W. W. Hansen Experimental Physics Laboratory

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305 - 4085

Gravity Probe B Relativity Mission

S1018, Revision -
January 20, 2006

Memorandum of Understanding
between
The Gravity Probe-B Mission
and
The National Space Science Data Center

2/22/06

Ed Grayzeck,
Head, National Space Science Data Center
NASA Goddard Space Flight Center

2/6/06

Francis Everitt
Principal Investigator, Gravity Probe-B
Stanford University

Approved by:

3/03/06

Joseph Bredekamp
Program Manager, NSSDC
NASA Headquarters

3/13/06

Alan Smale
Program Executive, Gravity Probe-B
NASA Headquarters

2/13/06

Tony Lyons
Program Manager
NASA Marshall Space Flight Center

2/8/06

Tom Langenstein
Gravity Probe B Deputy Program Manager
Stanford University

1/30/06

Jennifer Spencer
Data Processing Lead, Gravity Probe-B
Stanford University

2/8/06

Tom Langenstein ITAR Assessment Performed, ITAR Control Req'd? □ Yes ☒ No

Memorandum of Understanding
between
The Gravity Probe-B Mission
and
The National Space Science Data Center

1. Introduction

This is a Memorandum of Understanding (MOU) between the National Space Science Data Center (NSSDC) at Goddard Space Flight Center (GSFC) and the Gravity Probe-B mission (GP-B) at Stanford University. It documents the roles of those organizations in the acquisition, management, dissemination and preservation of data from the Gravity Probe B space mission. This MOU supersedes any prior agreements between the NSSDC and GP-B regarding the archiving and dissemination of relevant data.

The NSSDC was created in 1966 as NASA's only archive for space and Earth science data. The NSSDC's data management role has evolved with the emergence of a series of active archives in both space and Earth science. Presently it has permanent archiving responsibility for NASA space science mission data. It has active archiving responsibilities in certain space science discipline areas. It has additional roles not germane to this MOU. The NSSDC home page is at http://nssdc.gsfc.nasa.gov/.

Gravity Probe-B was begun in 1959, funded by NASA since 1963 (retroactively from 1964). The purpose of the Gravity Probe B Relativity Mission satellite is to measure two relativistic effects on nearly perfect gyroscopes. Einstein's General Theory of Relativity precisely predicts both of these effects; the spacecraft measurements are an experimental test of the General Theory of Relativity.

The two measured relativistic effects are the geodetic effect, which is due to the gravitational interaction of the spinning gyroscope and its orbital angular momentum about the earth, and the motional or frame-dragging effect which is due to the gravitational interaction between the spinning gyroscope and the angular momentum of the earth. The geodetic effect is predicted to cause a drift rate of 6.6 arc seconds per year in the plane of the orbit for a gyroscope in a ~640 km circular orbit, and the motional effect is predicted to cause a drift of the 41 milli-arc seconds per year in a direction perpendicular to the plane of the orbit.

The requirement for the overall accuracy of the Gravity Probe B Experiment is to measure the drift rate of each of the four gyroscopes to an accuracy of 0.5 milli-arc-seconds per year. At this level, the frame dragging effect will be measured to an accuracy of 1%, and the geodetic effect will be measured to an accuracy of 1 part in 10,000. A measurement of the drift rate of the gyroscopes at this level of accuracy will be the most accurate non-null experimental test of the General Theory of

Relativity. Present estimates of the overall accuracy of the experiment indicate that it will be possible to measure the drift rates significantly better than 0.5 milli-arc-seconds per year.

The telemetry from the satellite contains the essential information to determine the gyroscope drift rate as well as the health and safety of the satellite and its subsystems. The Gravity Probe B "Stanford Post-Processing Operations for Science Mission Data" document (S0401D) describes the method for processing and storing this information.

Inconsistencies between current practices and MOU statements, or future modifications to this MOU, will be addressed and agreed to by the Directors of the NSSDC and GP-B, with involvement of relevant NASA program managers when needed. This MOU will be consistent with the GP-B Data Management Plan (S0331A) and, as such, will satisfy GP-B's contract NAS8-39225 requirement for final archiving of data.

2. GP-B and NSSDC

GP-B has interfaces with NASA Headquarters, NASA-funded spaceflight missions, and with other relevant programs designated by NASA. NASA agencies are involved in the creation of the Data Management Plan (DMP), and Data Archive Plan. These documents specify what data and supporting material will be delivered to NSSDC and the delivery schedule.

The NSSDC will ensure that the data and supporting material are effectively accessible by potential users from NASA, other research communities, and by the public. It is expected that some user access will be electronic, but the NSSDC will also satisfy occasional requests for data to be sent offline. The GP-B team will provide supporting documentation and other material to ensure the data is usable.

GP-B will provide copies of its data to the NSSDC for permanent archiving in formats acceptable to GP-B and the NSSDC (and/or it will ensure a parallel flow of data and supporting material directly to the NSSDC). As GP-B releases new products to the public, these products will be transmitted to the NSSDC in a mutually agreed upon manner. For data releases on CD, DVD, or similar media, GP-B shall provide the NSSDC with a set of these volumes. For data to be sent electronically, the details of such transfer shall be devised and agreed upon by GP-B and the NSSDC. Data transferred electronically will be subject to quality assurance by the NSSDC and remote storage of backup copies will be provided by the NSSDC.

3. NSSDC as Permanent Archive

The NSSDC will receive NASA-sanctioned GP-B data and supporting material from GP-B, and it will ensure their long-term preservation against both media deterioration and technology obsolescence. The NSSDC permanent archive is not electronically accessible outside the NSSDC.

The NSSDC assumes that the data and supporting material provided by GP-B is correct. It is the responsibility of GP-B to ensure this correctness when the data are delivered to the NSSDC.

Upon request from GP-B, the NSSDC will provide copies of data and/or supporting material in the same format it was provided by GP-B at the time of the initial delivery.

Upon request from GP-B or the research or public user community, the NSSDC will replicate and mail data volumes to requesters. It will charge end users a fee just sufficient to cover the incremental cost of satisfying the request.

The NSSDC will point users to the appropriate web page as the source of GP-B data for researchers.