

ILRS Governing Board Meeting

Technical University of Vienna
Vienna, Austria
April 23, 2012
14:00-16:30 p.m.

Attendees:

Governing Board members:

G. Appleby	P. Bianco
C. Luceri	G. Kirchner
H. Mueller	E. Pavlis
M. Pearlman	D. McCormick
T. VanDam	J. Mueller
U. Schreiber	

Invited guests:

B. Donovan	J. Horvath
M. Wilkinson	H. Donovan
S. Wetzel	R. Ricklefs

Opening Remarks

G. Appleby opened the meeting and welcomed everyone.

David McCormick replaced David Carter as a NASA representative on the Governing Board. Working Group leadership remains the same.

Action Items from Previous GB Meeting

Action: The CB will prepare a letter for NASA HQ regarding the SLR data flow problems. - Done

Action: The CB will prepare the letter of support for the next laser ranging workshop and circulate through the GB for approval - Done

Network and Network Performance (CB)

Network data yield increased again this past year, gaining about 10% as stations came back into operation. Thirty-three stations operated during the last year; 24 met or exceeded the minimum total pass ILRS standard, but only half had LAGEOS data yields at or near 400 passes. Data yield is increasing on the GNSS satellites as more satellites with arrays meeting the ILRS standard are launched. Some stations are still marginal or non-participants in network operations. These stations remain in associate status.

The new Russian stations at Svetloe, Zenechukskaya, and Badary began sending data, which are now in quarantine undergoing checkout. The established stations in Russia did not provide much data. The new SLR station in Sejong Korea, co-located with the new VLBI systems, is in integration and testing and should be operational this year.

The network still struggles with Radioastron; only eleven passes have been tracked since launch (18-Jul-2011), and all were by the Grasse station. Other stations have viewed it optically without ranging success, indicating perhaps a range prediction error or a velocity aberration problem. We have not heard of any Russian station successes.

Stations are still not making the most effective use of their tracking schedules; we are inundated with data from Ajisai and Starlette and lean on data from the higher satellites. Stations are urged to use the real-time web facility at AIUB for scheduling updates.

Action: The CB will remind the stations again about the use of the real-time web facility at AIUB.

The LRO-LR project has done well; over 20,000 minutes of data have been taken to date with many two, three, and even some four station simultaneous events.

Satellites (Missions Working Group)

Currently the network is supporting 56 missions including 20 additional GLONASS satellites not on the roster, plus lunar tracking. Recent launches include GLONASS-130 (28-Nov-2011) and LARES (13-Feb-2012). ZY-3 (09-Jan-2012) was also launched, but technical issues with the satellite have delayed transmission of predictions.

LARES, built by ASI, is an addition to the geodetic satellites constellation, spherical shape with large mass-to-area ratio, requiring even smaller empirical accelerations to be modeled than for LAGEOS.

The Chinese Navigation satellites COMPASS-G1, -I3, -M3 have been approved. COMPASS-G1 and -I3 have been launched; launch of -M3 is imminent. Tracking approval for the Indian navigation satellites IRNSS (ISRO): scheduled for launch in mid-2012 awaits response to some technical questions asked by the Missions Working Group. Other upcoming missions include SWARM (ESA) and SARAL (CNES/ISRO).

Discussion continues on the issue of data availability and mission's relevancy to the ILRS in the decision to provide ILRS tracking support. In some cases the hook may be national commitment to support the ILRS with laser tracking.

Data and Data Flow Issues (Data Formats and Procedures Working Group)

Data Flow

Data inconsistencies between CDDIS/ITT and EDC have been pretty much remedied. Daily file comparison checks have been instituted with routine feedback procedures between the data centers. The only discrepancies left are a few passes that get caught in the last minute transmission-timing schedule. The Analysis Working Group has no problem with this. EDC, ITT, and CDDIS have done a nice job. A recent problem with loss of predictions for the network for several satellites has been resolved.

All stations are encouraged to submit full-rate data (including kHz) to be archived by the Data Centers.

Data Quarantine

At the moment there are some differences in the way EDC and ITT handle quarantine data and some events are slipping through the quarantine net. We have agreed to the following:

- The data receiving OC has the authority to declare quarantine status based on performance or lack of performance, and will inform the station with instruction on how to extricate itself;
- The two OC's will use a standardized station message and will keep each other informed of its actions;
- Stations may place themselves in quarantine by informing the OC;
- Stations with a total lapse of data for 90 days for any reason will be placed in quarantine;
- Standards for emergence from quarantine will be delineated;
- Current quarantine status should be posted on the website in a prominent location;
- The quarantine procedure in the website should be reviewed and updates as per this article.

Action: Ricklefs will work with the OC's to implement the updated quarantine package

Station Change Reporting

Although the situation is improving we still need to reinforce station responsibilities for advance reporting changes to the CB, where quarantine decisions based on configuration and procedural changes are currently made. The CB will inform the OC's on quarantine decisions for notification to the stations.

CRD Format Conversion

CRD conversion date is set for May 2. Only CRD will be issued by the data centers after that date. Data from stations still providing only legacy data will be forward converted by the operations centers. Stations in CRD compliance will be instructed by the OC's to stop sending legacy data once the analysis centers are satisfied that routine data flow has been achieved. The expectation is that this should take no more than a couple of weeks. The Analysis Working Group has been responsible for CRD validations and will continue to do so as present stations convert. New stations may not even generate legacy format data.

The only delinquent major stations are Riyadh (which is in repair at the moment) and San Juan.

Action: The CB will again contact the San Juan Station regarding the CRD format.

Analysis and Data Products (Analysis Working Group)

The weekly and daily operational data products are being delivered routinely by all nine ACs (ASI, BKG, DGFI, ESA, GA, GFZ, GRGS, JCET and NSGF), and combined by the Combination Centers at ASI and JCET.

The new satellites center-of-mass correction tables developed by Graham Appleby and Toshi Otsubo, which include modeling for the time history of station configuration changes, do not give a noticeable improvement in the data fit. We have strong confidence that the new modeling is a

better reflection of reality than the “one size fits all” strategy used earlier, but we need to test and understand it further before adoption.

On May 2, the Daily Product will become the new ILRS official data product. It will be issued with a 2-day latency. The current weekly product will then be used as a test bed for pilot projects for modeling improvements (atmospheric loading, low degree harmonics, etc.) for future data products. Since the IERS GGFC launched a mandatory Pilot Project that all Space Techniques have to support, we have decided to use this PP for testing our s/w implementation and at the same time providing GGFC with the requested test products by July 1, 2012. Work on this PP will start as soon as we can access the required GGFC input files.

Re-analysis of the historical data set starting in 1983 will begin about mid-year, once all improvements have been tested and validated, in preparation for the next ITRF.

The AWG held its spring meeting at TUW yesterday, April 21, 2012, and scheduled the fall meeting to coincide with the ILRS Technical Workshop in Frascati, Italy, on Saturday, November 3, 2012. The meeting was attended by a large group of ILRS associates and several colleagues from other techniques.

Task Force Reports

Normal Point Definition

The Normal Point Task Force (Graham Appleby, Georg Kirchner, Jan McGarry, and Mike Pearlman) is near closure on a revised version of the normal point definition for higher repetition rate ranging systems. We have agreement on the target of mm precision, a maximum of 1000 valid full-rate points per normal point, and a minimum of the Standard Normal Point Interval (SNPI) between the start-time of normal points on any satellite. A decision on the constraints on the starting time of normal points is now being resolved. The Task Force will issue its final revision shortly.

The Task Force did some normal point precision studies on the LAGEOS, Etalon, and GLONASS satellites using the high repetition rate, single photon system at Herstmonceux. With robust data flow (10%), LAGEOS normal points reached an internal precision of 1 -2 mm within 20 to 40 seconds; Etalon, GLONASS and COMPASS reach 2 mm within 200 – 400. Results depend upon data flow rates, but show that normal points duration can be reduced with out losing precision. It was suggested that the results be expressed in terms of number of points received to test the 1000 full rate limit above.

Satellite Center of Mass Corrections

The Satellite Center of Mass Task Force (Graham Appleby and Toshi Otsubo) provided tables for revised satellite center-of-mass corrections for the LAGEOS and Etalon satellites. These revisions incorporate the historical systems configuration and configuration changes, and will affect in particular the CoM values for the higher repetition rate, single photon systems. The tables are posted on the ILRS website. Although the new models more closely reflect the performance of the field systems, preliminary testing by the Analysis Working Group does not show an improvement in data fit. Examination and testing continues.

Lunar Ranging (Juergen Mueller)

The bulk of the lunar ranging data over the past year was taken by Grasse and MLRS on Apollo-15, -14, and -11. No Lunokhod data and no data from APOLLO were entered into the archive.

Action: Randy will check the APOLLO website for recent data.

Additional lunar retroreflectors are being proposed and data and scientific analysis continues at JPL, Paris Observatory Lunar Analysis Center (POLAC), the Institute of Geodesy (IfE), and other specialized centers.

Lunar ranging continues to play a key role in tests of General Relativity including the Equivalence principle (Nordtvedt Effect) and temporal variations in the gravitational constant. Lunar ranging is also the means by which we connect the lunar reference systems (lunar mapping) to the terrestrial and celestial reference systems to advance lunar science and space exploration.

Several major activities over the past couple of years included:

- ISSI workshop series on LLR modeling and analysis;
- CfA workshop 2010 on comparison of LLR software packages;
- Initiative on LLR data qualification (“French website”);
- LLR contribution the ILRS Journal of Geodesy special issue (subm., 2012);
- New DFG Research unit “Reference systems” with LLR related projects in Moon-related systems and Barycentric ephemeris.

International Technical Workshop (Simone Dell’Agnello)

An International Technical Laser Workshop 2012 (ITLW-12) “Satellite, Lunar and Planetary Laser Ranging: Characterizing the Space Segment” will be held in at the Frascati National Laboratories of the INFN-LNF, in Frascati (Rome), Italy (<http://www.lnf.infn.it/user.html>) during the week of November 5 – 9, 2012, in conjunction with a one-day Workshop on “ASI-INFN ETRUSCO-2 Project of Technological Development on SLR Payloads of GNSS” on November 8, 2012.

The workshop will focus on the critical design issues and characterization of payload performance for missions in operation and in preparation. Such characterization will be based on SLR/LLR tracking experience at the ILRS stations; ground testing of as-built and newly developed payloads; specialized optical, thermal, structural and orbital software modeling; and optimization approaches and integration.

Opportunities for ILRS working groups meetings will be scheduled before or during the workshop.

Action: Mike Pearlman and Simone Dell’Agnello: Issue the first circular for the Workshop.

GGOS Report

The GGOS Core Network presently has seven legacy Core Sites (Concepcion, Greenbelt, Wettzell, Matera, Hartebeesthoek, Shanghai, and most recently Yarragadee). Three new SLR stations in Russia (Svetloe, Zelechukskaya, and Badari), co-located with VLBI and GNSS, are

undergoing performance review by the Analysis Working Group. The new Core Site in Sejong, Korea is being readied for operation this year. BKG is working on a possible relocation of the TIGO system to central Argentina, a more geologically stable site than Concepcion.

Very significant geographic gaps exist in South America and Africa. Participation in meetings at the UN in Vienna (April 27) and GEO in Geneva (April 30) will explore opportunities for cooperation.

The GGOS Call for Participation, issued in August 2011, has had 14 responses to date, covering 36 sites. These sites ranged from legacy Core Sites, new technology sites, to available land that could be developed. Efforts continue to contact other groups for participation. The GGOS Core Site Requirements Document is being revised with more detail on the evaluation of site stability (Rob Reilinger/MIT) and descriptions of the measurements systems at Core Sites.

The GGOS Inter-Agency Committee (GIAC) has been organized to help GGOS expend its infrastructure (network) and lobby for local support. Fifteen agencies around the world have signed up as charter members and efforts continue to add more members. In cooperation with GIAC, NASA held meetings with representatives with from Colombia, Brazil, Norway, Finland, Korea, and France to discuss new station activities and possible cooperation and partnerships in future core stations.

NASA Space Geodesy Project

The NASA Space Geodesy Project (SGP) has been underway for about 6 months, on a two-year joint GSFC –JPL activity to setup a new technology Core Site at GSFC, establish the supporting analysis capability, and develop an implementation plan for a build-out of additional stations in support of the international network. A second phase if supported would fund additional stations.

Work continues on bringing the NGSRLR and VLBI2010 into operation as part of the site. Two multi-constellation GNSS receivers have been setup and RF interference studies have been conducted to help guide station layout.

A talk “NASA's Next Generation Space Geodesy Program” prepared by the SGP team was given at EGU 2012.

Intersystem Co-location Vectors

Intersystem Vectors at co-location sites have been identified as one of the largest error sources in our formulation of the reference frame. The Working Group on Co-location and Survey has reoriented itself under the leadership of Zuheir Altamimi and Pierguido Sarti. In support of this activity the IGN has committed people and resources for the:

- creation and maintenance of a Survey Data Archive with a dedicated database that will archive all possible local survey observations, survey reports, and meta data, and make them available on a community accessible web-server,
- establishment of Survey Data Format conversion tools to facilitate exchange of local survey raw observations to be analyzed by different groups and software packages; and
- development of Survey Guidelines/Specifications, a best-practice" document to compile experience, recommendations and things to be avoided.

An "advisory group" would be associated with the Working Group whose main job would be to address the systematic errors from each of the techniques that are now degrading the reference frame and other geodetic products. Pierguido will be the chair of the Working Group; John Dawson and Gary Johnston have agreed to serve also. The group will be composed of international local-survey experts who are already members of the currently existing "IERS and IAG Commission 1 Working Group on Site Survey and Co-location" and other volunteers. Since only the technique experts will be able to address their own errors sources (measurement and intersystem vector) the Services must play a major role.

An organizational meeting of the Working Group on Co-location and Survey will meet at EGU on April 25. A workshop will be planned for the fall.

Action: ILRS will select members for the Working Group.

Reports, Publications, and Communication

ILRS 2009-2010 Bi-Annual Report continues in preparation; a few of the station reports and the section on the Retroreflectors are still missing.

Proceedings for the 17th International Workshop on Laser Ranging are complete and ready to go to press, except for the introduction; Ulli Schreiber, Graham Appleby and Mike Pearlman are working on it.

ILRS Special Issue in the Journal of Geodesy is progressing slowly due mainly to the editors' time constraints. So far there are 24 submissions and three additional abstracts pending finalization. We hope the review process will be completed by the end of 2012.

Action: Peter Dunn, Mike Pearlman, and several other "volunteers" will address the missing Networks Section.

The new ILRS website uses the same major structure as the current site: About, Network, Missions, Science, Data&Products, and Technology. We are currently porting old content to the new format and reviewing and updating content. The new website is available for review: <http://ilrs-test.gsfc.nasa.gov>. We encourage everyone to review, comment, and let Carey Noll know if items are missing/confusing/needed

Meetings:

- GGOS Planning Workshop, June 26 – 28, 2012, Frankfurt, Germany
- AOGS 2012 Meeting; August 13 – 17, 2012, Singapore
- ILRS Technical Workshop: November 5 – 9, 2012, Frascati, Italy
- ILRS Analysis Working Group Meeting: Saturday, November 3, 2012, prior to the ILRS Technical Workshop in Frascati, Italy
- The 18th International Workshop on Laser Ranging: Fall 2013, Tokyo, Japan
- The next ILRS Governing Board meeting will be held on the Saturday November 3, 2012, before the Frascati Workshop.
- ILRS Analysis Working Group Meeting in Spring 2013: SUNDAY, APRIL 7, 2013, prior to the EGU in Vienna, Austria