31. COMMISSION DE L'HEURE

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GENERAL

We note with regret the death of Dr P. Lejay, S.J., and of Sir Harold Spencer Jones. The latter was President of this Commission from 1948 to 1955. His contributions to the study of the secular and irregular variations in speed of rotation of the Earth are of fundamental importance.

During the past three years improvements have been made in the accuracy of time determination. A significant development was the introduction of atomic clocks for control of transmissions and for use in studying variations in speed of rotation of the Earth.

Determinations of longitude and latitude made in connection with the IGY have continued. The co-ordination of time signals by several countries was begun.

The IAU will participate in an advisory capacity in the work of the International Radio Consultative Committee (CCIR). Commission 31 will be concerned with the work of Study Group no. VII of the CCIR (Standard Frequency and Time Signals).

BUREAU INTERNATIONAL DE L'HEURE

The BIH has continued to calculate and furnish corrections for variation in longitude promptly, thanks to the rapid transmission of results from 17 stations which utilize 20 instruments to determine the variation of latitude. These corrections are used for computing corrections to transform U.T. 0 to U.T. 1.

N. Stoyko has called attention to a difficulty attending the computation of the corrections for seasonal variation. The final corrections for time are sent to the BIH with a considerable delay, as much as 11 months, which hinders the work of the BIH. In response to this information the U.S. Naval Observatory adopted the policy of sending a copy of the final corrections to the BIH in advance of publication. Through the use of punched cards it was possible to send final corrections up to the middle of November 1960 at the end of the year.

The Report of the Director is given further below.

INTRODUCTION OF FK 4

Resolution no. 59 adopted at the tenth General Assembly of the IAU states that FK 4 will be introduced in timekeeping at the beginning of the year following the publication of corrections to individual positions of the fundamental stars which transform FK 3 into FK 4. A letter has been received from the Director of the Rechen-Institut which states that FK 4 will be published in the year 1961. Hence, FK 4 will replace FK 3 in timekeeping on 1962 January 1.

INSTRUMENTS

Photographic Zenith Tubes (PZT) and Danjon astrolabes have come into widespread use. The application of photo-electric registration for time determination has been continued. The

https://doi.org/10.1017/S0251107X00021970 Published online by Cambridge University Press

operation of the Danjon astrolabe is aided considerably by use of the totalizing chronograph developed by J. Blaser at Neuchâtel.

The probable errors obtained with the PZT at Ottawa were formerly high, despite several attempts to improve the operation of the instrument. The errors have been finally reduced to that of other PZT's, however, by moving the instrument from its location in the administration building to a separate shelter.

MOTION OF THE POLE

In accordance with discussions held at the tenth General Assembly of the IAU, it was decided that the origin of the pole used in the computation of $\Delta\lambda$ should be moved to the approximate center of the observed polar motion path. The change was made by the BIH accordingly, in the interval 1958·75 to 1958·95.

The shifting of the pole introduces discordances in the determination of U.T.1 and U.T.2. The change in the position of the origin was made on the assumption that the secular motion of the pole which has been observed since about 1920 was not due to motion of the pole. Evidence that the secular motion was real, however, was presented at the symposium on the variation of latitude, held at Helsinki in 1960 (**1**). Whether or not the pole is moving secularly, it is clear that the change in the origin from time to time introduces discontinuities in timekeeping. The desire has been expressed by several observatories that a fixed origin should be used for timekeeping. Resolutions were adopted at Helsinki which permit the computation of the motion of the pole to be based on either a fixed or a moving origin. A recommendation for the use of a fixed origin for timekeeping is proposed below.

ATOMIC OSCILLATORS AND ATOMIC TIME

The frequency of caesium in terms of the second of Ephemeris Time was determined jointly by the National Physical Laboratory, Teddington, and the U.S. Naval Observatory, Washington (**2**). The value obtained is 9 192 631 770 ± 20 cycles per second.

There has been developed in the United States a commercial caesium oscillator denoted Atomichron. Several of these have been compared with the caesium oscillator at Teddington, by direct comparison in the laboratory and by means of radio transmissions. Various caesium oscillators have the same frequency to about ± 2 parts in 10^{10}.

Ammonia masers have also come into use for timekeeping purposes, but not to the same extent as caesium oscillators. The frequency of an ammonia maser is more dependent upon construction than is a caesium-beam oscillator.

Resonators of the gas-cell type are under development for use as a source of constant frequency. These are simpler in construction and operation than either the caesium beam or ammonia maser. There are indications that high accuracy will be achieved, but thus far long-time comparisons have not been made.

A device which appears to give promise of very high accuracy is the hydrogen maser developed by N. Ramsey at Harvard, which is controlled by the 21-cm line of atomic hydrogen.

The U.S. Naval Observatory inaugurated a system of atomic time, denoted *A.1*, as of 13 September 1956. This system was initially based on the Atomichrons at the Naval Research Laboratory, Washington. Other caesium resonators were incorporated, beginning July 1960, through comparisons of frequency, using the VLF transmissions of NBA and GBR. *A.1* is now based upon atomic oscillators of the U.S. Naval Observatory at Washington and Richmond, the Naval Research Laboratory, the National Bureau of Standards, Harvard, the National

https://doi.org/10.1017/S0251107X00021970 Published online by Cambridge University Press

Research Council (Ottawa), the National Physical Laboratory (Teddington), CNET (Bagneux), and Neuchâtel.

A system of atomic time called T.A.I was inaugurated at Neuchâtel. This is based upon an assumed frequency of 22 789 421 730 cycles per second for the ammonia maser, derived from a comparison with caesium as given by the system A.1 of the U.S. Naval Observatory in 1957. The two systems are in good agreement.

VLF

The advantages of very low frequency (VLF) for the transmission of precise time and constant frequency have been demonstrated for a number of years through the operation of GBR, Rugby, on 16 kc/s.

In June 1959 the U.S. Navy announced its intention to provide constant frequency of high precision through stabilization of its several VLF transmitters. Transmissions of precise time and constant frequency were begun by NBA, Canal Zone, on 18 kc/s in December 1959, and on 1 July 1960 were increased to 24 hours daily.

The frequency is offset from nominal by -150×10^{-10} during 1960 and 1961, in accordance with agreements described below. The offset is announced each 15 minutes in International Morse code by NBA.

The frequency control is directed by the U.S. Naval Observatory, Washington, and is maintained constant to about ± 1 part in 10^{10} with respect to atomic oscillators located internationally. An analysis of the reports of seven laboratories shows that during October 1960 the frequency of NBA was constant at $-149{\cdot}6 \times 10^{-10}$ with respect to caesium. The day-to-day variation for a 24-hour interval was 3 parts in 10^{11}.

A comparison of the frequency differences between GBR and NBA as measured at several stations shows that frequency may be determined in a 24-hour interval to about 2 parts in 10^{11}, with respect to the transmitted carrier.

CO-ORDINATION OF TIME AND FREQUENCY TRANSMISSIONS

The observation of artificial satellites on a world-wide basis makes it necessary that time signals shall be available immediately about the world on a single system to avoid the necessity of waiting months for correction. As a step to achieve this, it was agreed in August 1959 to co-ordinate the time and frequency transmissions of the United Kingdom and the United States. Stations participating in the plan are: in the U.K., GBR and MSF, Rugby; in the U.S.A., NBA, Canal Zone, WWV, Beltsville, and WWVH, Hawaii. The agencies participating in this plan are; in the U.K., the Royal Greenwich Observatory, the National Physical Laboratory, the General Post Office; and in the U.S.A., the U.S. Naval Observatory, the Naval Research Laboratory, and the National Bureau of Standards.

The present goal is to have time signals emitted in synchronism to one millisecond and to have the carrier frequencies within ± 1 part in 10^{10} of an agreed offset value from nominal.

The Neuchâtel Observatory, the Dominion Observatory, and the Union Observatory have announced their intentions to participate in the co-ordination plan.

The co-ordination plan operates within the framework of the IAU and the CCIR. It is not planned to establish a new international agency. The operation of each station remains independent at all times.

For the co-operating stations, the time pulses and carrier frequency are locked together, being generated by the same quartz oscillator. The frequency is maintained constant with respect to caesium, using an assumed value of 9 192 631 770 c/s, but is offset by a fraction s, so that the frequency transmitted,

$$F = F_0 (1 + s),$$

is such that the time pulses are nearly in accord with U.T. 2. F_0 is the nominal frequency of the transmitter. The value of s is kept fixed in any year. The value for 1960 was -150×10^{-10} and the same value is retained for 1961.

The time pulses will remain within 50 ms of U.T. 2, as recommended by the CCIR. Changes of exactly 50 ms will be made on the first of a month, when necessary. Probably no more than two changes will be made in any year. None was made in 1960.

The frequency can be maintained to within 1 part in 10^{10} of the stated value. Thus, there can be immediately available without the necessity of waiting for corrections:

(*a*) U.T. 2 accurate to 50 ms,

and (*b*) standard frequency accurate to 1 part in 10^{10}.

In September 1960, URSI recommended that the offset frequency for each year should be chosen, after consultation with those concerned in the control of the stations, by the BIH. This is proposed as a recommendation for adoption by Commission 31 of the IAU.

CONVENTIONAL LONGITUDES

It is known that the conventional longitudes of stations which determine time are in error by as much as 80 milliseconds. In accordance with a recommendation of the IAU, however, the conventional longitudes cannot be arbitrarily changed. The errors are due to the fact that these longitudes were determined without the aid of radio time signals and with instruments which do not have modern accuracy. The co-ordination of time signals, described above, leads to the requirement that the conventional longitudes shall be co-ordinated. As a provisional measure, the U.S. Naval Observatory has adopted empirical corrections of $-0^s{\cdot}040$ for Washington and $-0^s{\cdot}029$ for Richmond, to be applied to Universal time determined by these stations to make the U.T.'s accordant and on the system of Greenwich.

There are three problems involved: (*a*) the error in the conventional longitude, (*b*) the error due to the displacement of the origin of the polar motion used for computing the variation in longitude, and (*c*) the error in star positions used to reduce to FK 3 or FK 4. A recommendation for revising the longitudes is given below.

TIME SIGNALS, EPOCH AND TIME INTERVAL

In accordance with recommendations of the IAU and the CCIR, time pulses are transmitted on the system U.T. 2. They could also be transmitted, however, on the system of ephemeris time or of atomic time. The system to be preferred is the one which best meets the needs of those who require time in the sense of epoch.

Epoch provided by U.T. 2 is based on the rotational position of the Earth about its axis, which is required for celestial navigation, geodesy, and for tracking artificial satellites against the background of the stars. Because of variations in the speed of rotation of the Earth the rotational position of the Earth cannot be obtained from a device such as an atomic clock but must be obtained by astronomical observation.

The physicist does not require epoch for describing physical phenomena, but merely time interval. This distinction between epoch and time interval has been recognized implicitly in a resolution adopted by the eleventh General Conference on Weights and Measures, held in

Paris in October 1960. The Conference recommended that a scale of time interval based on an atomic (or molecular) transition be considered for adoption at the twelfth General Conference to be held in 1966. It is possible, therefore, that a definition of time interval based on an atomic transition may be adopted then.

A scale of time interval which is identical with the second of Ephemeris Time was adopted in 1956. Thus, there may be two definitions of time interval in use in the future, one for astronomy and one for physics.

As regards epoch, the only kind that is needed immediately is the epoch of U.T. 2. Hence, transmissions of time pulses on U.T. 2 will be continued. Time pulses could be transmitted, in addition, on a system of atomic time, such as A. 1, which would have no predictable relation to U.T. 2 and which could depart from it by ever increasing amounts. It is undesirable, however, to transmit two kinds of time because of the confusion that would result to navigators and geodesists and because of the urgent necessity for conserving the radio frequency spectrum. Each transmission should serve as many users as possible. The utilization of atomic oscillators for the concurrent transmission of time signals and constant frequency as described under 'Co-ordination' appears to offer the best means, at present, of meeting the needs of navigation, geodesy, and physics.

SPEED OF ROTATION OF THE EARTH AND SOLAR ACTIVITY

The introduction of the atomic clock in timekeeping, in June 1955, along with the general employment of the PZT and Danjon astrolabe has made it possible to study changes in speed of rotation of the Earth with much higher precision than previously. This has led to studies of possible connections between solar activity and either sudden or irregular changes in speed of rotation. The results obtained by various investigators, however, are not always in agreement.

A. Danjon announced in November 1959 (3) that a sudden change in the speed of rotation of the Earth had occurred in July 1959, at about the same time that large geomagnetic storms had occurred on the Sun. The President of the Committee on Space Research (COSPAR) requested that Commission 31 of the IAU examine this matter in view of questions raised at the IUGG meeting in Helsinki, August 1960. This is now being done. There is general agreement that the rotation of the Earth was abnormal in 1959. What has to be decided is whether there was a sudden change in speed or merely a change in phase of the normal seasonal variation.

A basic difficulty in the problem is that the astronomical observations determine time and not rate; the latter must be obtained by some process which involves smoothing. It is essential that the observations for time for each night, referred to an atomic clock, shall be given to provide the bases for analytical studies. Such data were supplied for the PZT's of Washington and Richmond for each night of observation in 1959. Similar compilations were made by the Dominion, Greenwich, and Neuchâtel Observatories, and other ones are probably being made.

On the theoretical side, a mechanism is necessary to change the speed of rotation through solar activity. E. Schatzman (4) attempted to suggest a mechanism in May 1960. In October 1960, however, he decided that the transfer of sufficient momentum to or from the crust of the Earth to account for sudden changes could not be explained (5).

J. v. d. Heide reports that sudden changes in the rotation of the Earth occurred at 1956·1 and 1959·6, based on observations made with a small transit instrument and referred to quartz clocks. It is doubtful, however, if such results could have the precision necessary for determining sudden changes in speed.

H. Uyeda, Y. Suaburi, H. Iwasaki, of the Radio Research Laboratory, Japan, have announced

https://doi.org/10.1017/S0251107X00021970 Published online by Cambridge University Press

a strong correlation between sunspot number, R, and the speed of rotation of the Earth. The results are based on the operation of PZT's and caesium oscillators in England and the United States for the interval 1955·5 to 1960·0. This interval is less than half a sunspot cycle of 11 years, and the correlation found is probably fortuitous. D. Brouwer (**6**) has previously determined the speed of rotation of the Earth from 1820 to 1950. No general correlation with R is found for the interval 1820 to 1960.

INTERNATIONAL GEOPHYSICAL YEAR

Observations were made at about 35 stations for determining astronomical latitude and longitude. These results are being reduced by the BIH. Observations for the Moon programme were made at 16 stations. As of 1 January 1961, 5800 plates were received. Of these, 2800 were measured and reduced. Plates are measured at Washington, Greenwich, Paris, and Cape, and are reduced at Washington.

ARTIFICIAL SATELLITES IN TIMEKEEPING

An artificial satellite could be used to test whether a secular drift exists between gravitational time and atomic time. For this purpose the satellite should fly at a high altitude, 10 000 or 20 000 kilometers at perigee, and its density should be high. No such satellites have as yet been placed in orbit but it is hoped that they will be launched.

Other experiments that have been proposed concern the theory of relativity.

REPORTS OF OBSERVATORIES AND LABORATORIES

Belgrade

Transit instruments are used for time determination. Preparations have been made for installing quartz clocks. Two studies are to be published: one, on the influence of external and instrumental effects on the determination of time, by Z. M. Brkic, and the other, on astronomical pendulums, by Lj. A. Mitić.

Berlin-Babelsberg

A PZT is under construction. Trial observations are expected to begin about the middle of 1961. The instrument is to be used in conjunction with the meridian circle, chiefly for problems of basic astronomy.

Dominion Observatory (*Ottawa*)

The Ottawa PZT catalogue was revised January 1959. During 1960 the observing schedule was increased to all night. The PZT was moved from the transit room to a separate, newly-built hut. As a result, the night error in α and δ (dispersion of the nightly values from the adopted smooth curves) fell from 13 ms to 7 ms and from $0''\cdot08$ to $0''\cdot04$, respectively. The PZT operation is fully automated with a light and rain alarm, which closes the roof when necessary.

Commencing August 1960 the three CHU frequencies, 3330 kc/s, 7335 kc/s, and 14 670 kc/s, have been controlled by the same standard 100 kc/s oscillator from which the signal pulses are derived. Since January 1961 the oscillator frequency has been controlled with reference to the caesium standard of the National Research Council, Ottawa.

Edinburgh

A set of three 5-Mc quartz-crystal clocks has been installed at Royal Observatory, Edinburgh, for use chiefly in satellite tracking.

German Hydrographic Institute (Hamburg)

Since January 1959 determinations for time have been made with a PZT. The average external error of a group amounts to ±8 ms. The PZT catalogue is to be revised. Systematic errors of FK3 in α were derived from time determinations made with transit instruments.

Hamburg-Bergedorf

J. v. d. Heide has analyzed the observations for time with the aid of quartz-crystal clocks to obtain corrections in α to FK3. Also, he has found two sudden changes in the speed of rotation of the Earth: +0·736 ms/d (Earth faster) about 6 February 1956, and −0·347 ms/d (Earth slower) about 7 August 1959.

Hydrographic Service, Paris

A. Gougenheim has developed a method for the precise and simultaneous determination of latitude and time by the method of equal altitudes. The solution is made directly by least squares with the aid of an electronic calculator.

La Plata

The Astronomical Observatory at La Plata started its Time Service in August 1958. The time observations are made with transit instruments and meridian circle, using a quartz-crystal clock and a printing chronograph. The oscilloscope has been used since April 1960 for the reception of time signals. The Service participated in the determination of longitudes in the International Geophysical Year prolongation, from 1 August 1958 to 31 December 1959. The results are reported in *Boletin Horario*.

Mizusawa International Latitude Station

Observations are made with the PZT in a joint programme with U.S. Naval Observatory, for time as well as latitude. About half of the PZT stars are common to those of Washington, and the system of stars is the same as that of Washington. One Essen-ring quartz clock has been used, and another was installed in 1960.

Mount Stromlo Observatory

The PZT observations have been made regularly since November 1958, from dusk to dawn where possible, in order to obtain relative corrections to the star places. The reductions are carried out with an electronic computer. Time determinations with the transit instrument will cease in 1961 and will be made with the PZT instead. The rhythmic time signals from Belconnen have been replaced by mean time signals and the second-to-second stability has been improved. A VLF comparator, cathode-ray oscilloscope, and decimal counter and printer have been installed for frequency and time measurements.

National Center of Tele-communications (Bagneux, near Paris)

An Atomichron (caesium beam) has been in service since November 1957. Construction of a caesium beam, a gas cell, and a maser are in progress. Measurements of the phase of the VLF stations GBR and NBA were made for the comparison with atomic oscillators of other countries as well as for the study of transmission of phase. Work is also carried out in conjunction with the University of Besançon, which has installed an ammonia maser.

National Physical Laboratory (Teddington)

At the National Physical Laboratory, a new caesium beam chamber, denoted C. 3, has been built. It gives a resonance 50 c/s wide and should have a precision of a few parts in 10^{11}. It is used intermittently to check the original caesium standard. Comparisons with atomic standards operating elsewhere have been continued.

Equipment has been made for monitoring the frequencies of the VLF stations GBR and NBA. The results are used for co-ordinating the standard frequency transmissions from the United Kingdom and the United States.

Neuchâtel

Determinations of time have been made with the PZT and with a Danjon astrolabe. The latter was used at two locations, near the PZT and on a mountain top. A totalizing chronograph was developed by J. Blaser for use with the astrolabe.

A system of atomic time, denoted T.A. 1, was established in conjunction with the Laboratoire Suisse de Recherches Horlogères, which is based on the operation of an ammonia maser. The frequency of HBN is maintained constant with the aid of this maser. A caesium-beam oscillator has also been built. The frequencies of the VLF stations GBR and NBA are monitored regularly.

Prague

The Astronomical Institute of the Czechoslovakian Academy of Sciences uses an electronic method for the reception of time signals. Time and frequency are transmitted by station OMA on 2·5 Mc/s and 50 kc/s. Three Czechoslovakian astronomical stations have concluded their determinations of longitude and latitude for the IGY program.

Royal Greenwich Observatory

Observations for time are based on the Herstmonceux PZT. An astrolable was brought into use on 1 September 1959. Corrections to star places are being obtained but the astrolabe thus far is not used for the operational work of the Time Service.

Eight Essen-ring quartz-crystal oscillators have been installed at Herstmonceux. These are compared with clocks at the Post Office Laboratories and at NPL. A scale of atomic time, denoted Cs.1, was established. Rhythmic time signals, which commenced in 1927, ceased on 30 June 1958. Mean time signals continue from GBR. Beginning 1 April 1960 the time pulses from GBR have been generated at Rugby by the same clock that generates the MSF pulses. Co-ordination was affected between the transmissions of time and standard frequency of the U.K. and the U.S.A.

A dual-rate Moon camera was fitted to the 13-inch astrographic telescope and has been in use since 3 September 1958. One hundred pairs of plates taken at Herstmonceux have been measured, as well as 95 pairs taken at Perth between 1958 and 1960.

San Fernando

The determination of time is made with the aid of two transit instruments and two quartz-crystal clocks.

Tokyo

U.T. 2 has been determined by observations made with the PZT. Provisional star places were used during the IGY, but since the beginning of 1959 revised ones have been used.

An Essen-ring quartz-crystal clock, which has run continuously since November 1957, serves as a primary standard. A maser frequency standard of ammonia, designed by K.

https://doi.org/10.1017/S0251107X00021970 Published online by Cambridge University Press

Shimoda, was installed at the Observatory in 1960. It replaces the absorption resonator previously used.

Beginning March 1960, the only regular time signals from Japan are from JJY. Since February 1959, special signals have been emitted to Europe, for the purpose of determining the travel time of radio waves. A direction finder and a wave form monitoring apparatus are used for receiving foreign signals.

The variation in speed of rotation of the Earth has been studied.

Uccle

The observations for time are made with a transit instrument, 'Bamberg-Askania'. Reductions are made with the aid of an electronic calculator. An Essen-ring quartz-crystal oscillator was placed in service in 1960.

Union Observatory (Johannesburg)

Transmissions of time and standard frequency are broadcast although time is not yet determined by the Union Observatory. Time signals are steered with reference to WWV. Serious interference is caused by transmissions on the same frequencies from stations JJY and BPV.

U.S. Naval Observatory

Observations for time were continued with PZT's at Washington, D.C., and at Richmond, Florida. Group corrections were derived for each station, which will be applied beginning 1 January 1961. Observations are also being made at Washington with a Danjon astrolabe. It is planned to transfer this instrument to Richmond.

Beginning 1 January 1959, observations for time have been referred exclusively to atomic clocks. The atomic clocks are used for obtaining both atomic time and, by interpolation of observations, Universal Time. The system of atomic time, denoted A. 1, is described in *Time Service Notice* No. 6.

The control of transmissions of time signals from Naval Radio Stations NSS, NPG, NBA, and NPN has continued. VLF transmissions of precise time and constant frequency, 24 hours daily, were begun in December 1959, by NBA, Canal Zone, on 18 kc/s.

The dual-rate Moon camera was used to obtain Ephemeris Time. Reductions were made for plates measured at Greenwich, Paris and Cape.

Caesium oscillators were installed at Washington and Richmond in July 1960. These are used in conjunction with the caesium oscillator at the Naval Research Laboratory, Washington, which has been in operation since September 1956.

Studies of the speed of rotation of the Earth, using the improved star places, are in progress.

U.S.S.R.

To the twelve time services of the U.S.S.R. previously reported there has been added one at Novosibirsk. The number of time signals transmitted has increased since the beginning of 1960. The oscilloscope is used for the monitoring of time signals. The time-service equipment used has been improved. Ten transit instruments made in the U.S.S.R., which use the photo-electric method of registration, have been put in service. Six Danjon astrolabes are in use. A new photo-electric transit instrument is being constructed under the direction of N. N. Pavlov. During the IGY 12 727 series of observations for time and more than 150 000 observations of stars were made. Studies of the time results for each station are made in order to improve the catalogue positions. Radio transmissions are carried out in co-operation with the Observatory of Zi Ka-Wei. In 1960 the *Time Service Bulletin* published the results of 61 daily emissions of signals, of which 39 are of the U.S.S.R.

Warsaw

The Astronomical-Geodetic Observatory of the Warsaw Polytechnic Institute participated in the IGY longitude operation. In the period February 1958 to November 1959 about 5000 transits were observed. About 2000 time signals were received by the Polish National Bureau of Standards.

RAPPORT DU DIRECTEUR DU BUREAU INTERNATIONAL DE L'HEURE POUR LA PÉRIODE 1958-1960

La période de 1958–60 a continué d'affirmer un progrès de l'activité du BIH. Le nombre des réceptions de signaux horaires a augmenté de 54% en moyenne.

Le *Bulletin Horaire* a paru réguilièrement. Il a donné les heures demi-définitives de toutes les émissions reçues au BIH. Il a publié, de plus, les heures définitives pour les années 1957, 1958 et 1959. A partir du 1er Juillet 1957 les résultats se rapportent à l'Année Géophysique Internationale et à la Coopération Géophysique Internationale. Pendant cette période, l'heure définitive est publiée pour 280 émissions de signaux horaires radioélectriques d'après 1 140 réceptions journalières dans 41 observatoires, pour lesquels sont données les corrections quotidiennes. Ainsi, le nombre des réceptions exploitées est plus que doublé et le nombre des observatoires utilisés est augmenté de 37%.

Pour le calcul du temps universel uniforme provisoire (T.U. 2) le BIH détermine le mouvement du pôle instantané et l'irrégularité saisonnière de la rotation de la Terre d'après la décision de l'UAI. Les coordonnées du pôle instantané sont calculées par le BIH en utilisant les résultats des observations de latitude de 17 observatoires (Service International Rapide, SIR). Les corrections dues à l'irrégularité saisonnière de la rotation de la Terre sont extrapolées en utilisant les résultats des 3 résonateurs à césium (Paris, Teddington, et Washington) par rapport à l'heure définitive.

Les observations astronomiques ont été faites réguilièrement en utilisant deux astrolabes à prisme impersonnels de A. Danjon et deux lunettes de passages (Gautier no. 381, Bouty).

Pendant la période écoulée, on a étudié au BIH les variations de longitudes, l'irrégularité de la rotation de la Terre, le mouvement du pôle, la propagation des ondes radio-électriques, la comparaison des étalons atomiques situés à grande distance, les longitudes mondiales, etc. . .

Le BIH a été chargé par CSAGI de réunir et discuter pour la Section des longitudes les résultats des observations pendant l'AGI. A partir du 1er Juillet 1957 le BIH a reçu les résultats de 49 stations de longitudes et de 26 stations de latitudes. Le nombre des observations astronomiques de l'heure pendant cette opération est égal à 40 000 et le nombre des réceptions de signaux horaires radio-électriques à 1 000 000.

La discussion des résultats de l'AGI est déjà commencée et les résultats préliminaires sont déja calculés. L'écart moyen des résultats semestriels par rapport à la moyenne de deux années est égal à $0^s{\cdot}008$. On continue la discussion des résultats de longitudes par l'instrument et l'observateur, la détermination de la vitesse apparente de propagation des ondes radio-électriques, l'amélioration du catalogue d'étoiles observées, etc. . . .

PROPOSALS

A. The following suggestions have been made, which do not require formal approval:

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1. When publishing results of observations for time, the Julian date and decimal fraction should be given.

2. A copy of the final corrections to time signals should be sent to the BIH in advance of publication, if feasible.

3. Information on schedules of transmissions of time signals and changes thereto should be sent to the BIH for publication in the *Bulletin Horaire*.

B. The following recommendations are proposed for adoption by Commission 31:

1. A fixed origin, denoted the 'pole of 1900-05', should be used in the derivation of $\Delta\lambda$ for converting U.T. 0 to U.T.1.

2. A mixed commission of the IAU and International Association of Geodesy (IAG) be appointed to derive new values of the conventional longitudes of time determining stations. The work to be centralized in the BIH and to be carried on in consulation with the observatories concerned. The new values to be available about 1963.

3. Each year, after consultation with observatories concerned in the transmission of time pulses and constant frequency, the BIH shall recommend a value of the fractional offset from nominal frequency to be used during the next year in order that the time pulses shall be nearly on the system U.T. 2. The offset is based on an assumed frequency of 9 192 631 770 c/s for caesium.

C. The following resolution is proposed for adoption by Commission 31 and by the General Assembly:

1. Commission 31 recommends that high-altitude satellites be launched which can be used for experiments concerning the fundamental nature of time.

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APPENDIX

Milan Observatory, Brera

Operation of the time service began for the IGY, using two small transit instruments and two quartz-crystal clocks. Results for 1957, 1958, and 1959 have been published. The installation of a Danjon Astrolabe is planned for 1962.

https://doi.org/10.1017/S0251107X00021970 Published online by Cambridge University Press