MEMORANDUM OF UNDERSTANDING
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AND
THE DEFENSE MAPPING AGENCY
FOR A COOPERATIVE FLIGHT OF THE
SHUTTLE RADAR TOPOGRAPHY MISSION

ARTICLE I: GENERAL

1. The National Aeronautics and Space Administration (hereinafter referred to as NASA) and the Defense Mapping Agency (hereinafter referred to as DMA) desire to extend fruitful cooperation of previous joint projects and affirm their mutual interest in carrying out further cooperative activities for Earth sciences. The Shuttle Radar Topography Mission (SRTM) will consist of the Spaceborne Imaging Radar-C (SIR-C) and, following negotiations with the German (DARA) and Italian (ASI) Space Agencies, the X-Band Synthetic Aperture Radar (X-SAR). Both instruments will be modified to operate as interferometers. The concept for SRTM has been developed in conjunction with scientists and engineers from NASA, DMA and other Department of Defense (hereinafter referred to as DOD) agencies. SIR-C/X-SAR were flown on NASA's SRL-1 and SRL-2 missions in April and October 1994.

2. The primary objective of SRTM will be to measure the topographic surface of the Earth. SRTM will produce terrain height data for use by the civilian and defense community as provided herein.

ARTICLE II: PURPOSE

This Memorandum of Understanding (MOU) defines the terms and conditions under which NASA and DMA agree to cooperate on the SRTM mission. SRTM is described in the October 11, 1995 SRTM cost review package (See Attachment 1). Specifically, this MOU describes the managerial, technical, and operational interfaces between NASA and DMA that will be necessary to ensure continuation of and compatibility between their respective activities.

ARTICLE III: SCOPE

SRTM will be a reflight, on the NASA Space Shuttle, of the SIR-C/X-SAR hardware, modified with a boom and additional antenna to operate as an interferometer. The instrument will be capable of collecting near-global, contiguous SAR and Interferometric SAR (IFSAR)

data covering all land areas between approximately 60° north and 54° south latitude that can be processed to generate terrain height data with approximately 16 meter absolute vertical accuracy at 1 second of arc latitude and longitude. The terrain data generated from the mission will satisfy the terrain height data set specifications, referred to as Interferometric Terrain Height Data-2 (ITHD-2), described in Attachment 2.

ARTICLE IV: AUTHORITY

1. The authority for NASA entering into this MOU is Section 203(c) of the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2473(c)).

2. The authority for DMA entering into this MOU is 32 Code of Federal Regulations (C.F.R.) Part 399.

ARTICLE V: NASA RESPONSIBILITIES

1. To implement this cooperative program, NASA will, in accordance with the SRTM Implementation Plan to be developed, carry out the following responsibilities:

(a) Provide the existing SIR-C/X-SAR hardware in functional condition, as well as any infrastructure necessary for a reflight of such,

(b) Design the SRTM system in cooperation with DMA, secure or fabricate the necessary additional components, and modify the existing SIR-C hardware and software to operate as an interferometer;

(c) Integrate and test the SRTM system and prepare for launching by the Space Shuttle;

(d) Design and implement necessary ground systems for mission operations, SAR and IFSAR data processing, and generating the registered C-band scansar digital elevation model (DEM) data sets;

(e) Negotiate with DARA and ASI to provide for the upgrade, delivery, and integration of the interferometric X-SAR instrument, along with the necessary ground systems, mission operations and data processing support, and exchange of data consistent with Article VIII of this agreement and Article IX of the NASA/DARA SIR-C/X-SAR MOU as amended;

(f) Launch the SRTM system in late FY 2000 or earlier on the Space Shuttle in accordance with the schedule as defined in the SRTM Implementation Plan;

(g) Continue to examine and consult with DMA on alternatives for an earlier launch in either FY 1998 or FY 1999 consistent with Attachment 3 (letters between the Undersecretary of Defense for Acquisition and Technology and the Administrator of NASA);

(h) Operate the SRTM system, acquire, calibrate and process the SAR and IFSAR data for each ascending and descending pass over land areas, and generate a strip of DEM data sets in accordance with the schedule defined in the SRTM Implementation Plan under development;

(i) Produce a mosaic of the strips of DEM data sets from each ascending and descending orbit and use them to generate an ITHD-2 data set for DMA;

(j) Provide to DMA the C-Band SAR data from ascending and descending orbits into orthorectified image strips that can be made into a mosaic (image data will be provided in National Image Transfer Format-2 (NITF-2)); and,

(k) Consistent with Article VIII, archive and distribute data from SRTM.

ARTICLE VI: DMA RESPONSIBILITIES

1. To implement this cooperative program, DMA will, in accordance with the SRTM Implementation Plan to be developed, carry out the following responsibilities:

(a) Function as a liaison to the DOD community for SRTM;

(b) Represent DOD by defining the data processing priorities;

(c) Provide technical guidance to NASA for preparation and delivery of data sets to DMA;

(d) Provide technical review of SRTM, and appropriate representation at NASA SRTM design reviews in accordance with the schedule outlined in the SRTM Implementation Plan;

(e) Provide the Jet Propulsion Laboratory (JPL) with the best available digital topographic data base that will facilitate the verification of SRTM terrain height data during the processing;

(f) Function as liaison to solicit support for SRTM-related joint research with the Advanced Research Project Agency (ARPA) in the use of High Performance Computing Centers (HPCC) for generation of SRTM global data sets free of usage fees to NASA;

(g) Validate the terrain height data from NASA and populate the terrain height data base for DMA accordingly;

(h) Produce a 3 second of arc latitude and longitude data set from the ITHD-2 data set; and,

(i) Provide to NASA copies of the ITHD-2 data set and any data set generated from it for distribution. Notwithstanding the provisions of Article VIII, NASA shall not be restricted from agency access to and use of any data set derived from SRTM. Consistent with Article VIII, provide copies of the ITHD-2 data set and any data set generated from it to other parties.

ARTICLE VII: POINTS OF CONTACT

The NASA points of contact for SRTM are:

SRTM Program Manager
Office of Mission to Planet Earth
Code YF
NASA Headquarters
Washington DC 20546

SRTM Program Scientist
Office of Mission to Planet Earth
Code YS
NASA Headquarters
Washington DC 20546

The DMA points of contact for SRTM are:

DMA/ATSS
Science and Technology Office
Stop: A-10
Defense Mapping Agency
8613 Lee Highway
Fairfax, VA 22031-2137

DMA/ATCT
Terrain Modeling Project Office
Stop: A-13
(Same As Above)

DMA/CMP
Programs/Budget Division
Stop: A-04
(Same As Above)

DMA/OGC
Customer Support Federal Agencies Group
Stop: A-12
(Same As Above)

DMA/RP
Requirement and Policy Integration Directorate
Stop: A-30
(Same As Above)

ARTICLE VIII: DATA RIGHTS AND RELEASE

1. It is the intent of the parties that no data from SRTM will be classified.

2. For purposes of Titles 5 and 10 of the United States Code, the raw phase history information, ITHD-2, and strip DEM with 30 meter spatial resolution outside the United States are under the control of DOD.

3. NASA retains the right to distribute raw (amplitude) and processed image data obtained from SRTM. The data will be archived in the appropriate NASA data center and made available to all users without restriction and at no more than the cost of fulfilling the user request.

4. Terrain height data greater than or equal to three seconds of arc latitude and longitude generated from SRTM may be released and distributed by NASA and DMA without restrictions.

5. Raw phase history information, terrain height data of 1 second of arc latitude and longitude (i.e., ITHD-2 data sets), or strip DEM with 30 meter spatial resolution, over the United States may be released and distributed by NASA and DMA without restrictions.

6. Release of raw phase history information, terrain height data of 1 second of arc latitude and longitude (i.e., ITHD-2 data sets), or strip DEM data sets with 30 meter spatial resolution outside the United States will be in accordance with guidelines developed and agreed jointly by DMA and NASA, provided nothing in these guidelines shall prevent DOD from releasing this data for national security or security assistance purposes. The Parties will consult at least annually to review these guidelines.

ARTICLE IX: FUNDING AND SCHEDULE

1. NASA will provide the original SIR-C hardware and necessary infrastructure, which was developed and implemented for the previous SRL missions, for modification to support SRTM.

2. DMA will secure DOD payment to NASA to enable the addition of a flight on the Space Shuttle manifest and for payment of the agreed added costs for interferometric topographic data acquisition including the costs associated with modifications to the SIR-C hardware, mission operations, NASA management, data acquisition, and processing. DMA shall make payment to NASA for these requirements using a Military Interdepartmental Purchase Request (MIPR) or other valid authorizing document to transfer funds to NASA.

3. This agreement shall comply with NASA Financial Management Manual 9090. In addition, NASA will undertake these activities only within the limits of the funds advanced and transferred into the deposit account. Total DMA funding for SRTM will not exceed the following unless mutually agreed: ($ in millions).

	FY96	FY97	FY98	FY99	FY00	TOTAL
SRTM Project Costs	34.5	30.4	23.2	15.6	9.6	113.3
(1998 Launch Readiness Date)	34.5	30.4	23.2	8.1	2.1	98.3
(2000 Launch Readiness Date)				7.5	7.5	15.0
Space Shuttle Marginal Launch Costs in FY98$ (FY00 Launch)				50.0		50.0

4. Should an opportunity arise that allows SRTM to launched in FY 1998 or FY 1999, the Space Shuttle marginal costs will be rephased accordingly to support the earlier launch date. The incremental costs identified for a late FY 2000 launch will be reduced accordingly.

5. Should an opportunity arise that allows SRTM to be manifested as one of NASA's annually budgeted flights, NASA will seek to minimize the Space Shuttle marginal cost required from DOD.

ARTICLE X: LIABILITY

1. The purpose of this clause is to establish a cross-waiver of liability between the Parties and their related entities, in the interest of encouraging participation in the exploration,

exploitation, and use of outer space. This cross-waiver of liability shall be broadly construed to achieve this objective.

2. As used in this cross-waiver, the term:

(a) "Party" means a person or entity that signs this agreement;

(b) "Related Entity" means:

(i) a contractor or subcontractor or a Party at any tier;
(ii) a user or customer of a Party and any tier; or
(iii) a contractor or subcontractor of a user or customer of a Party at any tier.

"Contractor" and "Subcontractors" include suppliers of any kind;

(c) "Damage" means:

(i) bodily injury to, or other impairment of health of, or death of, any person;
(ii) damage to, loss of, or loss of use of any property;
(iii) loss of revenue or profits, or
(iv) other direct, indirect, or consequential damage;

(d) "Payload" means any property to be flown or used on or in the Shuttle; and

(e) For the purposes of this Agreement, "Protected Space Operations" means all launch vehicle and payload activities on Earth, in outer space, or in transit between Earth and outer space done in implementation of this Agreement. Protected Space Operations begins at the signature of this Agreement and ends when all activities done in implementation of this Agreement are completed. It includes, but is not limited to:

(i) research, design, development, test, manufacture, assembly, integration, operation, or use of: the Space Shuttle, transfer vehicles, payloads, related support equipment, and facilities and services.
(ii) all activities related to ground support, test, training, simulation, or guidance and control equipment and related facilities or services. "Protected Space Operations" excludes activities on Earth which are conducted on return from space to develop further a payload's product or process for use other than for Shuttle-related activities necessary to complete implementation of this Agreement.

3. (a) Each Party agrees to a cross-waiver of liability pursuant to which each Party waives all clams against any of the entities or persons listed in sub-paragraphs (i) through (iv) of this section based on damage arising out of Protected Space Operations. This cross-waiver shall apply only if the person, entity, or property causing the damage is involved in protected space causing the damage is involved in protected space operations under a NASA agreement for Shuttle services and the person, entity, or property damaged is damaged by virtue of its involvement in protected space operations under a NASA agreement for Shuttle services. The cross-waiver shall apply to any claims for damage, whatever the legal basis for such claims, including but not limited to delict and tort (including negligence of every degree and kind) and contract, against:

(i) another Party;
(ii) any party who has signed a NASA agreement that includes Shuttle services;
(iii) a related entity of another Party;
(iv) the employees of any of the entities identified in sub-paragraphs (i) and (iii) of this section.

(b) In addition, each Party shall extend the cross-waiver of liability as set forth in sub-paragraph (a) of this section to its own related entities by requiring them, by contract or other wise, to agree to waive all claims against the entities or persons identified in paragraphs (a)(i) through (a)(iv) of this section.

(c) Notwithstanding the other provisions of this section, this cross-waiver of liability shall not be applicable to:

(i) claims between a Party and its own related entity or between its own related entities;
(ii) claims made by a natural person, his/her estate, survivors, or subrogees for injury or death of such natural person, except when a subrogee is one of the Parties;
(iii) claims for damage caused by willful misconduct;
(iv) intellectual property claims;
(v) contract claims between the Parties based on the express contractual provisions of this Agreement;
(vi) claims for damage based on a failure of the Parties of their related entities to flow down the cross-waiver.

(e) Nothing in this section shall be construed to create the basis for a claim or suit where none would otherwise exist.

ARTICLE XI: SETTLEMENT OF DISPUTES

NASA and DMA agree that any dispute as to the interpretation or implementation of this Agreement shall be resolved through consultation between the points of contact identified in Article 7. Any dispute not resolved at this level shall first be referred to the NASA Associate for Mission to Planet Earth and the Director of DMA for resolution. Any dispute which cannot be resolved at this level shall be referred to the NASA Deputy Administrator and the DOD Undersecretary of Defense for Acquisition and Technology for settlement.

ARTICLE XII: ENTRY INTO FORCE, DURATION AND TERMINATION

This agreement shall enter into force upon the last signature and shall remain in force for eight years after the launch of SRTM. The agreement may be amended at any time by mutual written agreement and may be terminated by either of the consenting parties after ninety (90) days notification of intent to terminate.

For DMA:

J. J. Dantone, Jr.
Rear Admiral, USN

Date 8 Jan 96

For NASA:

W. F. Townsend
Deputy Associate Administrator for
Mission to Planet Earth (Programs)

Date 6/7/96