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**Memorandum of Understanding  
between the  
National Aeronautics and Space Administration  
of the United States  
and the  
German Aerospace Center  
for  
International Cooperation on the GRACE Mission**

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### **Preamble**

The National Aeronautics and Space Administration (NASA) of the United States and the German Aerospace Center (DLR) as the Parties to this Memorandum of Understanding (MOU):

Recalling the need for a mission to obtain a set of global, homogeneous, high-resolution gravity measurements, a need which has been articulated consistently since 1969;

Noting that the international scientific community places a high priority on a gravity mapping mission;

Recalling that, over the past 25 years, the United States, Germany, and the European Community have used tracking data from an ever-increasing number of satellites to improve incrementally the model of the gravity field;

Desiring to extend the fruitful cooperation between NASA and DLR in the Challenging Mini-Satellite Payload for Geoscientific Research and Applications (CHAMP) mission;

Concluding that it is technically feasible to conduct a Satellite-to-Satellite-Tracking (SST) gravity mission that will capitalize on the heritage of CHAMP; and

Convinced of the scientific value of the more accurate high-resolution data that can be provided by such a mission;

Have agreed as follows:

### **Article 1 - Purpose**

NASA and DLR each set forth in this MOU the general responsibilities of the Parties and the terms and conditions under which they will cooperate in the Gravity Recovery and Climate Experiment (GRACE) mission.

### **Article 2 - Mission Description**

The GRACE mission will provide a new model of the Earth's gravity field at monthly intervals for a period of 5 years. The model gravity fields will be used to help study global climatic issues. The GRACE mission will acquire the data for the gravity fields by flying two polar-orbiting satellites in a loosely controlled tandem formation. Variations in the Earth's gravity field will cause the distance between the two satellites to vary. This variation will be measured with high accuracy by a microwave link between the two satellites and measurements of these variations will be used to determine the Earth's gravity field.

### **Article 3 - Responsibilities of DLR**

To implement this cooperative project, DLR will use reasonable efforts to carry out the following responsibilities:

1. Support NASA as necessary in the design, development, integration and qualification for space flight of the two GRACE satellites and their instrumentation to achieve the scientific objectives of the mission, and to assure compatibility of the flight segment of the mission with the launch vehicle and the mission operations system;
2. Provide dedicated launch services on a ROCKOT launch vehicle from Russia to deliver two GRACE satellites to a near polar orbit on a date no earlier than March 2001. If excess mass capability is available, DLR may launch one or more co-passenger satellites provided that there is no interference or impact on the GRACE mission's launch schedule, cost, operations, or other requirements;
3. Provide NASA with specifications of the ROCKOT launch vehicle environmental conditions, safety requirements, and appropriate mechanical and electrical interfaces for use in the design of the two GRACE satellites;
4. Provide required technical information to enable NASA to assess the feasibility of providing available assets for telemetry, tracking and command (TT&C) support of the spacecraft during the Launch and Early Orbit Phase (LEOP) of the mission, including initial acquisition support, and for contingency TT&C support of the spacecraft for the duration of the mission;
5. Develop and provide the mission operations and telecommand systems for the GRACE mission and operate the mission from launch until completion;
6. Maintain and operate the German-controlled ground network of Global Positioning System (GPS) tracking stations which were implemented to support the CHAMP mission and are also required for the GRACE mission;
7. Extend and develop the science data system which is being implemented to support CHAMP, for the GRACE mission requirements;
8. Produce and archive the level-0 data products from the GRACE satellites and make them available to NASA within 24 hours of acquisition from the two GRACE satellites;
9. Promptly inform the NASA Principal Investigator (PI), Dr. Byron Tapley of the University of Texas, and NASA of any technical or programmatic problems which may affect overall GRACE project schedules, cost, or performance;

10. Support the development of the Cooperative Project Plan (CPP) as detailed in Article 5;
11. Consistent with relevant laws, arrange with the ROCKOT launch provider or governmental authorities that NASA-provided items will receive prompt customs entry at the Russian port-of-entry, and that the NASA-provided items will not be uncrated or removed from their shipping containers prior to arrival at the launch processing site, and then only by NASA and/or its contractors;
12. Provide for the transportation of the flight segment of the GRACE mission (which consists of two satellites, the instrumentation to calibrate the satellite-to-satellite tracking measurements) and the associated ground support equipment from the international port-of-entry to the Russian launch site; and
13. Arrange for the right of NASA and/or NASA contractors: (1) to house the flight segment and ground support equipment in a secure payload processing facility while at the launch site; (2) to accompany and be physically present with the flight segment and ground support equipment during prelaunch and launch activities at the launch site; and (3) such other rights as may be agreed in the CPP.

#### **Article 4 - Responsibilities of NASA**

To implement this cooperative project, NASA will use reasonable efforts to carry out the following responsibilities:

1. Design, develop, integrate, and qualify for space flight, the two GRACE satellites and their instrumentation to achieve the scientific objectives of the mission, and to assure compatibility of the flight segment of the mission with the ROCKOT launch vehicle, and the mission operations system;
2. Develop the flight segment of the GRACE mission which consists of two satellites and the instrumentation to calibrate the satellite-to-satellite tracking measurements; and deliver the flight segment to the international port-of-entry in Russia;
3. If feasible, and as agreed after analysis of information provided pursuant to Article 3, paragraph 4, provide available assets for TT&C support of the spacecraft during the LEOP of the mission, including initial acquisition support, and contingency TT&C support of the spacecraft for the duration of the mission.
4. Continue to maintain and operate the NASA-controlled ground network of GPS tracking stations which were implemented to support the CHAMP mission and are also required for the GRACE mission;

5. Develop the requisite techniques and capabilities for determining the level-1 and level-2 gravity data products;
6. Produce, validate and archive the level-1 data products from the GRACE instruments and make them available to DLR within 72 hours of acquisition of the level-0 data from DLR's operations center for the GRACE mission;
7. Promptly inform the DLR Co-Principal Investigator (Co-PI), Prof. Christopher Reigber of the GeoForschungsZentrum Potsdam, and DLR of any technical or programmatic problems which may affect overall GRACE project schedules, cost, or performance; and
8. Support the development of the CPP as detailed in Article 5.

#### **Article 5 - Cooperative Project Plan**

The CPP, will be the vehicle for coordinating implementation of this cooperative project and will include, *inter alia*, the following elements:

1. NASA is the lead agency for the GRACE project.
2. DLR is responsible for the German contribution to the mission.
3. The PI is responsible to NASA for the overall mission, and the Co-PI is responsible to the PI for the implementation of the German mission elements.
4. NASA and DLR, for the most part, will meet their respective responsibilities using contracts with research institutes, universities, and industry.
5. If it becomes necessary to change the PI or Co-PI, NASA and DLR will consult prior to appointment of a new PI or Co-PI.

Furthermore, the CPP will provide for:

6. The establishment by NASA of a GRACE Project Office to provide for project planning and management. This office will be responsible for the overall design, fabrication, test, calibration, integration, on-orbit verification of the GRACE instrumentation and satellites and for data distribution to U.S. investigators.
7. The establishment a German GRACE Project Office that will provide satellite-to-ROCKOT launch vehicle compatibility assessment, launch services, and launch of GRACE. This office will be responsible for the overall design of the mission operations system, and for operation of the mission and management of data from the GRACE instrumentation. The data management will include delivery of the

level-0 data to NASA's GRACE data system and distribution of the level-1 and level-2 data to the European investigators.

Furthermore, the CPP will cover:

8. The respective roles and responsibilities of the PI, Co-PI, NASA Project Manager (Mr. Ab Davis of the Jet Propulsion Laboratory), and DLR Project Manager (Mr. Frank Flechtner), in particular but not limited to, establishing a protocol and chain of authority for making decisions relevant to key milestones over the life of the project.
9. Delivery schedules, formal reviews and other management procedures.
10. All relevant technical information that is needed for effective cooperation.
11. All necessary launch site requirements, such as facilities, services and security.
12. Rules for communications between organizations. While direct interaction between various contractors will be required for the purpose of exchanging information, all interactions must be coordinated by the appropriate contracting technical officers designated by the PI and Co-PI. Technical direction to any contractor must flow down the contracting chain from the respective prime contractors and be consistent with Article 9 of this MOU.
13. The Parties will consult prior to undertaking activities involving participation by third parties in the plan to implement the project. It is understood that individual scientific investigators are not considered third parties for purposes of this type of consultation. In case of conflict between the CPP and this MOU, the MOU shall prevail.

#### **Article 6 - Project Oversight**

Within 6 months of execution of this MOU, a Steering Group will be established by the PI and the Co-PI to provide oversight of the project. The membership and operating rules of the Steering Group will be established by the PI and Co-PI. The PI will provide administrative support to the Steering Group.

#### **Article 7 - Scientific Investigations**

1. In accordance with the Earth System Science Pathfinder (ESSP) program guidelines, the PI and the Co-PI will be jointly responsible for the development of the scientific aspects of the cooperative mission and for assuring that the data are effectively used and that the results are expeditiously produced and made

available. They will also be jointly responsible for coordinating science requirements, plans and field experiments with other organizations.

2. NASA will allocate resources to fund a post-launch Science Data Analysis Program (SDAP) for broad scientific studies of the Earth using the data sets provided by the ESSP missions. The follow-on SDAP, which will be open to all parties interested in ESSP mission data sets, will focus on expanded interpretation and analysis activities.
3. Scientific investigations in Germany will be funded through respective German research establishments and universities with resources provided by appropriate funding organizations, such as the German Research Society. Participation will be offered through an appropriate announcement of opportunity.

#### **Article 8 - Data Policy**

Following a preliminary evaluation and assessment of data to be conducted during the first 6 months of the mission, the level-1 data will be placed in an appropriate data center and will be made available to all users without restriction at no more than the cost of fulfilling the user request.

Results of the investigation will be made available to the general scientific community through publication in appropriate journals or other established channels as soon as possible and consistent with good scientific practices. In the event such reports or publications are copyrighted, DLR and NASA shall have a royalty-free right under the copyright to reproduce, distribute and use such copyrighted work for their own purposes.

#### **Article 9 - Exchange of Technical Data and Goods**

The Parties are obligated to transfer only those technical data and goods necessary to fulfill their respective responsibilities under this MOU, in accordance with the following provisions:

1. Interface, integration, and safety data (excluding detailed design, development, production, and manufacturing data, and associated software) shall be exchanged by the Parties without restriction as to use or disclosure, except as specifically required by national laws and regulations.
2. In the event a Party finds it necessary to transfer technical data or goods which are proprietary or subject to export control in carrying out its responsibilities under this MOU, the provisions of this paragraph shall apply. In transferring data and goods which are proprietary or subject to export controls, and for which protection is to be maintained, such technical data shall be marked with a notice

and such goods shall be specifically identified to indicate that they shall be used and disclosed by the receiving Party only for the purposes of fulfilling the receiving Party's responsibilities under this MOU, and that the marked technical data and identified goods shall not be disclosed or re-transferred to any other entity (including the receiving Party's contractors, subcontractors, and other supporting entities) without the prior written permission of the furnishing Party. The receiving Party agrees to abide by the terms of the notice, and to protect any such marked technical data or identified goods from unauthorized use and disclosure. To the extent that the furnishing Party provides approval for further transfers of marked technical data or specifically identified goods to the receiving Party's contractors, subcontractors, and other supporting entities, the receiving Party shall obtain the prior agreement of those entities to likewise protect the marked data and/or identified goods, and abide by the furnishing Party's notice not to disclose, re-transfer or use for any purpose other than fulfilling the receiving Party's responsibilities under this MOU.

3. The Parties are under no obligation to protect any unmarked technical data or unidentified goods. However, all technical data and goods transferred under this MOU shall be used exclusively for the purposes of fulfilling the Parties' responsibilities under this MOU. Nothing in this Article requires the Parties to transfer technical data or goods contrary to national laws and regulations relating to export control or control of classified data.

#### **Article 10 - Invention and Patent Rights**

Nothing in this MOU shall be construed as granting or implying any rights to, or interest in, patents owned or inventions which are independently developed by the Parties or their contractors or subcontractors.

#### **Article 11 - Funding**

Each Party shall bear the costs of discharging its respective responsibilities under this MOU, including travel and subsistence of each agency's personnel and transportation of its own equipment and associated documentation. It is understood that the ability of the Parties to carry out their respective responsibilities is subject to their respective funding procedures and the availability of appropriated funds.

#### **Article 12 - Customs and Taxes**

Each Party shall seek to facilitate free customs clearance and waiver of applicable duties and taxes for equipment and related goods necessary for the implementation of this MOU. Such arrangements shall be fully reciprocal. DLR will be responsible for any

duties and taxes assessed by Russian authorities, based on the current estimate of 0.15% of the value, on the NASA-provided flight segment and/or associated ground support equipment.

### **Article 13 - Publication of Public Information and Results**

The Parties retain the right to release public information regarding their own activities under this MOU. The Parties shall coordinate with each other in advance concerning public information activities which relate to the other Party's responsibilities or performance under this MOU.

### **Article 14 - Liability**

1. The purpose of this Article is to establish a cross-waiver of liability between the Parties and the Parties' related entities in the interest of encouraging space exploration and investment. The cross-waiver of liability shall be broadly construed to achieve this objective.
2. For the purposes of this Article:
  - (a) Related Entity means:
    - (i) a contractor or subcontractor of a Party at any tier;
    - (ii) a user or customer of a Party at any tier;
    - (iii) a contractor or subcontractor of a user or customer of a Party at any tier; or
    - (iv) This subparagraph may also apply to a State or an agency or an institution of a State having the same relationship to a Party as described in (i) through (iii) above or otherwise engaged in the implementation of Protected Space Operations as defined in (2)(e) below.

"Contractors" and "Subcontractors" include suppliers of any kind.

- (b) 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.

- (c) The term "launch vehicle" means an object or any part thereof intended for launch, launched from Earth, or returning to Earth which carries payloads or persons, or both.
- (d) The term "payload" means all property to be flown or used on or in a launch vehicle.
- (e) The term "Protected Space Operations" means all activities pursuant to this MOU, including launch vehicle activities and payload activities on Earth, in outer space, or in transit between Earth and outer space. It includes, but is not limited to:
  - (i) research, design, development, test, manufacture, assembly, integration, operation, or use of launch or transfer vehicles, payloads, or instruments, as well as 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.

The term "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 the activity in question.

- 3. (a) Each Party agrees to a cross-waiver of liability pursuant to which each Party waives all claims against any of the entities or persons listed in sub-paragraphs (i) through (iii) below 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 Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations. 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) the other Party;
  - (ii) a related entity of the other Party;
  - (iii) the employees of any of the entities identified in sub-paragraphs (i) and (ii) above.
- (b) In addition, each Party shall extend the cross-waiver of liability as set forth in paragraph 3 (a) above to its own related entities by requiring them, by contract or otherwise, to agree to waive all claims against the entities or persons identified in sub-paragraphs 3 (a) (i) through 3 (a) (iii) above.
- (c) This cross-waiver of liability shall be applicable to liability arising from the Convention on the International Liability for Damage Caused by Space

Objects of March 29, 1972, where the person, entity, or property causing the damage is involved in Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations.

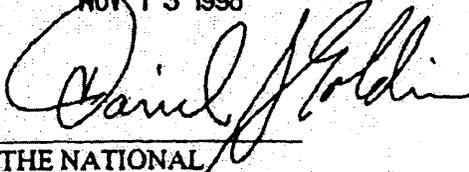
- (d) Notwithstanding the other provisions of this Article, this cross-waiver of liability shall not be applicable to:
- (i) claims between a Party and its own related entity or between its own related entities;
  - (ii) claims made by a natural person, his/her estate, survivors, or subrogees for bodily injury, other impairment of health or death of such natural person, except where a subrogee is one of the Parties;
  - (iii) claims for damage caused by willful misconduct;
  - (iv) intellectual property claims;
  - (v) claims for damage resulting from a failure of the Parties to extend the cross-waiver of liability as set forth in paragraph 3 (b) or from a failure of the Parties to ensure that their related entities extend the cross-waiver of liability as set forth in paragraph 3 (b); or
  - (vi) contract claims between the Parties based on the express contractual provisions.
- (e) Nothing in this Article shall be construed to create the basis for a claim or suit where none would otherwise exist.

#### **Article 15 - Entry into Force, Duration, Amendment and Termination**

This MOU shall enter into force upon signature by both Parties and remain in force until 7 years after the GRACE satellites have been launched. This MOU may be amended or extended by written agreement of the Parties. Either Party may terminate this MOU at any time upon 6 months written notice to the other Party. In the event of such termination, the Parties will consult with each other to minimize the negative effects of such a termination.

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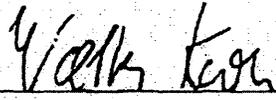
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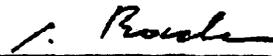
FOR THE NATIONAL  
AERONAUTICS AND SPACE  
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UNITED STATES

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