COMMISSION 19 : ROTATION OF THE EARTH (ROTATION DE LA TERRE)

President : M. Feissel
Vice-President: B. Kolaczek

Organizing Committee:

P. Brosche	W.E. Carter	J.O. Dickey
D.M. Djurovic	Jin W.-J.	N. Mironov
D.D. McCarthy	M.G. Rochester	T. Sasao
B.E. Schutz	J. Vondrak	G.A. Wilkins

INTRODUCTION

The main topics covered during this General Assembly were the nine resolutions proposed by the Working Group on Reference Systems (WGRS), of which Commission 19 was one of the sponsoring commissions, and the achievements of the newly created International Earth Rotation Service (IERS), concerning not only the precise determination of the Earth's rotation irregularities, but also the astronomical constants and models, and the extragalactic celestial reference frame.

The observing techniques used for the Earth rotation studies are radioastrometry (VLBI), Lunar Laser Ranging and satellite geodesy (LAGEOS, Global Positioning System), which insure a sub-milliarcsecond accuracy. However, the less precise method of optical astrometry has unique capabilities in specific fields, where Commission 19 made steps to help their efficient use: the commission supports a Working Group to reanalyze the 1900-1990 observations in reference frames provided by IERS and HIPPARCOS, and it encourages to seek cooperation with the International Association of Geodesy (IAG) to extract the geophysical signal from these observations (see the two Commission Resolutions listed at the end of this report).

Research on the Earth's rotation is an interdisciplinary field between astronomy and geophysics. Commission 19 has always had common members with the IUGG and/or IAG Working groups on this subject. The IAU Resolution listed at the end of this report re-affirms the intent of the commission to continue joint activities in this field.

BUSINESS SESSION 1.

The President presented a summary of activities of Commission 19 in the term 1988-1991. Following a resolution passed at the 20th General Assembly, the Presidents of Commissions 19 and 31 (Time) presented to the IAU Executive Committee a report to justify the request of an increase in the IAU support to the Federation of Astronomical and Geophysical data analysis Services (FAGS). This request was also supported by 10 commissions (5, 8, 10, 24, 25, 26, 33, 34, 40, 45) on the basis of their need of 5 of the 11 FAGS services (IERS, QBSA, IUWDS, SIDC, CDS). As a result of this action, the IAU Budget for 1991-1994 includes a raise of the IAU grant to FAGS.

The General Secretary proposed in 1990 to amalgamate commissions 19 and 31. The President of Commission 19, after consulting the Organizing Committee, refused the

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amalgamation, as did Commission 31. On this occasion, the interests of Commission 19 were defined as follows.

- Understanding of the irregularities of the Earth's rotation (polar motion, duration of the day, precession-nutation).

- Provision of the Earth's orientation to the astronomical community (operational and scientific solutions).

- Astrometric modelling.

- Extragalactic reference frames.

- Relationship among reference frames linked to quasars, to stars, to objects of the solar system, and to artificial satellites of the Earth.

- Terrestrial reference frames.

Commission 19 is one of the sponsoring commissions of the Working Group on Reference Systems (WGRS, Chairman : J. Hughes) ; 17 commission members formally belong to the WGRS, and others made contributions to its work. The nine recommendations of the WGRS, later adopted as IAU Resolutions, establish new basic concepts for the space-time reference systems to be used in astronomy, defined homogeneously in the framework of the theory of General Relativity. Detailed analysis of the concepts and of the consequences of their use can be found in the proceedings of IAU Colloquium 127 and of the Joint Discussion organized during this General Assembly by the WGRS. Of special importance to Commission 19 is the adoption of an extragalactic celestial system as primary system, as is already the case in the study of the Earth's rotation.

Commission 19 has another Working Group, on "Earth rotation in the HIPPARCOS reference frame", chaired by J. Vondrak. Refer to the report on scientific session 2 for detailed information. Commission 19 has high interest in the work of the International Earth Rotation Service (IERS), a service of FAGS sponsored by IAU and IUGG. The scientific meeting 3 is devoted to IERS.

Two Scientific meetings co-sponsored by Commission 19 were held since the IAU 20th General Assembly:
- IAU Symposium 141, 17-21 October 1989, Leningrad (USSR) "Inertial coordinate system on the sky". Proceedings published by Kluwer (1990), Lieske and Abalakin eds.
- IAU Colloquium 127, 14-20 October 1990, Virginia Beach (USA) "Reference systems". Proceedings published by USNO (1991), J.A. Hughes, C.A. Smith, G.H. Kaplan eds.

Three joint meetings co-sponsored by Commission 19 are to be held during the General Assembly, with Proceedings to appear in Highlight of Astronomy, vol. 7 :
- Rotation of the solar system bodies, with Commissions 15, 16, 20;
- Reference systems : what are they and what's the problem ?, with Commissions 4,7,8, 20,24,31,33,40;
- HIPPARCOS - an assessment, with Commissions 4, 8, 19, 24, 31, 40, 44;

Two proposed symposia are supported by Commission 19 :
- Developments in astrometry and their impacts on astrophysics and geodynamics, 15-19 September 1992, Shanghai (China),
- VLBI Technology, progress and future observational possibilities, 16-20 August 1993, Kyoto (Japan).

REFERENCE FRAMES : REALIZATION AND CONNECTION.
(Chair : D. McCarthy ; Secretariat : J. Luck).

O. Sovers (JPL) reported on a global VLBI catalog solution made using a number of observations from the Crustal Dynamics Project and IRIS. The largest errors are due to the treatment of possible source structure, source variability, and the overall connection to existing reference frames.

F. Arias (La Plata Observatory) reported on the connection of a radio source catalog to optical catalogs using RS CVn stars. Using simulated HIPPARCOS results she expects errors in the resulting link of about 0.001" in positions and 0.001"/yr in the angular velocity.

M. Feissel gave information on current discussions with the IAU General Secretary about an overall re-organization of commissions dealing with astrometry.

OPTICAL ASTROMETRY FOR EARTH ROTATION
(Chair : J. Vondrak ; Secretariat : F. Arias).

Jan Vondrak presented the report of the Working Group on Earth rotation in the HIPPARCOS reference frame, created by Commission 19 in Baltimore, 1988. The WG has 14 members and worked mainly by correspondence. It met only twice : October 1989 in Leningrad (IAU Symp. 141) and June 1991 in Paris (4 èmes Journées Systèmes de Référence Spatio-temporels). The WG prepared a list of observatories with best results to participate in the project of the prepared new reduction of optical astrometry observations (latitude since 1990, clock corrections since 1955) based on star-by-star data; 53 instruments were selected, out of which 41 already answered positively. The problems connected with homogeneisation of the observed data were shown and algorithms to be used were outlined (in order to bring all the observations into the unique celestial reference frame, using the same model for precession, nutation, aberration, gravitational deflection of light, refraction etc). Observation equations for all types of instruments have been derived and the necessary constraints to keep the terrestrial reference frame consistent with that of IERS formulated. Then the form of the normal equations of the final adjustment was presented and the problems connected with the identification and exclusion of outliers and selection of parameters to be adjusted were shown. The following discussion revealed the possibility of correlations between some of the adjusted parameters, e.g., UT1-UTC and motion of the celestial pole, expected due to nonregular distribution of observations in time.

Ye Shu-hua presented the report of the Analysis Center of Optical Astrometry in Shanghai, endorsed by Commission 19. It collected and analysed the data since 1988.0. The number of observations progressively decreased during the past three years, and the precision of the ERP determinations accordingly degraded. Shanghai Observatory published and distributed 12 quarterly reports; an astrometric database containing the observations from 1962.0 has been created. At present, there are 40 optical astrometric instruments active. It would be advisable to change the scientific goals of the Center, and to use these results to monitor the variations of the local verticals, using the ERP as defined by IERS and better star positions as given by HIPPARCOS as standards. Thus it will be possible to separate the local terms from the observational errors more efficiently. Shanghai Observatory is ready to undertake such a task. She also stressed that a great progress had been made lately in developing automatic photoelectric astrolabe in China, able to observe stars up to 11th magnitude. These observations can be used for prediction id earthquakes, as indicated in the papers by Hu Hui *et al.* and Zhang Guodang, whose abstracts were presented also by Ye Shu-hua.

K. Yokoyama shortly informed the audience about the works of the National Astronomical Observatory at Mizusawa related to this WG. The compilation of a unified catalog of Paris and Mizusawa astrolabe stars is on the way. The method used is a star-by-star comparison which is more informative and more useful for any research than using the averaged data. They can estimate ERP as well if they collect data from many stations.

B. Kolaczek presented the paper of M. Barlik and J. Rogowski: Variations of the plumb-line direction obtained from astronomical and gravimetric observations. During the past 15 years, these variations were systematically measured at the latitude station Jozefoslaw by the Warsaw University of Technology. There is a correlation between the secular drifts of both astrometrically and gravimetrically determined variations; the variations of the groundwater level show similar trend, but they cannot explain the variation of the meridien component.

M. Feissel then presented the draft versions of two resolutions, concerning 1) the future work of the WG on Earth rotation in the HIPPARCOS reference frame and 2) the Shanghai center, to be voted in the last bussiness meeting of Commission 19. The text of the first resolution was accepted by the attendants, while there were some objections to the wording of the second one; the participants thought that scientific considerations justifying the change should be more specific, even if they are out of direct interest of Commission 19. It was also stressed that the only long series of data existing are the ones with optical astrometry and it would be good not to interrupt them. As a consequence, a committee (J. Kovalevsky, D. McCarthy and B. Kolaczek) was designated to improve the formulation of the second resolution before the last bussiness meeting.

INTERNATIONAL EARTH ROTATION SERVICE (IERS)
(with Commission 31 ; Chair : K. Yokoyama, Chairman of the IERS Directing Board)

This session was organized to report to the IAU science community about the scientific and organizational achievements made by the various components of IERS during three and a half years since the beginning of the service in 1988. In the context of IAU interest, IERS has contributed considerably to constructing IAU reference systems, by compiling the IERS extra-galactic radio reference frame, as well as the IERS Standards as its fundamental basis. In fact during this General Assembly, IERS achievements have been reported at the Joint Discussion on Reference Systems, and the importance of the IERS work for the IAU reference system issues was clearly stated in the passed resolutions.

The meeting was attended by about 100 scientists. The session was started by an overview of the IERS activities by K. Yokoyama and "Summary Report of the IERS for the Period from August 1988 through July 1991" was distributed to the attendants. Then reports by the Central Bureau (CB, M. Feissel), Sub-Bureau for Rapid Service and Predictions (SBRSP, D.D. McCarthy), Sub-Bureau for Atmospheric Angular Momentum (SBAAM, D. Salstein, presented by M. Feissel), four technique Coordinating Centers (CC, VLBI, W.E. Carter; SLR, B.E. Schutz; GPS, W.G. Melbourne; LLR, Ch. Veillet; former three were presented by K. Yokoyama), and the advisor of the IERS Standards (D.D. McCarthy) followed.

K. Yokoyama summarized the report on the meetings, publications, dissemination of data and information, relations to the international bodies, etc., as well as the following special projects and events.

1) The Sub-Bureau for the Atmospheric Angular Momentum was set up on October 1, 1989 at the National Meteorological Agency (USA) led by J.A. Miller.

2) "IERS Standards (1989)" was published in November 1989 as the IERS Technical Note No 3 (ed. D.D. McCarthy). Improvement is being explored to cope with the millimeter accuracy achieved by the improvement of the observing techniques.

3) GPS is now one of the four observing techniques of IERS, with the Jet Propulsion Laboratory (USA) being its Coordinating Center. GPS CC conducted the first IERS global GPS campaign called GIG'91 during January to February 1991, with over 130 participating stations and 20 Analysis Centers. The first results of the polar motion analyzed by an MIT group was reported. Agreement with the VLBI results is excellent and this insures the usefulness of GPS in the future of the Earth rotation study.

4) VLBI technical development centers have been set up at the Haystack Observatory (USA) and the Communications Research Laboratory (Japan).

5) Intensive campaigns to detect short periodic variations in the Earth's rotation and relate them to atmospheric excitation have been decided to be conducted during 1991 to 1992 putting emphasis on synchronized observation with multiple observing techniques.

M. Feissel reported the activities of CB. The IERS Celestial Reference Frame (ICRF) has been implemented at the celestial frame section of the IERS/CB based on the individual radio reference frames provided by the VLBI Analysis Centers. It includes 396 objects between declinations -84° and +85° with 109 objects having uncertainties smaller than 0.001". The consistency among the individual frames after removing biases is about 0.0005", and the origins on the equator agree within ±0.0007". Uncertainties of the angles between the frames are at the level of 0.0001"~0.0003". The current efforts are to extend the Southern hemisphere coverage by VLBI observations.

The IERS Terrestrial Reference Frame (ITRF) has been implemented by the terrestrial frame section of the IERS/CB based on sets of station coordinates by various techniques provided by Analysis Centers. The scale and origin of the ITRF are defined by LAGEOS based coordinates computed by the Center for Space Research, University of Texas. In the latest realization, 134 sites are included, with 51 primary sites and 28 colocation sites. The uncertainty of the coordinates of most stations are smaller than a few cm.

Earth orientation parameters (EOP) have been computed at the Earth orientation section of the IERS/CB keeping consistency with the ICRF and ITRF. In the Annual Report for the Year 1990, three VLBI series, GSFC, NGS and USNO, and three SLR series, CSR, DGFII and GSFC were adopted to produce the 5-day spacing polar motion; the systematic corrections model by constant bias and linear trend. On the other hand, a daily UT1 series was produced from two VLBI series, NGS and GSFC, as well as the NGS daily UT1 series and the CSR SLR series. The length of day values are made by differenciating the daily UT1 series. Uncertainties of the 5-day raw normal values of polar motion are usually better than 0.0003" and those of 1-day UT1 are better than 0.1ms. Series of the celestial pole offsets were also produced on the basis of the VLBI series, with a precision better than 0.0002".

D.D. McCarthy's report of SBRSP was as follows. The major contributors to the SBRSP maintained by the National Earth Orientation Service (NEOS, USA) are: LAGEOS day (SLR), Delft 5-day (SLR), IRIS 5-day (VLBI), IRIS 1-day, Texas LLR. The series given in the Bulletin A for rapid service (NEOS rapid) has some systematic biases compared to the refined series of the NEOS and Central Bureau final values, but smaller than 0.001".

D. Salstein reported that SBAAM serves as the focal point for the collection of atmospheric data from the four centers, U.S. National Meteorological Center, European Centre for Medium Weather Forecast, United Kingdom Meteorological Office, and Japan Meteorological Agency. The primary quantities are analysis and forecast values of the effective atmospheric angular momentum functions, at 00 and 12 UT. Recently, three centers except JMA are preparing for providing 6-hour resolution data. Some data are available on a daily basis via a dial-up system.

W.E. Carter reported various achievements and plans of the VLBI community. IRIS-A, NAVNET, IRIS-P, IRIS-S and DSN networks are running regularly, and especially IRIS-A and NAVNET are producing 3.5-day spacing EOP's. Southern exten-

sion of the VLBI networks was emphasized. Important projects, such as VLBA, USSR QUASAR and Japanese VSOP were introduced. It was particularly important that the doubling of the bandwidths (both in s and x bands) of the US Mark-3 system realized mm accuracy repeatability in station coordinates determination.

B.E. Schutz reported that the operation of LAGEOS tracking by SLR has been done regularly. Following the launching of the USSR ETALON satellites (ETALON-1 in January 1989, ETALON-2 in May, 1989), a special campaign to evaluate the ETALON satellites for Earth rotation applications took place during September 1 to December 1, 1990.

Ch. Veillet reported that the operation of LLR has been conducted at Haleakala, CERGA and McDonald. In addition to the regular three stations, Wettzell and Orroral are attempting lunar laser ranging. Recently, Haleakala has met a serious budgetary cut from NASA for ranging to the Moon.

D.D. McCarthy reported that the revision of "IERS Standards (1989)" is being explored and a new version will be finalized by the end of 1991, by incorporating geophysical models hitherto unmodeled, as well as improved versions of the models in the current standards.

In order to advertise the IERS activities in the IAU, an article titled "The International Earth Rotation Service" prepared by F. Arias and K. Yokoyama appeared on the IAU newspaper, "Cruz del Sur", No. 10 issued on August 1.

At the end of the session, J. Kovalevsky made the following acknowledgement for the activities of IERS.

"We just heard the reports on the remarkable results obtained by IERS. This complex, and increasingly complex organization is working amazingly smoothly, and this by itself is an achievement. The precision of results is outstanding. So I believe that I can speak not only for myself but also on behalf of the whole scientific community here present to warmly congratulate all the participants of IERS from the Central Bureau, Coordinating Centers, Analysis Centers and observing stations."

RELATIVITY AS ITS AFFECTS REFERENCE SYSTEMS
(with Commission 31; Chair: P.Pâquet)

See the report of Commission 31, this volume.

VARIATIONS IN THE EARTH'S ROTATION.
(Chair : B. Kolaczek ; Secretariat : J. Popelar)

The session was chaired by Dr. B. Kolaczek who welcomed all and briefly introduced the program of the session and speakers.

V. Dehant reported on "The Effects of the Free Inner Core Nutation (FICN) on the Earth's Nutation". Computations of the FICN have been done analytically and corrections to the IAU 1980 nutation series have been obtained for the annual, the semi-annual and the 13.6 day terms. Comparisons with observationnal results show the best agreement for the semi-annual at 0.1 mas whereas unexplained residuals still remain for the 13.6 day and the annual terms. Further improvement for the annual term is expected from introduction of atmospheric pressure effects to be considered in the future work. Importance of ocean and gravity effects was pointed out by Yokoyama in the discussion and Matsakis mentioned that instabilities in some numerical solutions may account for differences between the analytical and numerical results.

D. Djurovic presented a paper co-authored by P. Pâquet "A Quasi Biennial Oscillation in Earth Rotation Fluctuations and Activity of the Solar Corona". He described the data sources and processing techniques which have been used to detect a significant

correlation between the Sun corona indices and the UT1-TAI time series between 1964 and 1990. Solar activity effects on the atmosphere and the Earth's magnetic field have been identified to facilitate such an interaction with the solid Earth. Questions about the length of the series used for the analysis and other possible periods have been addressed in the discussion which also emplasizes the need for greather collaboration with solar physicists.

D. McCarthy presented the paper by J.O. Dickey on "High Time Resolution Measurements of Earth Rotation". The work started in 1988 when Earth rotation measurements by several techniques were analysed with objectives to refine geophysical models and improve predictions of changes in the Earth rotation. A significant coherence between LOD and AAM down to about 8 days has been shown and a mismatch at 13.6 day period has been removed by the introduction of the Brosche ocean tide model. The AAM data show increased noise levels at lower frequencies. Future campaigns are expected to improve accuracy and increase frequency of geodetic measurements to be coordinated by the IERS. In the discussion Kolaczek pointed out the great importance of this work for the IAU Commission 19 and supporting resolution should be strongly endorsed.

K. Yokoyama reviewed "Results of the IRIS-P Burst Earth Rotation Observations in February 1990". Several 24-hour VLBI observing sessions by different networks (IRIS-P, IRIS-A, NAVNET) have been combined to obtain 2-hour EOP solutions over a pariod of one week. Using fixed station coordinates obtained from a global solution, short term variations in EOP have been determined but comparison with other independent techniques is needed for verification. Also, data reduction procedures will have to be studied to eliminate any possible systematic effects on the 2-hour EOP solutions due to nutation, atmospheric and other modelling. The design of future new VLBI systems should facilitate detection of short term EOP variations. The discussion stressed the preliminary character of the present results which need further studies and analyses.

M. Feissel summarized "Comments on the Precision of Polar Motion Determination" based on the analyses of six series of VLBI and SLR observations between 1984 and 1990. As a probable effect of unequal longitude distribution of stations in the VLBI and SLR networks used in the determination of polar motion, the uncertainty ellipses of the 5-day polar coordinates have a preferred direction of the major axis at about 45° E longitude. The direction obtained from the Allan variance analysis of the series of results match those determined from the variance-covariance matrices of each series. As a result, the IERS pole positions at 5-day intervals have an error ellipse with semi-major axis in the 45° E direction with an amplitude of about 0.4 mas. During the interval 1984-1990 the instability of polar motion for periods under 100 days attributable to geophysical causes have a noise ellipse with the semi-major axis in the direction 15-30° and the ratio between the semi-minor and the semi-major axes of 0.5. For higher frequencies the noise ellipse of the geophysical effects matches the error ellipse of the measurements for periods of about 10 days. In the discussion it was agreed that a particular attention must be given to a complete removal of any systematic differences between the series.

B. Kolaczek presented the last paper on "Analyses of Variations of Chandler Nutation and Seasonal Variations of Polar Motion between 1846 and 1988" based on the pole coordinates series compiled by the Kiev Main Astronomical Observatory. The FFT spectrum shows two peaks for the Chandler range and a single peak for the annual variations. The Chandler and annual nutations of pole coordinate variations were computed by the FFT filter as differences between input data and data obtained by inverse FFT with a selected frequency band removed. The choice of the removed frequency band has a considerable effect on the amplitude modulations of the Chandler and annual oscilla-

tions. The most pronounced oscillations of amplitude variations for the Chandler and annual oscillations have the period of about 40 years which may suggest a common source of their perturbations. The computed models of the amplitude modulation of the Chandler nutation consistent with the past oscillations predict a deep minimum for the Chandler wobble amplitude between 2010 and 2020.

A general discussion on a proposed resolution supporting greater cooperation with meteorologists and geophysicists in studies of the Earth rotation followed. It was decided that the resolution will be finalized and presented for a vote at the meeting of the commission on July 31, 1991. B. Kolaczek thanked all speakers and participants and adjourned the session.

THE WGRS RECOMMENDATIONS.
(With Commissions 4,7,8,20,24,31,33,40; Chair: J. Hughes)

The scientific aspects of the WGRS recommendations had been covered during the Joint Discussion earlier in the General Assembly. The discussion focused on their implementation. It was agreed that the recommendations are meant to *propose* a high precision consistent framework, and that actual implementations would be adapted to each particular case.

BUSINESS SESSION 2.
(Chair : M. Feissel ; Secretariat : J. Vondrak)

The General Secretary had made a proposal to merge some commissions, among which 19 (Rotation of the Earth) and 31 (Time) ; after receiving responses from the commissions concerned which emphasized the growing independence of their matters of concern, he withdrew his proposal. However, it is understood that the Executive Committee of IAU (EC) still wishes to reduce the number of commissions. Due to lack of information on the EC precise intents, the question could not be examined by the commission members. This situation gave rise to a general discussion on the functionning the IAU ; the main ideas expressed in the discussion are as follows. There is a lack of communication between the EC and the Commission Presidents which precludes mutual understanding ; the quick turnaround of functions (3 years) makes it impossible to pursue large scale actions ; the General Secretary should stay in function for a longer time, e.g. three successive terms ; if a reorganisation of the IAU is to be considered, proposals should be made by the EC to the National Committees for consideration, rather than to the Commission Presidents.

Information was given on the format proposed by the incoming General Secretary for the next General Assembly, to be held about 14-27 August 1994 in Den Haag, The Netherlands. Some of the symposia and colloquia sponsored by IAU in conjunction with the General Assembly would be held during the General Assembly itself, in parallel with commission meetings. The detailed setting will be worked out by the Executive Committee.

The establishment and membership of the two Working Groups recommended by the WGRS was discussed.

The Working Group on the Reference Frame is formed by IAU Commissions 4, 8, 19, 24, 31, 40, and IERS. A draft list of members was set up by the chairman of the WGRS, without consultation of the commissions involved. The incoming President of Commission 19, B. Kolaczek, is asked by the commission members to establish formal relationships with the chairman of the Working Group, C. De Vegt, and to nominate representatives of the commission.

The Permanent Working Group on Astronomical Standards is organized by Commissions 4, 8 , 19 , 24 and 31, in consultation with the IAG and the IERS ; its

chairman is T. Fukushima. Commission 19 nominated N. Capitaine, V. Dehant and D. McCarthy as its representatives in this Working Group.

The three resolutions presented during the previous meetings were further discussed and adopted. In the discussion of the first one, it was recognized that the schedule set by the IAU for the Business meetings was inconsistent with the deadline for submitting resolutions to the Resolution Committee ; as a consequence, the draft resolution had to be submitted to the latter before the vote could take place in the commission. The final text of the resolutions are listed at the end of the Commission report.

The commission officers for 1991-1994 listed hereafter were elected.

President : B. Kolaczek
Vice President : J. Vondrak

Organizing Committee

N. Capitaine (1)	N. Mironov (2)
J.O. Dickey (2)	W.G. Melbourne (1)
S. Dickman (1)	L. Morrison (1)
M. Feissel (1)	D. Robertson (1)
Jin W.J. (2)	T. Sasao (2)
D.D. McCarthy (2)	P. Wilson (1)

(1) First term ; (2) Second term

The following list of new commission members and consultants was adopted.

New members

A. Banni	Italy
G. Beutler	Switzerland
M. Bougeard	France
J. Boytel	Cuba
A. Brzezinski	Poland
V. Dehant	Belgium
D. Gambis	France
J. Hefty	Czechoslov
O. Kameya	Japan
Z.A. Li	China
C.Y. Liu	China
G. Petit	France
M. Soffel	Germany
K. Steinert	Germany
J.Y. Xu	China
Y.Z. Zhu	China

Consultants

K.D. Aldridge	Canada
B.F. Chao	USA
R.Eanes	USA
R.S. Gross	USA
T. Herring	USA
H. Jochmann	Germany
Z.S. Li	China
C. Ma	China
K. Nurutdinov	USSR
N. Pejovic	Yugoslavia
B. Richter	Germany
R. Sabadini	Italy
H. Schuh	Germany
G. Soltau	Germany
M. Stavinschi	Romania
M. Tsesis	USSR
C. Wilson	USA
V.E. Zharov	USSR
Y.Z. Zhu	China
J.Y. Xu	China

Three members died in the 1988-1991 term : J.G. Davies (UK), H. Jeffreys (UK), and A. Stoyko (France) ; three members resigned : K. Lambeck (Australia), N.P.J.

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O'Hora (UK), and A Orte (Spain) ; 48 other individuals who did not confirm their intent to remain members of Commission 19 had their names deleted from the membership list.

RESOLUTIONS

HIGH TIME RESOLUTION MEASUREMENTS OF THE EARTH'S ROTATION

The 21st General Assembly of the International Astronomical Union

recognizing
the importance of rapid determinations of Earth rotation recommended by the International Workshop "Interdisciplinary role of space geodesy" held in Erice (Italy) in 1988, and

considering
the proposal made to the International Association of Geodesy by its Special Study Group 5.98 on "Atmospheric excitation of the Earth's rotation" to set up a Working Group on "High time resolution measurements of Earth rotation",

requests
the Executive Committee of International Astronomical Union to approach the International Association of Geodesy in order to consider the possibility of organizing a joint IUGG/IAU Working Group for such activity.

THE EARTH'S ROTATION IN THE HIPPARCOS REFERENCE FRAME

Commission 19, Rotation of the Earth

Considering
- that the HIPPARCOS program is expected to provide star coordinates, yearly proper motions and parallaxes at the 0.002" level of accuracy,

- the conclusion of the Working Group on Earth Rotation in the HIPPARCOS reference frame stating that the re-reduction of past optical observations is feasible,

- that the new data collection and the test of the new reduction scheme proposed by the Working Group will require time for preparation,

thanks
- the observatories which have accepted to contribute their observations to the new analysis,

- the Working Group on Earth Rotation in the HIPPARCOS reference frame for its achievements under the efficient chairmanship of J. Vondrak,

recommends
- that the Working Group on Earth Rotation in the HIPPARCOS reference frame extends its activity to the actual implementation of the analysis scheme proposed, under the present chairmanship
- that the observatories provide the past observations to the Working Group,
- that the Astronomical Institute of the Czechoslovak Academy of Sciences collects the observations and performs their global analysis,
- that the contributing observatories be given the same priority of access to the results of the analysis as the Working Group members.

APPLICATIONS OF OPTICAL ASTROMETRY TIME AND LATITUDE PROGRAMS

Commission 19, Rotation of the Earth

Considering
- that modern astrometric observations provide a unique set of data sensitive to variations in the deflection of the vertical,
- that optical astrometric data previously used to measure the rotation of the Earth have been shown to measure the variations in the deflection of the vertical,
- that the collected astrometric data contain valuable information on star positions including radio stars,
- that Recommendation 7 of the Working Group on Reference Systems calls for new comparisons between reference frames,

thanks
the Shanghai Observatory for establishing and operating an analysis centre for optical Earth rotation data, and

recommends
that optical astrometric data continue to be collected by the Shanghai Observatory in order
1) to investigate the possibility of deriving long-term variations in the deflection of the vertical within the reference frame provided by HIPPARCOS, and that the International Association of Geodesy be invited to consider undertaking this project,
2) to provide data for the connection of celestial reference frames.