

ILRS Governing Board Meeting

Vienna University of Technology
Gusshausstr. 27-29, Room 124, 3rd Floor

Tuesday, April 26, 2005
18:00 – 21:00

Attendees:	M. Pearlman	D. Carter
	P. Bianco	G. Appleby
	R. Noomen	W. Seemueller
	P. Shelus	C. Noll
	U. Schreiber	W. Gurtner
	H. Kunimori	

Opening Remarks:

Gurtner welcomed the attendees to the first GB meeting this year; we will have another meeting during the October workshop. A quorum was not present at the last meeting in San Francisco.

Gurtner noted that once again, agencies responsible for SLR systems are having funding problems: Geoscience Australia with Yarragadee and KACST with Riyadh. The CB has sent information to contacts for both stations.

ILRS Status/Action Items:

Please consult the handout prepared by the Central Bureau (Appendix A) for news about the recent activities within the Central Bureau and the ILRS in general.

Noll reviewed the action items from the December 2004 GB meeting; open action items and key discussions are given below.

1. *CB will contact missions such as TOPEX, Envisat, GP-B etc. to remind them that we need recognition in their publications.*

Pearlman has contacted several ILRS missions stressing the importance of giving appropriate credit to the ILRS. Acknowledgements and/or references in publications, websites, etc. are crucial for continued funding of the components. Feedback was obtained from J. Ries that TOPEX will try to push this point within the project, but the satellite is nearing the end of its lifetime; operations may discontinue at the end of this year. Envisat contacts have also provided some useful suggestions on getting the word out to the project and science community. Appleby pointed out that an email was issued in April from GFZ/Massmann celebrating the 10 years of successful ERS-2 operations; he checked the GFZ website and found no mention on the home page about SLR. Gurtner did find references to retroreflectors when looking deeper into the website. The ILRS may need to approach the webmasters of various missions about placing an acknowledgement of the ILRS directly on their websites.

Action: CB should browse all existing mission websites and search for references to the service and information about the role of SLR for the mission; if not found, have webmasters add it.

2. *CB will contact the IAG Outreach to suggest that the IAG make its participants aware of the issue of service recognition issue in publications, papers, reports, and presentations.*

As stated above, acknowledgement and reference of the services and their components in scientific publications continues to be a problem for all services of the IAG. Papers were given at the EGU clearly using SLR data without a proper citation or acknowledgement to the service. Reference frame users acknowledge the IERS but not the services in their papers. It was suggested that any ILRS representatives present at conferences, etc. should actually stand up and publicly remind the authors of their obligation to cite the ILRS. Pearlman is working with representatives from the central bureaus of the other IAG services

to develop a solution that could be used by all. The service representatives agree that a joint solution is best. One suggestion is to select a few articles from the ILRS to use in citations. These references would then be made available on the ILRS web and ftp sites.

5. *If we do not hear anything by mid-January, the CB will send a note to Drs. Shargorodsky and Vasiliev.*

See discussions on the Russian agreement below.

8. *Gurtner will look at existing list of data problems (previously maintained by V. Husson) on the ILRS website and see if the webpage can be re-activated and updated on a regular basis.*

See discussions on data quality and feedback below.

11. *CB will examine the idea of issuing a call for a volunteer on the dynamic priorities.*

HTSI personnel are working on an implementation of dynamic priorities utilizing their scheduler; this activity is probably more elaborate than what the ILRS hoped to use. The ILRS has discussed turning off tracking of a satellite if tracking has exceeded requirements, etc. (e.g., ICESat tracking is only required when GLAS is operating). Dynamic priorities may be a method to handle that situation. The ILRS may simply review data yield and determine when additional or less effort is needed. Appleby indicated that NSGF could volunteer to work on this activity if an algorithm is available.

Action: The CB will work with NSGF in implementing a simplified dynamic priority system.

12. *CB will bring to closure the recommendation on the Galileo request for tracking support. (Done)*

Approval was sent to Galileo on February 22. Suggestions on cube design were forwarded to the Galileo project but they were not used.

13. *CB will send a letter broaching the retroreflector issues with the GPS project. (Done)*

Pearlman sent a letter to Michael Shaw, GPS Project Manager suggesting that retroreflectors be included on GPS-III series satellites. Although a direct response has not been received, discussions between NASA and the project indicate that there is interest. There appears to be little science that we can get directly from the tracking of GPS, but Yoaz Bar-Sever/JPL is writing a white paper supporting the retroreflectors from the point of view of GPS calibration and resolution of the antenna phase uncertainty. Dave Arnold is looking at some light weight options for retroreflectors that might be applicable.

NASA SLR Status:

Carter gave an update on the status of NASA SLR (see presentation in Appendix B). He is currently working on contracts with personnel at both Arequipa and Haleakala for resuming activities at the sites. TLRS-4 is presently undergoing refurbishment at GSFC in preparation for shipment to Hawaii in late summer 2005. The system will undergo collocation with MOBILAS-7 prior to transfer to Hawaii. McGarry, Zagwodski, et. al., are working on moving SLR2000 to an operational state. Other stations in the NASA network are operational. Tahiti is in the process of hiring another crewmember; NASA SLR staff will assist in training that person. Carter reported that recent meetings with NASA HQ have confirmed that they are committed to their SLR operations for the next 5-7 years. GSFC staff are working on plans to obtain funding for the SLR2000 prototype replication. The NASA SLR budget is ~\$4M for operations and SLR2000.

Working Group Reports:

AWG:

Noomen's AWG presentation is included in Appendix B. The main activity in the AWG is driven by our principal customer, the IERS. They are very pleased with our activities. The generation of the ILRS operational pos+eop product (7 day intervals and solutions for 7-day network coordinates and 1-day EOPs) has been in place since 11/2003. Some ACs use Etalon in addition to LAGEOS. ASI is the primary

combination center and DGFI is the backup, but both have the same obligations and produce the official ILRS products (since 6/2004).

New contributions to the latest ITRF solution have been generated by the ILRS ACs from the time of the LAGEOS-2 launch and on. The geocenter and scale components of the weekly station solutions have been checked by independent analysts and have been found to be very good. The analysts have had a lot of communication about these solutions, mainly in resolving problems in point referencing, editing of poor solutions of individual stations, and biases in older data. The rules used in our newer operational products may not work for these older data. The IERS has given the ILRS additional time (until 5/31/2005) to clean up the outstanding problems. The MERIT campaign (09/1983) would be a good starting point for the next ILRS products for later ITRF solutions (the IERS will have to decide whether the ITRF solution will be issued yearly or less often). Going earlier than that time frame may be difficult due to lack of data as well as station quality (no station we have now existed that long ago). Matching the positions of older stations to new stations as far back as 1983 may also be difficult. Analysis of older LAGEOS-1 data for effort will not start until after 10/2005; the ACs will want to include the new models (CoM corrections, troposphere) in this analysis of older data. The ACs will also use 28-day intervals and 4-day EOPs for these products.

DFPWG:

Seemueller's presentation is included in Appendix B. Tests have been done using the new prediction format at MLRS; Zimmerwald has not used the new prediction format on satellites but has incorporated the format in station software. Two topics for the fall ILRS workshop from the DFPWG were proposed: refraction issues (particularly dispersion) and the new prediction format.

MWG:

Kunimori's presentation is included in Appendix B. Updates on the ALOS, ICESat, OICETS, and LRO missions were given at the WG meeting on April 25. ALOS requires restricted tracking and will utilize the new procedures developed within the group. OICETS is an optical communication experimental satellite scheduled to launch this fall; a mission support request has been submitted to the ILRS CB and will be forwarded to the MWG and GB soon.

NEWG:

Schreiber explained that the Networks and Engineering Working Group did not hold a meeting at EGU because most of the engineering oriented people did not attend EGU.

Pearlman believes we do know what our future technology in SLR is (see slide in GGOS presentation). Shelus stated that many of the stations must work on their existing systems to make sure they operate and do not have time or resources to develop new systems or capabilities; the stations are waiting for the next generation systems to be developed and deployed. Pearlman stated that we do need to write out our vision for SLR for the next 10 years; the VLBI technologists and scientists have written such a document. Pearlman believes this effort would force the community to address what it wants to do and how it wants to do it. He used an example of the S. Koreans from KASI who plan to build a new SLR system using technology from 15 years ago. Gurtner suggested a small group be formed to develop this vision as a position paper, which would include science inputs. Pearlman stated that the GGOS science board should be issuing requirements that the services must support. Gurtner also stated we need to know what wavelengths are best for new systems given the new missions (e.g., transponders) and what retroreflector technology is in development now. The NEWG should be prepared to give recommendations in this area to new/upgraded stations prior to development.

Pearlman stated that we should have a good look at two-color ranging at this fall's workshop in the UK, where we are and where we can go. Bianco said that not enough has been done in two-color experiments at this time because it is difficult and expensive; the charts on the new troposphere model showed that it does not handle the low wavelengths well. Appleby stated that we should know what the science drivers are for two-color. Pavlis is looking at the Zimmerwald two-color data. Gurtner does not believe that the Zimmerwald two-color data are accurate enough to yield dispersion information. Schreiber stated that the TIGO laser type was specifically installed to do dual-color work; however, the field operations are quite

difficult using this type of laser. A session at the fall workshop should be held where analysts and technologists can meet to discuss both the data and future of the two-color technology.

Action: A subgroup of technology and science representatives should write a white paper on the future vision for SLR (Who is going to do this?)

Action: Bianco should make sure Pavlis has looked at the MLRO two-color data.

SPWG:

Appleby's presentation is included in Appendix B. Presently we do not have satellite CoM corrections accurate to 1 mm; therefore, it was suggested that analysts may still need to solve for a range bias. Noomen stated that solving for the range biases weakens the network solution, particularly for the core stations. The AWG had already agreed that range biases of the core stations would not be solved for; solving for range biases for the other stations would be left up to the individual analysis centers. The CoM corrections are signal strength dependent, and therefore inherently uncertain at the few-mm level. Appleby has characterized a signal strength regime estimate for the most productive stations. He will extend the calculations, based on the paper with Otsubo, for the whole ILRS network, and work with the CB to make the values available at least on the ILRS website.

Action: Appleby will provide station signal strength regimes to the CB for placement in the site logs with perhaps a separate table automatically updated/extracted and linked to the CoM pages on the ILRS website. The information is not in the site log now so the format will have to be modified.

Galileo is about 3500 km higher than GPS. Two engineering versions of the Galileo satellite will be launched this fall. GSTB-V2/A will have a retroreflector array "GAIN" furnished by Galileo Industries (ESA) with a return signal strength comparable to that of GPS. GSTB-V2/B will have an array built by Surrey Satellite Technology Ltd (UK) with slightly larger return signal. The subsequent operational satellites will have arrays, but the design has not yet been settled. Velocity aberration is small and not a major issue.

Transponder WG:

Schreiber presented (see Appendix B) the need for a new working group to address laser transponders. Gurtner suggested that one responsibility for this WG would be to obtain information on what the ILRS needs to plan for future SLR upgrades. The T2L2 mission has been approved; Y. Fumin and E. Samain are working on it. Kunimori mentioned that the Japanese are also considering ideas for transponder/optical communication missions. The opinion of the board is that the formation of this new WG was a good idea. Schreiber agreed to chair the WG.

Action: Schreiber will prepare a charter and a list of members for the Transponder Working Group; he will contact the proposed members and confirm participation.

Russian Satellites:

Pearlman gave a presentation (see Appendix B) on the proposed agreement between Federal Space Agency (FSA) of Russia and the ILRS on the launch and tracking of "novel" SLR satellites using the Luneberg lens. Under the agreement the Russian Space Agency would build and launch the satellites and the ILRS would track them and make the data generally available. This would be an engineering test, but there may be some application for gravity field studies depending upon the orbit. From previous experience the satellite maybe difficult to track and it was recommended that we proceed on a best effort basis. After some modifications and concurrence from FSA, Gurtner and Pearlman will sign the agreement on behalf of the ILRS.

Action: The CB will edit the Russian agreement and will reply to the FSA that the ILRS is interested in tracking these new satellites.

New ILRS Orbit Product:

Noomen reported that we have a proposal to generate an official ILRS orbit product. A committee consisting of J. Ries, J. Mueller, R. Koenig, C. Luceri, and W. Gurtner will work on the particulars for this product. We hope to start with a test data set using four one-week periods of LAGEOS data. We will use a procedure similar to that used for the current data product. It is anticipated that this could be an official ILRS product within a year.

Action: An ILRS orbit product committee should be formed and develop a plan for the new product.

Data Analysis and Feedback:

Gurtner gave a presentation (see Appendix B) on the need for data analysis and feedback to the ILRS stations and analysis centers. Since funding cuts affected the capabilities of the ILRS CB, data quality checks, problem catalogs, consistent analysis with respect to dealing with errors and problems in the data, etc. are no longer performed as before. We had several systems in place for checking the data but unfortunately, these procedures are no longer maintained. Furthermore, no process currently exists to collect all the AC/AAC reports into a central place. The ILRS needs to establish procedures where station/data related problems are dealt with through the whole ILRS system, from tracking station to analysis center and finally to the general user. Detected problems need to be archived in a way that the information can be used in the future for the reprocessing of historical data. We need a group/institution that will look at all the levels of problem detection.

Action: A committee will be formed to work on the specifications and needs for a “Call for Proposal” to handle data analysis and feedback (Gurtner, Pearlman, Noomen).

Tracking Restrictions:

Gurtner gave an update on satellite tracking restrictions (see Appendix B). Gurtner, Rickleffs, and HTSI have developed a tracking restrictions plan and are now at a point where the proposal is acceptable to JAXA for ALOS tracking. Some final changes are being made to include additional satellites identification information on the pass segment form. It was agreed to forego the formal agreement between the satellite owner and the stations, and rather have the owner qualify stations through specified tests. JAXA will submit its test plans to the CB for review, prior to approaching the stations.

Action: The CB will inform the stations that JAXA will be contacting them with the ILRS-approved/evaluated request to track ALOS.

Action: JAXA will prepare a station test plan for review by the CB

Galileo Geodesy Service Provider: Link to the ILRS:

Gurtner gave a presentation on the Galileo Geodesy Service Provider (GGSP) CfP (see Appendix B). At least two groups answered the proposal; the group consisting of GFZ, AIUB, ESOC, IGN, BKG, Wuhan, and NRCan were awarded this project by the European Commission. The project, which started this winter, will provide the Galileo terrestrial reference frame and links from the Galileo ground segment to the IAG services (IGS, ILRS, IERS). The Galileo project does not want to/cannot deal with the individual services (including the ILRS) so the GGSP will be the intermediary. The GGSP will also generate products for the advanced user community, including predictions and updates to the ILRS.

The group must set up a prototype GGSP over the next few years with the test bed satellites; a second call for the operational GGSP will be generated later. A meeting in Darmstadt of the IGS GNSS WG discussed the role of SLR in Galileo. It was thought that Galileo will probably use the SLR data in a campaign mode, rather than continuous tracking, at least for test bed, but this decision is not final. Thus far, the ILRS has agreed to support the test bed satellites; a request has not yet been made on the operational configuration. The test bed satellites are being launched this year for systems tests and to occupy the reserved frequencies; otherwise they could be in jeopardy. The project wants to check POD with the microwave pseudo-range signals and timing system using SLR.

A full constellation of Galileo satellites with retroreflectors could pose a challenge for the ILRS network. The tracking strategy is not yet determined; a subset of stations may be adequate. Continuous tracking may

require some dedicated or nearly dedicated stations which would need funding support from Galileo, perhaps on a regional basis.

Gurtner is considering entering negotiations with the Galileo project for financial support for the European ILRS sub network. This policy could then be expanded to other mission sponsors. For example, if ESA requests ILRS track on a satellite, the agency should financially support the EUROLAS network. The ILRS needs to develop a future vision. Space missions with a commercial aspect, or scientific missions with a large budget (e.g., GP-B), should be asked to assign a small part of their budget for laser tracking. Tracking a constellation of thirty Galileo satellites could mean that we have to rethink how we do business. Any mission approached in such a fashion would continue to go through ILRS, not directly to station. The ILRS must get involved early in these missions to make sure the ILRS network is incorporated into the budget. However, if we start to push this new position, we could weaken our current financial support from our funding institutions. We may also find ourselves with erratic year-to-year funding profiles. The stations could use the additional funding to buy other equipment. No decision was recommended at the meeting, but the ILRS does need to consider its financial options. Missions must recognize that the tracking service cost money.

GGOS/Pearlman

Pearlman gave an update on the Global Geodetic Observing System (GGOS) (see Appendix B). GGOS is the current project under development in the IAG. One of the main focus areas now is to promote GGOS interaction with several international science and political activities (IGOS, GEO, etc.). A session on GGOS is planned for the IAG meeting in Cairns Australia in August 2005. The new structure, including working groups, of the project was shown; Pearlman is chair of the Ground Networks and Communication Working Group. A primary focus of this group will be to integrate and maintain the networks supporting the IAG services (e.g., IGS, ILRS, IVS, IDS). GGOS will probably not optimize all networks together but rather optimize by technique, focusing on what each technique can provide. A poster from the WG is planned for the Cairns meeting.

Fall ILRS Workshop:

Appleby discussed plans for the fall ILRS workshop, to be held in Eastbourne, UK. He has reserved the workshop venue for October 3-7. The ILRS should allocate three days for workshop sessions, one day for WG and GB meetings, and a half-day (Friday) for the ILRS general assembly. A draft of the workshop program should be available by June for iteration. A website has been implemented at <http://nercslr.nmt.ac.uk/workshop2005/workshop2005.html>.

Action: WG chairs should provide topics for the fall workshop to Appleby. Chairs should also provide the local organizing committee with an indication of how much time is required for each splinter meeting.

The meeting ended at 21:00. We would like to thank Harald Schuh from the Technical University of Vienna for providing the facilities and refreshments for this meeting.