

Report of AWG Meeting, Vienna, 2005.

The ILRS AWG members and representatives from IGS, IDS and IERS met during the EGU, on Monday 25th April 2005. The meeting began at 15.30 hrs. The agenda and list of attendance are given in Tables 1 and 2, respectively.

Ron Noomen chaired the meeting, noting that the meeting room would be available only for 3.5 hours. He passed on greetings from Van Husson.

Announcements: P. Shelus, deputy coordinator of the AWG, has now been appointed deputy coordinator of the Missions WG. G. Appleby has been appointed deputy coordinator of AWG.

Pilot Project.

The Chairman noted the large amount of work that continues to be done by the Analysis Centres (ACs) and the Combination Centres (CCs) regarding the ongoing weekly Pilot Project and 10-year 'back' solutions. He asked for any comments from the Centres regarding the weekly Pilot Project. There being no items to discuss, the Chairman then asked the CCs to report on progress.

Cecilia Sciarretta presented the **ILRS primary Combination Centre (ASI)** report. She had taken loosely constrained weekly 'back' solutions from five ACs for the period January 4, 1993, to December 2004 and computed loosely constrained combination solutions, ready for further inter-technique combination. An initial 'v1' solution contained some AC-generated problems, particularly with incorrect DOMES numbers. But with smarter software most of the problems had been overcome, and a 'v2' solution series had been issued. Some overall checks of the coordinate solutions with respect to ITRF2000 and the EOPs wrt USNO finals data showed weighted RMS agreement at the 1cm level. There appeared to be a long-period problem in the LoD solutions from NSGF.

Overall, it is clear that, as expected, the combined solutions are 'tighter' than the individual solutions. Cecilia had also looked at the solutions for 1999-2001 from the GEOS AC, and found only some problems with the LoD solutions; the site coordinates appearing to be consistent with ITRF2000.

A check on ILRSA vs. ILRSB (DGFI) showed that the Helmert translation parameters agreed to ~1.5mm, but that there were some scale differences that require investigation.

Some discussion followed regarding whether individual station solutions could be rigorously eliminated from the solution of a given AC, should that prove necessary prior to combination. It was felt that this was possible, but that to be fully rigorous the covariance (or Normal) matrices in the SINEX files would have to include all the parameters that contributed to each solution. An interim solution would be to down-weight a whole AC solution if it contained a problem station coordinate value. It was also noted that in some AC solutions at times there are problems with the EOP values at the start and end of the seven-day arcs.

It was agreed that the prime products from ILRS are station coordinates (geocentre and scale), so we should not dwell on EOP solutions and problems at this stage. It was also agreed that if a problem is found with a given solution from an AC, the CC should ask the AC to correct it, rather than doing so itself.

Rainer Kelm presented the **ILRS back-up Combination Centre (DGFI)** report.

Regarding the ongoing weekly PP solutions, he continues to produce minimum constraint combination solutions. He too has experimented with adding in the GEOS solutions, but it appears there are some tight constraints in the solutions.

'Back' Solutions. Rainer has carried out two combination runs on the 10-year series, the first to look at outliers, the second to do the combination. In comparisons with the ILRSA (ASI) solutions for 2004, the Helmert parameters revealed some systematic differences, which are being investigated. There also appear to be some systematic differences between AC solutions, which are again being characterized. These differences must be understood and eliminated.

IERS PP/ITRF2004 status:

Zuheir Altamimi reported that he had carried out a full analysis of the series from each AC, in terms of the TRF scale and origin realized by the solutions and when compared to ITRF2000. The results suggest that no modification to the scale and origin implicit in ITRF2000 will be required when forming the combined solution for ITRF2004. He noted that outlying EOP results from individual ACs should be rejected when forming the combined ILRS solutions, since they would contaminate the multi-technique combinations. It also appeared that the scale defined by the GFZ series was tighter than that of the other solutions. He thanked all ILRS elements for the very good work in contributing to ITRF2004. Regarding whether the 1993-date 'back' solutions required more work, he agreed that it would be worth solving some of the issues that had been raised, in particular to remove outlying solutions and parameters at the combination stage, rather than potentially having whole solutions rejected at the multi-technique combination stage. It was agreed that, since some ACs would like time to re-submit their series, a second round of combination would be carried out. **The deadline for ACs to submit would be mid-May, with the combined solutions available by the end of May 2005.**

The issue of pre-1993 laser data was raised. Zuheir noted that any new solutions would be too late to contribute to ITRF2004, but that surely the older data would be useful at some stage, perhaps in combination with VLBI which was a less uniform network at that time.

It was agreed that, once the current re-submissions had been done, the ACs would look at pre-1993 data, to include LAGEOS and, if possible, ETALON-1 and -2. It was also agreed that 28-day arc, 4-day EOP solutions would be carried out, starting at the beginning of MERIT-II in September 1983 and linking with the beginning of the current 'back' solutions. (by the minute-writer's calculations, we should begin the 28-day solutions on **Sunday August 28, 1983**, MJD 45574, which will produce 122 such solutions up to midnight on Saturday January 2, 1993).

Station and satellite signatures

Graham Appleby presented a short report by the SPWG, essentially an Otsubo/Appleby collaboration. Most of the data concerning location of array phase-centres on spacecraft had now been published on the ILRS website, along with LAGEOS, ETALON and AJISAI CoM values as functions of station hardware and receive energy regimes. For the major ILRS stations, the report gave recommended CoM values with their likely uncertainties of up to 4mm. Crucial to these computations is estimating the variability in return energy of each system. A suggestion was presented that the uncertainties in the CoM values could be used to constrain range 'bias'

solutions for all the stations, but it was agreed that no such bias would be solved for the primary stations. It was proposed that **ACs should produce solutions for one month with and without these station-specific CoM values**, and compare the solutions. Appleby agreed to **extend the table of recommended CoM values to all the current ILRS stations**, prior to these tests being carried out. The table would be placed on the ILRS website.

Refraction model transition.

John Ries presented his solutions using the Marini-Murray (MM) and the Mendes & Pavlis (M&P) model. He found a good improvement in fit to data for LAGEOS, but no change for LAGEOS-2 solutions. This work is part of a determination of GM; with MM, Ries gets .44144 +/- 0.0003; with M&P, .4416 or .4417. It appears that no change is required to the IERS value of GM, since these values are all within the uncertainty.

It was agreed that all ACs should carry out solutions using the M&P troposphere model. The chairman agreed to specify the dates, etc., for the experiment.

New Products.

Werner Gurtner raised the issue of providing SLR-based orbits for the geodetic satellites, which would be useful in a number of investigations, including calibrating optical tracking data and in the comparison of AC's coordinates solutions. It was proposed that SP3 format be adopted and that the ACs be encouraged to produce such orbits on a regular basis. **Werner, John Reis and Horst Mueller agreed to form a group to look into the proposal.** Cecilia Sciarretta and Rolf Koenig expressed interest in joining the group.

Other Issues.

Data Centres. The Chairman made the point that data centres exist at both CDDIS and EDC; we should always submit products to both centres.

Referencing ILRS in publications. Recommendations are required for publications that should be referenced in order to acknowledge the work of the ILRS. Subsequently the following was designated the official ILRS recommendation: Pearlman, M.R., Degnan, J.J., and Bosworth, J.M., "[The International Laser Ranging Service](#)", *Advances in Space Research*, Vol. 30, No. 2, pp. 135-143, July 2002.

Benchmark Process.

Erricos Pavlis reported that the BKG AC had passed the first test and that he was setting up the final, blind, test to be carried out by May 15.

Network Status.

David Carter reported that the Arequipa system would be resuming operations in late summer 2005. A new site on Hawaii would be occupied in the same timeframe by a TLRS system relocated from Goddard.

Ramesh Govind reported that operations at the highly prolific station at Yarragadee might be under threat. A review of the Australian geodetic programme is underway and questions are being asked about the need for two stations in the country. A good science case has been made, but funding cuts are still very likely. A possible compromise may be to offer a reduced tracking

load at Stromlo in order to maintain operations at Yarragadee, which has a long history at a co-located site. The meeting strongly recommended that Yarragadee should not be closed.

AC/AAC categorization.

Currently five groups routinely contribute to the ILRS combination product, and perhaps should be considered as ILRS ACs. The Chairman, Werner Gurtner and Peter Shelus agreed to look at the ToR and make a recommendation.

Assessing quality of new SLR systems

Any new station should seek out an “analyst” (analysis center) for evaluation of its data, under the direction of the Central Bureau. On behalf of DGFI, Horst Mueller volunteered to carry out this task.

Station Report Card.

Mark Torrence still doing it, now up to every quarter. The ‘bar charts’ showing stations’ performances will follow.

Consistency of QC Reports

Werner Gurtner presented the current situation regarding data Quality Checks. Ideally the ‘system’ should detect a problem, feedback to the station, inform analysis and combination centers and archive for future use. Problems addressed must include range and time biases, noise, noisy normal points, bad formats, un-calibrated data, malfunctions, epochs and satellite ID errors. The system must be homogeneous. Van Husson’s checks are no longer available, but hourly analysis is carried out by NSGF as a by-product of time bias production, and daily solutions on laser ranging to GNSS are provided by CODE. Questions are whether the five/seven analysis center reports can be homogenized and whether feedback could be organized from the primary combination centre, during the weekly combination stage. A group was formed to look at this issue and work up a call for proposal; group members are Ron Noomen, Mike Pearlman and Werner Gurtner.

Next Meeting

To be held in conjunction with the Fall 2005 ILRS Workshop at Eastbourne, near Herstmonceux, UK. The format would be similar to the workshop in Koetzing, in Fall 2003. The dates for the main workshop, to include a session run by the AWG coordinators, are October 3-7. Subsequently the date of the AWG was set for Sunday October 2, 2005 (taking place all day).

The Chairman closed the meeting at 19.00 hrs.

Table 1: Agenda

1. opening
2. announcements
3. pilot project "positioning + earth orientation"
 - 3.1. evaluation of combination results
 - 3.2. IERS PP/ ITRF2005 backwards: status
 - 3.3. implementation station/satellite signature
 - 3.4. implementation new tropo model
 - 3.5. new products
 - 3.6. other issues
4. benchmark project: status
5. miscellaneous
 - 5.1. status SLR tracking network
 - 5.2. analysis center categorization
 - 5.3. procedure for assessing quality of new SLR system
 - 5.4. station performance card
 - 5.5. consistency QC reports
 - 5.6. laser workshop Herstmonceux
6. next meeting
7. action items
8. closure

Table 2: Attendance

Zuheir Altamimi	altamimi@ensg.ign.fr
Per-Helge Andersen	per-helge.andersen@ffi.no
Graham Appleby	graham.appleby@nerc.ac.uk
Richard Biancale	richard.biancale@cnes.fr
Giuseppe Bianco	giuseppe.bianco@asi.it
Peter Clarke	peter.clarke@newcastle.ac.uk
Xavier Collilieux	xavier.collilieux@ensg.ign.fr
Ramesh Govind	ramesh.govind@ga.gov.au
Werner Gurtner	gurtner@aiub.unibe.ch
Julie Horvath	julie.horvath@honeywell-tsi.com
Rainer Kelm	kelm@dgfi.badw.de
Rolf Koenig	koenigr@gfz-potsdam.de
Frank Lemoine	flemoine@bowie.gsfc.nasa.gov
Stavros Melachroinos	stavros@pontos.cst.cnes.fr
Horst Müller	mueller@dgfi.badw.de
Jürgen Müller	mueller@ife.uni-hannover.de
Carey Noll	carey.noll@nasa.gov
Ron Noomen	ron.noomen@deos.tudelft.nl
Konstantin Nurutdinov	nurut@mail.ru
Erricos C. Pavlis	epavlis@jcet.umbc.edu
Mike Pearlman	mpearlman@cfa.harvard.edu
Jim Ray	jimr@ngs.noaa.gov
Bernd Richter	bernd.richter@bkg.bund.de
John C. Ries	ries@csr.utexas.edu
Markus Rothacher	rothacher@gfz-potsdam.de
Ulrich Schreiber	schreiber@wetzell.ifag.de
Cecilia Sciarretta	cecilia.sciarretta@asi.it
Peter J. Shelus	pjs@astro.as.utexas.edu
Scott Wetzel	scott.wetzel@honeywell-tsi.com
Matt Wilkinson	matwi@nerc.ac.uk