Appendix III

Statement of Work

A.Continuous Operation, Support, and Maintenance of Remote Terminal Services

The American Institute in Taiwan's (AIT) designated representative, the University Corporation for Atmospheric Research (UCAR), will provide all required services and personnel to integrate, test, operate and maintain the Remote Terminal Services (RTS) for stations in Alaska and Norway on a 24/7/365 basis for the Taipei Economic and Cultural Representative Office's (TECRO) designated representative, the National Space Organization (NSPO). The RTS will provide ninety percent (90%) or greater operational reliability.

AIT designated representative, UCAR, will provide ground station data reception services from the ground stations in NOAA/NESDIS' Fairbanks Command and Data Acquisition Station (FCDAS) in Alaska and the Kongsberg Satellite Services (KSAT) ground station in Tromso, Norway, and satellite commanding from FCDAS only. The FCDAS station will include a primary and secondary antenna for COSMIC data reception and FORMOSAT-3/COSMIC satellite commanding. The FCDAS station will provide a real-time network interface to TECRO designated representative, NSPO Satellite Operation Control Center (SOCC), for state-of-health telemetry and commanding (T&C). The KSAT station will include a new 3 m receive-only antenna for telemetry. The FCDAS and KSAT ground stations will be able to provide five (5) minute turnaround times from one pass to the next pass. The NESDIS Wallops CDAS (WCDAS) on Wallops Island, Virginia, will provide backup downlink and commanding services for FCDAS on an as-available basis. The National Oceanic and Atmospheric Administration (NOAA) and KSAT will place the received Virtual Channel (VC) data on local servers and initiate the transfer of the data within three (3) minutes of loss-of-signal to AIT designated representative, UCAR, and TECRO designated representative, NSPO, via the internet. The NOAA local servers will store the most recent ten (10) days of COSMIC VC data, and the most recent twenty-four (24) hours of raw data.

AIT designated representative, UCAR, will provide the required RTS for FORMOSAT-3/ COSMIC that are described in Appendix V: FORMOSAT-3/COSMIC Mission Support Plan for NOAA Ground Stations to TECRO designated representative, NSPO. The RTS provided under this Agreement will adhere to the following document in Appendix IV: FORMOSAT-3/COSMIC Ground Network Interface Control Document for NOAA Ground Stations.

AIT designated representative, UCAR, will also provide the necessary engineering and program management support to facilitate the transition from the current RTS provided by Universal Space Network, Inc. (USN) to the RTS to be provided by NOAA. In particular, UCAR will provide:

-> Engineering and management support to help define the ground network interface control document for NOAA, KSAT, UCAR, and NSPO SOCC;

-> Engineering and management support for the testing of ground interfaces between NOAA, KSAT, UCAR, and NSPO SOCC;

-> Aid in managing the testing of the interface between the FORMOSAT-3/COSMIC spacecraft and the new NOAA RTS;

-> Support for ongoing operations and troubleshooting of the interfaces between the NOAA ground stations, UCAR, and the NSPO SOCC;

-> Management and execution of a transition support subcontract with USN;

-> Management and export control of technical documents to non-U.S. entities (i.e. NSPO and KSAT); and,

-> Support for, and will chair, weekly teleconferences with NOAA, KSAT and NSPO as required.

B. Continuous Operation, Support, and Maintenance of the COSMIC Data Analysis and Archive Center (CDAAC)

UCAR CDAAC system will be operated, maintained, and improved in order to maximize the quantity and quality of FORMOSAT-3/COSMIC payload data available to the operational and scientific communities. The main tasks to be performed with the CDAAC include: orbit determination, atmospheric profiling, science data monitoring and improvement, data ingestion/dissemination/archival, and system monitoring. These tasks will be performed by a team of experts from AIT Designated Representative, UCAR, that are familiar with the operational and scientific aspects of the CDAAC software system.

C. Support for NSPO Taiwan Analysis Center for COSMIC (TACC)

AIT Designated Representative, UCAR, will provide up to six hundred and three (603) man-hours per year for routine system maintenance for the TACC. The effort is required for TACC to operate nominally for the FORMOSAT-3/COSMIC mission. The main tasks are described below:

-> Provide monthly upgrades to sync CDAAC and TACC software;

-> Send patches / fixes to TACC when there are critical problems;

-> Provide functional level algorithm descriptions and data flow diagrams for CDAAC 2.0;

-> Provide hardware architecture updates;

-> Provide post-processed FORMOSAT-3/COSMIC data;

-> Provide web access log information;

-> Assist in acquiring new input data products for the TACC (i.e. ECMWF high resolution forecast and analysis model data, EUMETSAT fiducial data); and

-> Provide training to personnel operating the TACC.

D. Payload Operations and Scientific Engineering Support

Payload operations support for CDAAC is required to maximize the quantity and quality of payload data that is delivered to the operational and scientific communities. Payload operations support requires seven (7) days/week monitoring of the data flow from the ground stations to the users, monitoring of the satellite and payload state of health, maintaining the status web pages and database, and monitoring payload data processing for quality control purposes. Anomalies have to be detected and dealt with in a timely manner. As future satellite and payload anomalies arise, UCAR will spend effort to minimize the negative impacts of the anomalies. This effort may include the following tasks:

-> discussing and understanding the anomaly

-> developing tools for mining and analyzing the data

-> developing work-around methods for CDAAC

-> discussing firmware changes with the Jet Propulsion Laboratory (JPL)

-> discussing possible satellite operations changes with NSPO

-> testing effects of changes in CDAAC software and/or firmware

-> communicating changes / impacts with the user community

After the next firmware upload, AIT Designated Representative, UCAR, will work on new tasks. UCAR will make sure that CDAAC processing deals correctly with the new way of scheduling reference satellites. UCAR will investigate if improved L2 phase data (due to turning off of code-enhanced tracking for setting occultation) will lead to fewer failures in soundings and if this would affect the climate data record. There are several other firmware changes, the impacts of which must be carefully investigated and tracked by UCAR.

Payload work is focused on Global Positioning System (GPS) radio occultation receiver (GOX). AIT designated representative, UCAR, will observe GOX SNRs in relation to Tri-Band Beacon (TBB) on/off status. For Tiny Ionospheric Photometer (TIP), UCAR currently produces results for FM-1, 4, 5, 6, but UCAR does not have a deep understanding of these data at this time. Pending user demand, UCAR may have to upgrade its TIP products and its level of in-house knowledge. TIP and TBB require communicating with the user community and providing operations updates as required. UCAR will provide this type of engineering support to the project so that TECRO Designated Representative, NSPO, can properly manage the satellites. This support will be required over the life of the mission.

Weekly teleconferences between UCAR, NSPO and JPL will also be conducted.

E. Ongoing JPL Firmware Support

JPL designed the Blackjack family of receivers. These receivers were built by Broad Reach Engineering (BRE) of Tempe, AZ. Under a separate arrangement, JPL will provide periodic updates and fixes to the FORMOSAT-3/COSMIC receiver firmware. AIT designated representative, UCAR, will provide technical and contract management of JPL's work to upgrade firmware. UCAR, will also contract with BRE to provide GPS hardware engineering analysis and anomaly resolution. The FORMOSAT-3/COSMIC constellation is expected to require software updates (to be provided by JPL) approximately every six (6) months for the remainder of the mission.

F. Program Management Support

For the smooth operation of the FORMOSAT-3/COSMIC constellation and to maximize the scientific productivity of the mission, effective program management and close coordination are required between partners on nearly all aspects of the program. These tasks include payload operation, data distribution policy, data use agreements, data download frequency coordination, joint press releases, joint scientific meetings, collaborative research, financial and contract management, and education and outreach activities.