

REFERENCES

- (1) *Trans. I.A.U.* **8**, 92, 1954.
- (2) *Trans. I.A.U.* **8**, 90, 1954.
- (3) G. M. Clemence, *Astr. Pap., Wash.*, **11**, part II, 1949.
- (4) D. H. Sadler, *Occasional Notes, R.A.S.*, no. 17, 1954.
- (5) A. J. J. van Woerkom, *Astr. Pap., Wash.*, **13**, part I, 1950.
- (6) Joseph Ashbrook, *Astr. J.* **58**, 145, 1953.

APPENDIX

REPORTS OF THE DIRECTORS OF THE NATIONAL EPHEMERIDES

Instituto y Observatorio de Marina, San Fernando (Cádiz), Spain

The contribution to *Apparent Places of Fundamental Stars*, of the apparent places of 396 10-day stars, has been continued. The *Almanaque Náutico*, *Almanaque Náutico para uso de los Navegantes* and *Almanaque Aeronáutico* have been published regularly, with only minor modifications.

W. BENITEZ

Nautical Almanac Office, U.S. Naval Observatory, Washington, D.C., U.S.A.

The *American Ephemeris*, the *American Nautical Almanac*, and the unified *Air Almanac* have been published regularly without substantial changes.

The apparent places of 162 10-day stars have been supplied annually for the volume *Apparent Places of Fundamental Stars*.

The work on the motions of the principal planets undertaken in 1947 jointly by the Yale University Observatory, the Watson Scientific Computing Laboratory, and this Office has continued with the support of the Office of Naval Research. The general theory of the motion of Mars, mentioned in the preceding report, is now complete; before calculating the new ephemeris it remains to obtain suitable elements of the orbit by comparing the new theory with observations. Since the preceding report, *Astr. Pap., Wash.*, Vol. **12**, Vol. **13**, parts I, II, III, IV, V, Vol. **14**, and Vol. **15**, parts I and II have appeared. These contain precise co-ordinates of Jupiter, Saturn, Uranus, Neptune and Pluto, at 40-day intervals from 1653 to 2060, by Eckert, Brouwer and Clemence; a study of the motion of Jupiter V, 1842–1949, by A. J. J. van Woerkom; a new calculation of the secular variations of the orbital elements of the principal planets, by Brouwer and van Woerkom; a catalogue of the positions and proper motions of 5268 standard stars, based on the normal system N 30, by H. R. Morgan; the co-ordinates of the centre of mass of the Sun and the five outer planets, 1800–2060, by Clemence; general perturbations of the five outer planets by the four inner ones by Clemence; precise co-ordinates of the Sun and of the centre of mass of the Earth and Moon at 4-day intervals from 1800 to 2000, by Paul Herget; a new general theory of the rotation of the Earth around its centre of mass, by Edgar W. Woolard; and a new determination of the mass of Saturn from its action on Jupiter 1884–1948, by Hans G. Hertz. Other work mentioned in the preceding report is still in progress or being prepared for publication.

G. M. CLEMENCE

Institute for Theoretical Astronomy, Leningrad, U.S.S.R.

L'Annuaire Astronomique de l'U.R.S.S. has been published annually; the volume for the year 1956 appeared in March 1953, and that for 1957 in March 1954. The almanac for the year 1958 is ready for printing. The following changes have occurred during this period: beginning with 1955 the equatorial co-ordinates of the Moon are given for every hour instead of every 12 hours; beginning with 1957 apparent places of 64 additional stars are given, to meet the requirements of geodesists. Thus the almanac now includes mean places of 730 stars and apparent places of 673 stars.

All the computations for the almanac were performed on punched-card calculating machines. The methods used have been described in detail in papers by D. K. Kulikov⁽¹⁾ and D. V. Zagrebin⁽²⁾.

Papers have been published on questions connected with the recommendations of the eighth meeting in Rome, 1952, by E. A. Mitrofanova⁽³⁾, D. V. Zagrebin⁽⁴⁾, M. B. Shelesniak and E. A. Mitrofanova⁽⁵⁾ and D. V. Zagrebin, E. A. Mitrofanova and G. M. Posniak⁽⁶⁾.

In addition, the *Nautical Almanac* and the *Air Almanac* have been regularly published. Some details about the history of these almanacs, and of their contents and form, are given in a paper by I. D. Yongolovich⁽⁷⁾.

Other work has included:

The annual computation of the apparent places of 210 10-day stars for *Apparent Places of Fundamental Stars*.

The regular computation of reductions to apparent places of stars for the Fundamental Catalogue of Faint Stars.

The computation of 'Tables for the principal precessional values for the years 1950–2000'⁽⁸⁾.

Research is in progress on the group of astronomical constants connected with the Earth. Results obtained using material of the World Gravity Survey have been discussed in a memoir by I. D. Yongolovich⁽⁹⁾. Further results obtained from astronomical-geodetic work on different continents are discussed in a paper ready for printing, by the same author.

M. SUBBOTIN

Astronomisches Rechen-Institut, Heidelberg, Germany

A large part of the work of the Institute is concerned with the astronomical system of co-ordinates and ephemerides; this work is in three parts.

Fundamental catalogue

A. Kopff is occupied with a revision of the FK 3, according to the same principles as were applied in the derivation of the FK 3. A. Kopff has also prepared a list of 1987 bright stars which should form an extension of the FK 3 and which are especially suitable for the execution of programmes of geodetic observations. The exact positions and proper motions of these stars (equinox 1950.0, system FK 3) have been printed in the appendices of the *Astronomisch-Geodätisches Jahrbuch* 1954 (northern part) and 1956 (southern part). For details of this work see the Draft Report of Commission 8.

Exchange of ephemerides

The contribution to the international exchange of ephemerides has not changed since the last report. A large part of the calculations for the star ephemerides 1956–75 was completed in 1951–53. The increase of accuracy in the calculation of the reduction to the apparent place as intended from 1960 onwards has required comprehensive revision and new computation.

The binary star 61 Cygni (FK 3, no. 793) has been so far treated in the FK 3, on account of its slow orbital motion, as if the brighter component moved in a straight line and with uniform velocity. This has caused in the last decades greater and greater differences O–C; these differences have been the inducement for a new discussion by H. Nowacki⁽¹⁰⁾. The basis of the revision is the new orbital elements by K. A. Strand. In consequence of this treatment 61 Cygni has now been adopted as fifth binary star in the FK 3. Improved ephemerides 1950–55 are to be found in the appendix of the *Astronomisch-Geodätisches Jahrbuch* 1956. *Apparent Places of Fundamental Stars* contains the new ephemeris from volume 1956 onwards.

German almanacs

The Astronomisches Rechen-Institut in Heidelberg is co-editor of the *Berliner Astronomisches Jahrbuch* published in Berlin. The mean places, apparent places of 10-day and

circumpolar stars, and data for the satellites of Saturn calculated in Heidelberg are printed in this almanac. In addition it issues an almanac of its own, the *Astronomisch-Geodätisches Jahrbuch*. As from 1954 this has undergone a thorough revision, in accordance with principles developed in a written and oral discussion initiated jointly with the president of the Deutsche Geodätische Kommission. A complete statement of the details is given in the preface to the edition for 1954, pp. iii-vi. Beginning with the issue for 1955, the booklet *Astronomische Grundlagen für den Kalender* has been greatly enlarged; it now provides the times of rising and setting of the Sun and Moon in local time as well as immediately in M.E.Z.

At the request of the Institut für Ionosphärenforschung (Lindau, Harz) and of the Service de Préviation Ionosphérique Militaire (Freiburg), special calculations for the two eclipses of the Sun on 1952 February 25 and 1954 June 30 were made to give the magnitude of the eclipse for special places and different heights and the path of the central line at different heights.

In March 1954 F. Gondolatsch visited H.M. Nautical Almanac Office, Herstmonceux, to study the organization of the office and to discuss matters of common interest with the Superintendent.

A. KOPFF

Astronomisches Recheninstitut, Berlin, Germany

The computations for the *Berliner Astronomisches Jahrbuch* have been done as usual; the edition for 1955 was published in 1953, that for 1956 is in the Press and should be published before the end of 1954, and the manuscript for 1957 is in preparation.

A. KAHRSTEDT

Bureau des Longitudes, Paris, France

Le grand retard qui existait dans l'époque de publication de la *Connaissance des Temps* est maintenant presque entièrement regagné: le volume pour 1956 a paru, en effet, dès Septembre 1954.

Nous pouvons donc envisager la possibilité prochaine d'apporter une contribution un peu plus importante aux calculs concernant le volume international *Apparent Places of Fundamental Stars*.

Comme précédemment nous nous sommes chargés de calculer, d'après les Tables de R. A. Sampson, les éphémérides détaillées relatives aux quatre premiers satellites de Jupiter et les circonstances de phénomènes correspondants.

Sur la demande de plusieurs astronomes français nous fournissons les éléments des éclipses de Lune par la pénombre. Depuis 1954, on publie la parallaxe et le demi-diamètre de la Lune de 3 en 3 heures et non plus de 12 en 12 heures comme précédemment.

Jusqu'en 1952, la *Connaissance des Temps* donnait les angles en degrés et parties sexagésimales de degré, à l'exception des ascensions droites, exprimées en heures et parties sexagésimales d'heure, et des éléments des satellites de Jupiter qui étaient fournis en degrés et fractions décimales de degré. En 1953, on a étendu l'usage de la division décimale du degré aux coordonnées écliptiques (longitudes et latitudes héliocentriques et géocentriques), aux éléments qui s'y rattachent (précession, nutation et aberration en longitude) ainsi qu'aux données relatives à la libration de la Lune. En conséquence on a remplacé, par une table plus détaillée, l'ancienne table de conversion des parties sexagésimales de degré en fractions décimales de degré. D'autre part, on a ajouté, depuis 1954, des tables facilitant la transformation des heures et parties sexagésimales d'heure en degrés et fractions décimales de degré ou inversement.

En ce qui concerne les *Ephémérides Aéronautiques*, le nomogramme pour le lever et le coucher du Soleil et de la Lune, introduit à titre d'essai dans le fascicule de juillet-août 1949, a été conservé dans les années suivantes, ainsi que les cartes célestes données également en 1949.

En 1952, le nomogramme a été complété par une échelle d'angle au pôle pour l'obten-

tion du début de l'aube et de la fin du crépuscule civils (centre du Soleil à 6° au-dessous de l'horizon).

Pour 1955, dans un souci de coopération internationale, l'Etat-Major de l'Armée de l'Air Française a décidé de modifier les *Ephémérides Aéronautiques* pour les mettre en conformité avec les publications similaires anglaises et américaines. En conséquence, les données des feuilles quotidiennes, les schémas du ciel, les tables d'interpolation ou de transformation sont fournies par l'Angleterre. On a simplement inscrit les titres en français et ajouté les heures du passage, au méridien origine, du Soleil, de la Lune et des planètes. On a conservé les cartes célestes antérieures, ainsi que le nomogramme des heures des levers et couchers, légèrement modifié pour en étendre l'emploi aux régions polaires. Les explications sont rédigées en français, conformément aux données de l'ouvrage.

A partir de 1956, nos *Ephémérides Nautiques* seront notablement modifiées et leur volume considérablement accru. La nouvelle structure sera sensiblement identique à celle adoptée, depuis déjà plusieurs années, par la plupart des autres nations maritimes.

La partie principale consistera en tableaux quotidiens fournissant, d'heure en heure, les angles horaires et les déclinaisons des principaux astres errants (Soleil, Lune, Vénus, Mars, Jupiter et Saturne). On y trouvera également les heures des levers et couchers du Soleil et de la Lune aux diverses latitudes. L'ouvrage est complété par de nombreuses tables auxiliaires.

G. FAYET

H.M. Nautical Almanac Office, Royal Greenwich Observatory, Herstmonceux, England

The routine work of the Office has been continued without interruption. The *Nautical Almanac*, the *Abridged Nautical Almanac*, the unified *Air Almanac*, the *Star Almanac* and the international volume of *Apparent Places of Fundamental Stars* have all been published without substantial change. The copy for the 1956 edition of the international volume has been prepared on the card-controlled typewriter, and is being reproduced by photolithography; only very minor changes of presentation have been necessary.

The occultation programme has also been continued without modification, except that all calculations are now done on the punched-card machines. In future, predictions will also be made of occultations by the Moon of radio sources.

The material for the third volume of *Planetary Co-ordinates for the Equinox 1950.0*, designed to cover the years 1960–80, is practically complete; copy for reproduction by photolithography will shortly be prepared on the card-controlled typewriter.

The first part of the *Nautical Almanac* for 1960 has been completely redesigned in accord with the Recommendations made at the Eighth General Assembly in 1952; a detailed list of contents has been circulated to the Directors of the national ephemerides. Agreement has been reached with the U.S. Nautical Almanac Office for the conformity of the *American Ephemeris* and the *Nautical Almanac* (see main Report) as from 1960. The long-promised *Supplement* will be prepared jointly to refer to the 'conformed' almanacs.

The nutation in longitude and obliquity has been evaluated from the new series expansion of E. W. Woolard for every day from J.D. 241 5000.5 to J.D. 245 5000.5 (i.e. from 1899 December 11.5 to 2009 June 18.0). The apparent right ascension and declination of the Moon for each hour for the years 1952–59 have been calculated from the fundamental values of the longitude and latitude supplied by W. J. Eckert. Copy for 279 pages of the *Improved Lunar Ephemeris* (see main Report) has been prepared on the card-controlled typewriter.

The Superintendent had the privilege of visiting the Institute for Theoretical Astronomy in Leningrad in May 1954, and the Nautical Almanac Office at the U.S. Naval Observatory in Washington in October, 1954.

D. H. SADLER

Institut Astronomique de l'Académie des Sciences, Prague, Tchécoslovaquie

Suivant la recommandation de l'U.A.I. (11) F. Link en collaboration de J. Bouška et Z. Linkova a continué de publier l'éphéméride détaillée des éclipses de Lune en 1953 et 1954 (12) qui contient les coordonnées relatives de la Lune par rapport au centre de l'ombre terrestre de 10 en 10 minutes de temps, les éléments horaires de Kosik pour la réduction des passages de cratères et la position du terminateur de l'ombre sur la surface terrestre. Les éléments de base sont fournis régulièrement d'avance par H.M. Nautical Almanac Office. Dans l'avenir on compte de maintenir la publication de cette éphéméride qui rend de grandes services aux observateurs d'éclipses de Lune.

F. Link et L. Neuzil ont établi une éphéméride préalable d'occultations des deux radio-sources 05.01 Tau et 06.01 Gem par la Lune qui auront lieu en 1955-57 (13). On propose que H.M. Nautical Almanac Office qui fait autorité en matière d'occultations des sources optiques range dans l'avenir dans son programme aussi les radiosources. En cas échéant nous sommes disposés à l'Institut astronomique de faire la recherche de tels phénomènes et d'en publier l'éphéméride.

F. Link a continué de fournir l'éphéméride des éclipses coronales des radiosources (14) et compte dans l'avenir de s'occuper de cette tâche.

F. LINK

Tokyo Astronomical Observatory, Mitaka, near Tokyo, Japan

Eleven papers have been published in *Tokyo Astronomical Bulletin*, second series, no. 47, 1952, and no. 63, 1953, and in *Tokyo Astronomical Observatory Report*, Vol. 10, no. 3, 1953, and Vol. 11, no. 1, 1954. Ten of these relate to forthcoming solar and lunar eclipses and have been prepared at the request of the Eclipse Committee of the Science Council of Japan; the eleventh relates to the transit of Mercury of 1957 May 5-6.

The following work has been done in the Japanese Hydrographic Office.

Ephemerides computations

Sun: Ecliptic, equatorial rectangular and equatorial co-ordinates and associated quantities for the years 1958-60. Moon: Ecliptic and equatorial co-ordinates and associated quantities for the years 1957-59. Planets: Heliocentric co-ordinates of Mercury, Venus, Mars, Jupiter, Saturn, Uranus and Neptune, geocentric ecliptic and equatorial co-ordinates of these planets, and associated quantities for the years 1956-59.

Besselian and independent day numbers for the years 1958-60.

Stars: Apparent places of 780 10-day and 10 circumpolar stars, and associated quantities, for the years 1956-58.

Eclipses and occultations: Elements, circumstances, predictions and associated quantities for the years 1954-57.

Transit of Mercury: Elements, circumstances, predictions and associated quantities for 1957 May 5-6.

Compilation and publications

Japanese Ephemeris for the years 1953-56; *Nautical Almanac* for the years 1952-55; *Abridged Nautical Almanac* for the years 1952-55.

Y. HAGIHARA

REFERENCES

- (1) D. K. Kulikov, 'Mechanization of astronomical computations', *Bull. Inst. Theor. Astr.* 5, no. 8/71, 1953.
- (2) D. V. Zagrebin, 'On the Computation of the ephemeris of the Moon on punched-card machines', *Bull. Inst. Theor. Astr.* 5, no. 8/71, 1953.
- (3) E. A. Mitrofanova, 'On the amendment of the lunar ephemeris', *Bull. Inst. Theor. Astr.* 5, no. 4/67, 1952.

- (4) D. V. Zagrebín, 'Method of improvement of Brown's Tables for the amendment of the Lunar ephemeris', *Astr. J. U.S.S.R.* **30**, 1, 1953.
- (5) M. B. Shelesniak and E. A. Mitrofanova, 'Tables for the reduction of the lunar ephemeris to ephemeris time', *Bull. Inst. Theor. Astr.* **5**, no. 10/73, 1954.
- (6) D. V. Zagrebín, E. A. Mitrofanova and G. M. Posniak, 'Difference between Ephemeris Time and Universal Time from observations of occultations of stars by the Moon', *Bull. Inst. Theor. Astr.* **6**, no. 1/75, 1955.
- (7) I. D. Yongolovich, 'On the history of the creation of nautical and air almanacs in our country', *Bull. Inst. Theor. Astr.* **5**, no. 8/71, 498-511, 1953.
- (8) *Bull. Inst. Theor. Astr.* **5**, no. 10/73, 1954.
- (9) I. D. Yongolovich, 'External gravitational field of the Earth and fundamental constants connected with it', *Mem. Inst. Theor. Astr.* **3**, 1-125, 1952.
- (10) H. Nowacki, 'Verbesserung von Ort und Eigenbewegung von 61 Cygni', *Veröff. ARI, Heidelberg*, no. 4, 1952.
- (11) *Trans. I.A.U.* **7**, 61, 1950.
- (12) F. Link *et al.*, *Bull. Inst. Astr. Czechosl.* **3**, 76, 1952; **4**, 170, 1953.
- (13) F. Link, *B.A.C.*, sous presse.
- (14) F. Link, *Circ. I.A.U.* no. 1450, 1954.

Report of Meetings of Commission 4

PRESIDENT: Mr D. H. SADLER.

SECRETARY: Dr J. G. PORTER.

At the first meeting on Tuesday, 30 August, sixty-two members were present. The President reported the loss to the Commission by death of Prof. J. Chazy and Admiral W. Benitez e Inglott.

In a discussion on the proposed definition of the unit of time, which had been adopted by the Comité International des Poids et Mesures at its meeting in September 1954 (*Trans.* **9**, p. 451), Dr Clemence and Dr Gondolatsch pointed out the advantages of defining the unit in terms of the tropical year, rather than the sidereal year. As the matter had been referred to Commission 31, which was not scheduled to meet until the end of the week, it was agreed that the President should notify the Executive Committee that Commission 4 would support the proposal if it were adopted by Commission 31.

The President then presented the following Report from the Directors of the National Ephemerides on the redistribution of astronomical calculations.

The conformity of the *American Ephemeris* and the (British) *Nautical Almanac* will involve a number of minor changes in the distribution of calculations between the two Offices; the principal one is that from 1960 onwards the (British) *Nautical Almanac* Office will assume responsibility for the calculation of elements of lunar occultations.

The availability of reproducible material for the unified Almanac has led to the decision of the Astronomisches Rechen-Institut at Heidelberg to suspend publication, as from 1958, of the *Astronomisch-Geodätisches Jahrbuch* and to use the *Nautical Almanac* and later the unified Almanac instead. This in turn has made it possible for the Astronomisches Rechen-Institut to take over, from the (British) *Nautical Almanac* Office, the publication, as from 1960, of the international volume *Apparent Places of Fundamental Stars*. It is particularly appropriate that the A.R.-I., which is primarily responsible for the fundamental star places, should now assume responsibility for the apparent places based on those star positions. Most of the redistribution of calculations is directed towards the more efficient production of the international volume by the centralization of the calculation of apparent places of stars in a small number of Offices.