 For the purposes of Article 12.1, data formats will be specified in the JPIP. Data in these formats will be referred to as the Primary Data Set (PDS). In the event that other data formats of a lower or higher level may be generated by the Parties, they will endeavour, to the extent that it is practicable, to make these types compatible, of consistent quality and as freely available as the PDS. In support of this effort the JPIP will also include specifications and procedures for data quality control.

12.3 Data in archives maintained by the Parties will be available in the PDS format. CSA will maintain a total catalogue of these archives based on information provided by the other Party.

12.4 All copyright and ownership rights for SAR data will be vested or reserved solely in or to CSA, the other Party having rights of use as described in this MOU to the extent permitted by the laws of the Parties.

12.5 In order to promote the global use of SAR data, an international company (called the Distributor in this MOU) will be given the exclusive right to distribute SAR data to all Third Parties. The Distributor will be composed of Canadian and U.S. private sector entities with equity approximately proportional to the contributions of that country's Parties to the capital costs of the RADARSAT project as determined under Section 8.1.ii. This arrangement is consistent with the applicable national law of the Countries, including, for the U.S., Title V of the U.S. Land Remote Sensing Commercialization Act of 1984 and will be subject to the approval and ongoing review of the ISC.

12.6 Proposals for access to SAR data by agencies or organizations outside of the Governments of the Parties will be a matter for negotiation by the Distributor in cooperation with the CSA and the terms, conditions

and arrangements for any such participation will be the subject of a separate agreement with the CSA. Such outside agencies or organizations will agree to support all project objectives, including data sharing responsibilities (Article 9) and restrictions on data distribution (Article 12). They will not have any management role in the Project. Any such agreement between CSA and an outside agency or organization shall be with the concurrence of the Distributor and will not add to the costs or responsibilities nor infringe upon the right of any Party unless that Party expressly agrees.

12.7 To ensure the viability of the Distributor and protect it from competitive harm, the Parties will not sell, give, or otherwise make available RADARSAT SAR data to any Third Party, without the agreement of the Distributor and to the extent that the laws of the Parties permit.

ARTICLE 13 FUNDING ARRANGEMENTS

13.1 Each Party will bear the costs of discharging its responsibilities in the Project and also the costs of travel and subsistence for its personnel and transportation of the material and equipment they are providing. It is understood that the ability of the Parties to carry out their obligations is subject to their respective funding procedures.

13.2 CSA will bear operation costs for the MCS. Part of these costs will be offset by revenue sharing between the Distributor and CSA.

13.3 In the event that either Party finds that non-availability of appropriated funds endangers the orderly conduct of the Project, that Party will notify in writing the other Party.

ARTICLE 14 DESIGN CHANGES

14.1 Whilst the JPIP provides a mechanism for design changes, the Parties recognize that the consequences of design changes by one Party could result in excessive expenditures on the part of the other. For this reason the Parties undertake to use their best efforts to minimize such changes and to provide for mutual representation on the change control boards, which will make decisions by consensus. In the event that such

changes are deemed necessary, each Party will normally bear the cost of the variation insofar as it affects its responsibilities in the Project. If either Party considers this apportionment of cost inequitable, it may request a redistribution of costs by the ISC.

14.2 The Parties will use their best efforts to avoid changes in scope which would have an impact on the performance of the mission, the achievement of the objectives or the adherence to the schedule of the Project.

ARTICLE 15 TECHNICAL INFORMATION EXCHANGE

15.1 The Parties will exchange payload interface, integration and check out technical information necessary for the purpose of launching the RADARSAT satellite. Because such information, commonly known as form, fit and function information, is not restricted or proprietary in nature, it will be exchanged without restrictions.

15.2 In the event it is necessary to exchange technical information other than that provided for in 15.1, and the furnishing Party considers that such technical information is to be protected for proprietary or export control purposes, the following notice will be affixed to such information by the furnishing Party and the receiving Party will protect such information in accordance with the terms of the notice, to the extent permitted under its laws.

NOTICE

This information is submitted in confidence under the RADARSAT MOU. The receiving Party agrees that the information will not be duplicated, used or disclosed by the receiving Party or its contractors for any purpose other than as necessary for the receiving Party to meet its responsibilities under the MOU, nor disclosed or retransferred to any other government, person or entity without prior written permission of the furnishing party. If required by such contractors, the information will only be furnished after the contractors have agreed in writing to protect the information from unauthorized duplication, use and disclosure. This NOTICE will be marked on any reproduction of the information in whole or in part.

15.3 The Parties may use and disclose without restriction, any exchanged proprietary information which does not have the above NOTICE affixed thereto.

ARTICLE 16 PUBLIC INFORMATION

16.1 Each Party may release general information to the public regarding its own portion of the project as desired, and, insofar as the activities of the other Party are concerned, after initial consultation with that Party. Information concerning the Project as a whole will be released by CSA after consultation with the other Party.

16.2 Each Party will use its best efforts to record the progress of the Project in still photos, cine film or video tape as appropriate and will make such material freely available to the other Parties for the purposes of public information.

ARTICLE 17 PROCUREMENT

17.1 The procurement of equipment by the Parties will be in accordance with their respective procurement and approval procedures.

17.2 Each Party will use its best efforts, within its own country, on request and in accordance with its national laws and regulations, to provide reasonable assistance to the other Party with their procurement of equipment or related components including required documentation for this Project.

17.3 Each Party, when taking receipt of equipment or related components or materials, will use its best efforts to arrange free customs clearance when those items must cross national borders, subject to its national laws and regulations.

17.4 All official interaction regarding matters related to the RADARSAT Project will be between the Parties or their delegates and representatives. Direct interaction, other than for the purpose of exchanging information, and related technical communications, will not take place between the various contractors or subcontractors without the approval of the affected Parties.

ARTICLE 18 LIABILITY

18.1 With respect to cooperative activities undertaken pursuant to this MOU, neither Party will bring a claim or suit against the other Party or the other Party's contractors or subcontractors for damages arising out of injury to or death of its employees or damage to or loss of its property whether such injury, death, damage or loss arises through negligence or otherwise. The Parties in their contracts with each other related to this MOU will include the said inter-party waiver of liability. Each Party will stipulate in any contract with a contractor related to cooperative activities under this MOU that that contractor will be responsible for injury to or death of its own employees and for damage to or loss of its own property and that that contractor will not bring a claim or suit against the other Party or the other Party's contractors or subcontractors for such injury, death, damage or loss. Each Party will

require the said subcontractors to include the same provisions in contracts with subcontractors related to this MOU.

18.2 Nothing in this Article prohibits a claim or suit between a Party and its own contractors and subcontractors.

18.3 For purposes of Article 18.1, the property and employees of a Party's contractors and subcontractors will be deemed to be the property and employees of that Party.

18.4 In the event of damage resulting to persons or property for which there is joint and several liability under the Convention on International Liability for Damage Caused by Space Objects or otherwise under international law, the Parties, or other designated Government bodies, will consult on an equitable sharing of liability with a view to recommending to their respective governments a course of action.

18.5 Upon taking possession of any items supplied by one Party (the supplying Party) to the other Party (the receiving Party) under a loan arrangement for the purposes of the project, the receiving Party will be responsible for such items and will return such items, except expendables and items authorized for testing to destruction, to the supplying Party in as good condition as when received, reasonable wear and tear excepted. Possession will pass from the supplying Party to the receiving Party at the point of off-loading. If the receiving Party fails to return such items, except expendables and items authorized for testing to destruction, the receiving Party will pay to the supplying Party an amount equal to the replacement value of such items less the amount determined to represent reasonable wear and tear during the period that the items were loaned.

18.6 NASA, for the U.S., hereby gives its authorization and consent to CSA, and its contractors and subcontractors, for all use and manufacture of any invention or process described in and covered by a patent of the United States in carrying out CSA's responsibilities under this MOU.

18.7 A Party furnishing equipment (the furnishing Party) under this MOU will include in its equipment acquisition contracts indemnity provisions which will reimburse the other Party for any patent infringement costs

incurred by the other Party as a result of its use or disposal under the MOU of equipment furnished by the furnishing Party, and if the furnishing Party fails to do so, it will reimburse the other Party for such patent infringement costs. It is further agreed that the other Party will provide the furnishing Party with notice as soon as practicable of any claim or suit alleging infringement of patents concerning such equipment, together with an opportunity under applicable laws, rules or regulations to participate in or undertake the defense of any such claim or suit, and that no settlement of any such claim or suit will be made without the furnishing Party's written consent other than as required by final decree of a court of competent jurisdiction.

ARTICLE 19 FREQUENCY ALLOCATION AND CLEARANCE

19.1 CSA will be responsible for seeking frequency allocation for the microwave sensing frequencies, for data telemetry and for Telemetry Tracking and Command (TT&C). It will be the responsibility of the individual Parties to this MOU, to cooperate with the appropriate competent authorities within their respective countries in obtaining such regional or national clearances, as may be necessary, for the performance of any data acquisition, data reception or TT&C.

ARTICLE 20 EXTENSION OR REDUCTION OF POST LAUNCH OPERATIONS

20.1 For the purpose of this MOU the nominal lifetime of post launch operation is five years.

20.2 In the event that the performance of the Satellite falls below nominal at any time during the mission, the decisions on changes in operational procedures will be taken by CSA, at the time of the event based on guidelines established by the ISC and direct consultations with the other Party.

20.3 In the event that, at the end of the five year nominal life, the performance of the Satellite seems to warrant extension of RADARSAT operations, the decision to continue will be made by CSA in consultation with the other Party through its representatives on the ISC.

ARTICLE 21 CONFLICTING OBLIGATIONS

21.1 In the event that either Party or its contractors or subcontractors enters into arrangements relating to the RADARSAT Program, whether they predate or antedate this MOU, and such arrangements are in conflict with the provisions of this MOU, it is the responsibility of the Party (or its contractors or subcontractors) to take steps to resolve these conflicts in a manner which does not affect the good of the Project or the interests of the other Party and the provisions of this MOU.

ARTICLE 22 SETTLEMENT OF DISPUTES

22.1 Any dispute which is not settled through the mechanisms provided for in Article 6, or any other issue concerning the interpretation or implementation of the terms of this MOU that cannot be resolved otherwise, will be referred to the appropriate level of authority of the Parties for consideration and action.

ARTICLE 23 AMENDMENT

23.1 This MOU may be amended at any time by written agreement of the Parties.

ARTICLE 24 ENTRY INTO FORCE, TERMINATION AND WITHDRAWAL

24.1 This MOU shall enter into force upon the conclusion of an agreement between the two Governments and shall remain in force for 5 years after the launch date.

24.2 This MOU may be terminated at any time by mutual consent of the Parties. Either Party may withdraw from this MOU after having given the other Party at least 180 days written notice of its intent to withdraw. All remaining necessary arrangements regarding orderly termination of this MOU will be determined by the ISC.

ARTICLE 25 SIGNATURE

25.1 This MOU consists of Article 1 to 25 inclusive and one Appendix; it is done in duplicate, in the English and French languages, both texts being equally authentic.

Signed at: Washington, D.C.

Date: February 27, 1991

For the National Aeronautics and Space Administration

Signed at: Washington, D.C.

Date: February 27, 1991

For the Canadian Space Agency of Canada

Signed at: Washington, D.C.

Date: February 27, 1991

For the National Oceanic and Atmospheric Administration of the Department of Commerce

Of the United States of America.

APPENDIX ABBREVIATIONS AND DEFINITIONS

ABBREVIATIONS

(CSA)	Canadian Space Agency
(EAO)	Experiment Announcement of Opportunity
(EGSE)	Electrical Ground Support Equipment
(EMR)	Department of Energy, Mines and Resources
(GSE)	Ground Support Equipment
(HBRD)	High Bit Rate Data
(JPIP)	Joint Project Implementation Plan
(JSVT)	Joint Sensor Validation Teams
(MGSE)	Mechanical Ground Support Equipment
(MOU)	Memorandum of Understanding
(MCF)	Mission Control Facility
(MCS)	Mission Control System
(MMO)	Mission Management Office
(NASA)	National Aeronautics and Space Administration
(NESDIS)	National Environmental Satellite Data and Information Service
(NOAA)	National Oceanic and Atmospheric Administration
(PDS)	Primary Data Set
(ISC)	International Steering Committee
(SAR)	Synthetic Aperture Radar
(TT&C)	Telemetry, Tracking and Control
(TT&CS)	Telemetry, Tracking and Control Station
(U.S.)	United States of America

DEFINITIONS

CHANGE CONTROL BOARDS

Committees established within the project management structure of each of the Parties to review proposed design changes and to approve, modify, reject them, or refer them to the ISC.

DATA

A generic term referring to the output from sensors and processing levels. It is usually used in conjunction with a noun making its meaning more specific, vis:

- Access

  The opportunity and means of obtaining data for any desired use, subject to the restrictions imposed by the MOU.

- Acquisition

  The generation of signals on board the Satellite representing a measurement of the phenomenon observed. These data may be transmitted directly to a receiving station or tape recorded for a subsequent dump to a receiving station.

- Distribution

  Making SAR data in the PDS format universally available in accordance with the Project policy of non-discrimination. This function will be filled by a Private sector partnership of companies jointly called the Distributor.

- Geocoded

  Data which has been geometrically and radiometrically corrected and registered to a conventional map grid.

- Reception

  The readout of raw data from the Satellite by telemetry link. This may be a direct transmission of the data as they are acquired, or a dump of tape recorded data.

- SAR

  All forms of SAR data from the raw telemetry data stream to processed geocoded data including the various formats of the PDS.

- Use

  Refers to the different uses to which the data may be put. Controls and restrictions on data use are described in the MOU.

DEMONSTRATION PROJECTS

A limited use of certain data in a particular application, generally including samples of the final product. Demonstration projects may be for user education and may include calibration for particular applications. Timeliness of product delivery may not be essential.

EXCLUSIVE RIGHT

Refers to the distribution of SAR data which is reserved to the company (the Distributor) set up for the purpose. No other person or organization is allowed to distribute data (see Articles 12.5 and 12.7) although it does allow the Parties themselves such distribution privileges as are necessary to meet their objectives. (See Article 11.5)

GOVERNMENT USE

Includes, but is not restricted to, operational surveillance and monitoring required for operational departments or agencies as well as research uses.

GLOBAL

The entire earths surface which is accessible by a given sensor. Distinction is not made between oceans, land and sea or continental ice sheets.

MISSION CONTROL SYSTEM (MCS)

The MCS comprises:

i) the Mission Management Office (MMO) which coordinates all ground services including data quality control and the administration of data policy,

ii) the Mission Control Facility (MCF) which schedules and monitors all communication with the Satellite, including its state of health, and

iii) the Telemetry Tracking and Control Station (TTCS) which is the ground end of the communication link with the satellite.

NON-DISCRIMINATION

The requirement that data be made available on the same terms to all Third Party users.

PARTIES

The Agencies signatory to the MOU.

RECEIVING MASK

The boundary on the earths surface surrounding a receiving station defining the region within which the nadir point of the Satellite must fall for there to be good data reception.

SPONSORED

Refers to a class of bona fide research and experimental studies and application demonstrations conducted in furtherance of the objectives of the Project and approved by the Parties individually or jointly. They generally result from either agreements between government agencies or a proposal submission and peer review process such as would normally be expected to lead to the acceptance or rejection of funding of the proposal.

THIRD PARTIES

Any person, organization, or agency who is neither a part of nor sponsored by, according to the provisions of Article 11.5, the executive branch of the countries represented by the Parties.

VALUE-ADDED PRODUCTS

Products resulting from the interpretation of SAR data, and/or the addition of data or information from other sources.

AMENDMENT
TO THE
MEMORANDUM OF UNDERSTANDING
BETWEEN
THE CANADIAN SPACE AGENCY OF CANADA
AND
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
OF THE DEPARTMENT OF COMMERCE
OF THE UNITED STATES OF AMERICA

CONCERNING THE RADARSAT PROJECT
SIGNED AT WASHINGTON ON FEBRUARY 27, 1991

WHEREAS the Canadian Space Agency (CSA) of Canada and the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration of the Department of Commerce (NOAA) of the United States of America, hereinafter referred to as "the Parties," have entered into a Memorandum of Understanding Concerning the RADARSAT Project, signed at Washington on February 27, 1991 (the MOU);

WHEREAS the Parties note the success of their cooperation under the MOU;

WHEREAS the Parties note as well the successful operation of the RADARSAT satellite, which will soon exceed its nominal lifetime;

WHEREAS the Parties recognize that this cooperation will, under the terms of the MOU, come to an end on November 4, 2000, unless extended; and

WHEREAS the Parties now wish to enter into this Amendment to the MOU in order to extend the duration and amend the terms of the MOU and, hence, to continue their mutually beneficial relationship;

THE PARTIES HAVE REACHED THE FOLLOWING UNDERSTANDING:

ARTICLE 1

ARTICLE 5, Clause 5.2, Paragraph xvi, is hereby amended by deleting it in its entirety, and substituting therefor the following:

"xvi) to reorient the Satellite once, so that the SAR beam is directed to the south to enable complete SAR coverage of the Antarctic continent. The scheduling and exact timing of this activity will be decided by the International Steering Committee (ISC)."

ARTICLE 2

ARTICLE 5, Clause 5.2, is hereby amended by adding a new Paragraph xvii) as follows:

"xvii) to provide a Modified Antarctic Mapping Mission (MAMM) subject to the successful completion of activities described under Paragraph xvi. The MAMM will be performed between Fall of 2000 and Fall of 2001 using SAR on-time allocation over and above the existing U.S. allocation. CSA and NASA are responsible for establishing the detailed terms and conditions of the MAMM."

ARTICLE 3

ARTICLE 24, Clause 24.1, is hereby amended by deleting it in its entirety and substituting therefor the following:

"24.1 This MOU will take effect upon the conclusion of an agreement between the two Governments, and will remain in effect for ten (10) years after the launch date or until one of the following events occurs:

(a) the termination of RADARSAT satellite operations; or

(b) the launch and the entry into operations of Canada's second RADARSAT satellite, RADARSAT 2."

ARTICLE 4

This Amendment will be read and construed with the MOU, and all terms and conditions of the MOU, except to the extent expressly amended herein, will remain in effect.

This Amendment will come into effect upon signature.

DONE in duplicate at Washington in the English and French languages, both texts being equally valid, this 24th day of October, 2000.

FOR THE CANADIAN SPACE AGENCY
OF CANADA

W.M. (Mac) Evans
President

FOR THE NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION OF
THE UNITED STATES OF AMERICA

Daniel S. Goldin
Administrator

FOR THE NATIONAL OCEANIC
AND ATMOSPHERIC
ADMINISTRATION OF THE
DEPARTMENT OF COMMERCE OF
THE UNITED STATES OF AMERICA

D. James Baker
Administrator