



INTERNATIONAL EARTH ROTATION SERVICE (IERS)
SERVICE INTERNATIONAL DE LA ROTATION TERRESTRE

DIRECTING BOARD

REPORT OF MEETING No. 13

**Held on 1994 March 21 and 24 in Paris and Saint Mandé (France)
in conjunction with the 1994 IERS and IGS Workshops**

The Directing Board met on March 21, 10:00-13:00 at Paris Observatory, and on March 24, 14:00-15:30 and 18:00-20:00 at Institut Géographique National.

Attendance: E.F. Arias, C. Boucher, M. Feissel (secretary), W.G. Melbourne, D.D. McCarthy,
D. Salstein, B.E. Schutz, C. Veillet, Ya. S. Yatskiv (Chairman).

Invitees (March 24, 18:00 - 20:00):

Gerhard Beutler, Chairman,	IGS Governing Board
Jean Dickey, President,	IAG Section V (Geodynamics)
Barbara Kolaczek, President,	IAU Com. 19 (Rotation of the Earth)
Leslie Morrison, President,	IAU Com. 8 (Positional Astronomy)

This report also includes matters that were discussed during the workshop and are important for the evolution of the service.

Reports of IERS activities

Lunar Laser Ranging. Three observatories are developing LLR stations: Orroal, Matera and Shanghai. The Wettzell station has obtained a few observations. Rapid operational determinations of UT0 are provided by the University of Texas at Austin. A new analysis centre has started providing global analyses at the Technical University of Munich. CERGA will complete a new analysis model by the end of 1994. Thus in 1995 there will be four independent analysis packages for LLR: CERGA, FSG (Munich), JPL and UTXMO.

Satellite Laser Ranging. A number of satellites are permanently tracked: Lageos 1 and 2, Starlette and Stella, Etalon 1 and 2, two GPS satellites, Topex/Poseidon, ERS1. The extra shifts added at the NASA stations for the Topex/Poseidon mission benefit observation of the other satellites. 25 to 30 stations have significant IERS contributions (Lageos 1, 2). Effort is being made towards the automation of the stations in order to reduce costs in the future.

Global Positioning System. The official start of IGS was on 1 January 1994. The IGS Central Bureau/IERS GPS Coordinating Centre at JPL has a staff of three people; it interacts with the IGS Analysis Coordinator. Seven analysis centres provide operational results and/or global analyses of polar motion, length of day or short-term UT1, and terrestrial reference frames. Anti-spoofing (AS) has been continually activated since February 1; the consequences are an increase of the cost of analysis and some loss of precision for low elevation observations, but the global results of interest to the IERS are practically unaffected. There are discussions between JPL and the US Department of Defense on the future scheduling of AS activation.

The GPS core network observations are analysed by seven groups. The satellites orbits obtained are merged into a mean IGS orbit computed in the IERS System. Some centres are concentrating more on global aspects, some others more on regional ones. There is an increasing interest in the regional densification approach. The agreement of GPS and SLR orbits of GPS satellites is progressing, but the lack of observations in the southern hemisphere limits the validity of the comparisons.

Very Long Baseline radio Interferometry. The future funding of VLBI observations and analysis by NOAA, NASA and USNO is currently under discussion, with a tendency to decrease. Although the satellite techniques can provide high density polar motion and station coordinates, VLBI remains the unique technique for long term determination of universal time, precession-nutation (with LLR) and the maintenance of the extragalactic reference frame.

Two chinese stations were added in the IRIS-P network. K4 stations are planned to be installed in Hobart, Alaska, Urumqi, and Mizusawa. The capacity of the K4 correlator is being extended to three stations. K4 is not compatible with Mark4, but translation programs of Mark4 into K4 will be available.

Central Bureau: Earth rotation. The highlights are the use of Earth orientation determinations by VLBI and LLR to estimate the direction of the equinox in the IERS Celestial Reference Frame (study in cooperation with JPL) and the analysis of celestial pole offsets for precession-nutation corrections and the estimation of the direction of the J2000.0 celestial pole in the IERS system. In the operational solutions of polar motion, the contribution of GPS is increasing.

Central Bureau: Celestial frame. Systematic differences between extragalactic celestial reference frame have been further investigated. While the typical precision of source positions is around 0.3 mas, systematic differences that exist at the level of 1 mas can be easily modelled; they are related to low elevation observations. IERS/CB participates in the IAU Working Group on Reference Frames and in the Hipparcos group for the extragalactic tie. Plans have been made to set up a data base on source structures.

Central Bureau: Terrestrial frame. The introduction of GPS station coordinates based on contemporary observations reveals anomalies in some sites that were observed by SLR and VLBI in the last 10 years. A new generation software for global analysis of the terrestrial and celestial reference frames and the Earth's orientation is under study.

Sub-bureau for Atmospheric Angular Momentum. The operational collection of AAM values of the four meteorological centres has been continued. NMC is improving their calculation with respect to accuracy and completeness; a new, homogeneous, analysis since 1958 has been undertaken. A questionnaire to survey the users needs has been made; see the report in Annex of the IERS and IGS Workshops Report.

Sub-bureau for Rapid Service and Predictions. The agreement of the rapid service EOP with both the revised series and the Bulletin B one is within ± 0.5 mas. The prediction error of polar motion is ± 10 mas a 10 days lag, ± 20 mas for a one year lag. The error on UT1 for a one year lag is ± 25 ms.

IERS Standards. The 1992 issue of the IERS Standards included a questionnaire. Responses were received from 21 colleagues. All replies showed that the users were well satisfied with the publication and many requested material from Technical Note 13 in machine-readable form. (This has since been provided.) The chapters which appear to be the most useful were those on the transformation between the celestial and terrestrial reference frames, the terrestrial reference frame, the numerical standards, and the solid Earth tides. Least important to users were the chapters on radiation pressure reflectance models and relativity. Most suggested that the IERS Standards be revised about every three years.

Plans and needs of IERS until 2000

Considering the rapid evolution of achievements of the techniques used by IERS and the correlative changes in national funding, it was decided to prepare a 10-page document describing the plans and needs of the IERS in the future that could be used in budget discussions.

Proposed participation of DORIS

The French Groupe de Recherches de Géodésie Spatiale (GRGS) has submitted to the Directing Board a proposal to study the adoption of DORIS as an IERS technique. The Directing Board decided to issue a Call for Proposals for the various IERS functions. The proposals will be reviewed at the August, 1994, meeting.

Relationships with IGS

It is agreed that the IERS representative in the IGS Governing Board will be appointed by the IERS Directing Board every two years. The current representative is M. Feissel, until 1995. The IERS GPS Coordinator is the representative of the IGS Central Bureau in IERS; he (she) is presently a non-voting member of the IGS Governing Board. The IERS Directing Board stressed again that the distinction between voting and non-voting status in the IGS Governing Board is not satisfactory. However, it was also mentioned by G. Beutler that the IGS Governing Board tries to obtain consensus on the decisions and that the vote is practically not used.

The IERS Celestial Reference Frame and the IAU

The Celestial Frame Section (head since 1994: E.F. Arias) has actively participated in the studies for the selection of definition objects for the future IAU Celestial Reference Frame, using the results contributed since 1987 by the IERS VLBI analysis centres.

Proposed future actions concern monitoring of the sources, setting up of a source structure data base, and studies of the optimisation of observation scheduling in space and time. The Directing Board supports and encourages these plans.

IERS Standards (1995)

The next issue of IERS Standards will be prepared after the IAU General Assembly (August 1994) and circulated before the end of the year.

At a technical meeting on precession-nutation corrections held during the Workshop, it was decided that the 1995 issue would include an empirical correction model to the standard 1976 and 1980 IAU models. VLBI and LLR observations would be used to derive improved geophysical parameters that would be applied to convert the Kinoshita and Souchay (1990) theory of luni-solar and planetary nutation for a rigid Earth into a series for a realistic non-rigid Earth.

The current IAU Standards would remain the reference for the IERS publications (celestial pole offsets in Bulletins A and B and in the Annual Report). The correcting model would be considered as a means to have more correct a priori values, or as an alternate to the IERS Bulletins.

Discussion on atmospheric data

The session of IERS workshop related to atmospheric data generated considerable interest in how data sets from the Sub-bureau for Atmospheric Angular Momentum were being used for research purposes. Currently atmospheric sets from four different meteorological agencies are available, as well as global values of torques that dynamically transfer momentum across the atmosphere's lower interface. Excitations for both axial rotation (length of day) and polar motion were discussed in the session, and the range of time scales of interest was very wide, from the sub-daily to interannual.

Decadal signals in the strengths of seasonal zonal winds were reviewed first, followed by reports of length of day fluctuations on multidecadal time scales based on high-resolution astronomical data. Moving to somewhat shorter time scales, the range of interannual variability in the atmospheric series, based on series from different centers, was addressed. Analysis of polar motion excitation functions was considered, including the correlation of the contributions from each hemisphere with polar motion.

A comparison of two approaches to the method of comparing polar motion and its excitation was given, and the "integration" and "differentiation" approaches showed the importance of high frequency atmospheric data. On the shortest time scales, the power present in the atmosphere for high frequency polar motion, and nutation was estimated.

The Earth orientation parameters from different geodetic techniques were compared with the atmospheric excitation quantities. Also, the tides that are present in the atmosphere have an effect on the polar motion excitations, and these were emphasized in a final presentation.

Organisational matters

The Directing Board expresses concern about the cancellation of the participation the VLBI Coordinator, W.G. Carter, in the meeting. The Chairman will send a letter to the NOAA Administrator stressing the importance of NOAA's role in the setting up and operation of IERS, and asking for continued participation.

The report to IAU Commission 19 (Rotation of the Earth) will include oral reports on general activities and posters for the participation of the techniques. The report to Commission 31 (Time) will deal with UTC and the suggestion that the definition of the link between UT1, UTC and TAI be re-studied.

The new IAU representative to IERS will be designated by IAU in August 1994. It is asked that the term of the IAU representative be four years, with dates matching the IUGG General Assemblies schedule.

New corresponding members are appointed: B. Chao, R. Ponte, N. Kawano. Peter Bender resigned.

Next meeting: in conjunction with the IAU General Assembly at Den Haag, The Netherlands, in August 1994.